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METCACP+

METEOROLOGICAL COMMUNICATION AND APPLICATION PACKAGE (2012)

Edited By
Kemal DOKUYUCU
kdokuyucu@mgm.gov.tr
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CHAPTER 1

HISTORY

Parallel to development in PC technology, a young group of engineers started to develop communication and graphical software to simplify and fasten the daily routine duties. First packages was developed in C, C++ and PASCAL in DOS mode and started to be used in central forecasting Office in Ankara and airports forecasting offices all over Turkey in 1992. First package was developed to fulfill requirements from the users. This package mainly was to send and receive data from main communication computer, plot main synoptic and upper level charts and create SkewT diagrams. Most of the airports was using dedicated data lines up to 19200 bps.

In 1996 first Windows version of the packages was developed and called METCAP. The biggest innovation of the package was the module that creates NWP charts from ECMWF GRID products. In 1999 new version of the package was released. T4, GRIB and BUFR data was used with this version. Increase in communication speed and Internet technology enabled remote users to have more and more meteorological products like satellite data, GRIB data from different sources and Radar data.

Increase in data types caused users to use different software to analyze each data type. In order to simplify use of bulky data, development of new version of Metcap (called METCAP+) was started in 2010 and first prototype completed and installed in Ankara Forecasting Center in December 2011.
CHAPTER 2
DATA SOURCES

METCAP+ package may receive required data like METAR, TAF, SIGMETS, GRIB and BUFR bulletins from different sources and use them. Some significant data sources may be listed as follows:

Message Switching Systems:
Required meteorological observations, forecast reports, numerical weather prediction products in different formats are transferred to the airports via satellite or grounded lines by using ftp and broadcast methods. All data received from this system are used by the software.

SADIS System:
Satellite Distribution System (SADIS) is run by UK Met Office on behalf of ICAO to transfer meteorological observations, forecast and other numerical data to end users at the airports in different countries. Distributed data includes both OPMET data from different countries and GRIB and BUFR forecast products produced by World Area Forecast Centers like Exeter and Washington. Target areas are Europe, Africa, Middle East and Indian Ocean. To get data from SADIS system the users must have either reception system (antenna, receiver etc) or a user name and password for accessing SADIS ftp site. If these requirements is fulfilled then Metcap+ uses all data from this system.

RETIM System:
RETIM is run Meteo France and delivers OPMET, T4, GRIB and BUFR data to the users at airports, national met services and TVs. If the reception system was installed, all data received from system may be digested by the software.

NOAA Internet Service:
All meteorological data which may be used for aviational purposes generated by NOAA or collected from other sources may be downloaded from Internet freely. The software may download OPMET data like METAR, TAF and SIGMET from the ftp site.

The package has a module to download Numerical Weather Prediction data that was generated four times a day for whole globe in GRIB2 format by USA met service.
METCAP+ Data sources diagram
CHAPTER 3
DATA RETRIEVE

All received data are stored on the disks. These data may be retrieved by different modules of the package to create charts or simply display in raw formats. Raw format display may be in two different ways which are described below.

3.1 BULLETIN SEARCH

Meteorological data distributed through the GTS (Global Telecommunication System) are in the form of bulletins. Each bulletin consists of “Header” and “Data” sections. METCAP+ stores and indexes the meteorological bulletins according to “Headers”. A bulletin header contains many information about the bulletin. Detailed explanation of the headers may be found on the documents “WMO No. 386 Manual on the Global Telecommunication System”. General structure of a header is as follows:

T1T2A1A2ii CCCC YYGGgg where

T1T2 : Data type and/or form designators.
A1A2: Geographical and/or data type and/or time designators.
ii : It shall be a number with two digits. When a center issues two or more bulletins with the same T1T2A1A2 and CCCC the ii shall be used to differentiate the bulletins and will be unique to each bulletin.

CCCC : International four-letter location indicator of the station or centre originating or compiling the bulletin, as agreed internationally, and published in WMO-No. 9, Volume C1, Catalogue of Meteorological Bulletins.

YYGGgg : International date-time group. YY Day of the month, GGgg For bulletins containing meteorological reports intended for standard times of observation, the time shall be the standard time of observation in UTC.

Bulletin Search Module of METCAP+ enables users to access stored bulletins easily. In order to see a bulletin the user may write all or some parts of the header. But at least first two letter of the header MUST be written. Center (CCCC) and Date Time Fields are optional. For example following search will list all synoptic bulletins of 4th day of the month and hour 6 UTC created by ICAO ‘L’ region (Albania, Bulgaria, France, Greece, Turkey etc). Second search will list only synoptic bulletins of Turkey.
TTAAii : Full or some parts of the bulletin headers’ T1T2A1A2ii is written here.

First two letter of the header that shows bulletin type must be written. 2nd and 3rd characters indicates countries. If country indicator letters are known, it decreases the search time. 5ft and 6th letters show bulletin number.

SM : Indicates all main synoptic bulletins of specified day and time

SMT : Indicates all main synoptic bulletins belong to the countries whose names starts with T (TT = Turkey, TS = Tunis, TR = Turkmenistan etc)

SMTU : All main synoptic bulletins belong to Turkey (SMTU10,SMTU20 etc)

SMTU1: All main synoptic bulletins whos bulletin number starts with 1 and belong to Turkey (SMTU10,SMTU11 etc)

SMTU10: Just bulletin SMTU10 of Turkey

CCCC : Indicates originating center ICAO code. It may be written as whole (4 characters) or shorter.

LTAA : All bulletins created by Ankara NMC

LTA : All bulletins created by LTAx (LTAA,LTAC, LTAD etc)

LT : All bulletins created by LTxx (LTAA,LTBA, LTCC etc)

YYGGgg : Shows bulletin creation day, our and minute.

YY : All bulletins that belong to specified day.

YYG : All bulletins that belong to specified day and first digit of the hour (260 searches all bulletins from 260000 to 260959)

YYGG : All bulletins that belong to specified day and hour (2600 searches all bulletins from 260000 to 260059)

YYGGg : All bulletins that belong to specified day hour .and first digit of the minute (26005 searches all bulletins from 260050 to 260959)

YYGGgg : All bulletins that belong to specified day hour, hour and minute.

When bulletin search completed all found data may be listed as a whole or one in a page.
Description of the messages and buttons of the display dialog box is given below.

[2 / 60] (Order / Total Number of bulletins). The second of total 66 SMTU bulletins.

Previous Bulletin

Next Bulletin

Display mode is one bulletin in a page.

All bulletins in one page

List of found bulletins

Save displayed bulletin(s) in a file

Load data into the display area from a file.

Print the bulletin(s)

When a bulletin is found and displayed in the dialog box, the user may make software to decode the observation or report just by choosing the station number / ICAO indicator and right click. This may be done for synoptic, METAR, SPECI observations and TAF reports.
Instead of writing WMO headers, there are two more ways to access the bulletins. One of them is to choose from "LIST" by clicking button. In this case following box will be opened and the user may continue to search by clicking Date, Bulletin Type, Time and Bulletin header in related columns. Country Filter y be used to decrease the number of bulletins searched and decrease time.

Second way of bulletin search is to use button. This button is used to access bulletins which are often used. The procedure is very similar to the first one but often used bulletin must be defined before by clicking on main menu area. Related areas and bulletin header written and recorded.
Prepares the screen by cleaning all areas.

Closes “Bulletin Search” module.

3.2 STATION SEARCH

Most of the meteorological bulletins, especially Synoptic, Temp, METAR and TAF bulletins, contains many stations. The users shouldn’t have to know which station is in which bulletin. “Station Search” module may be used to simplify accessing station reports.

The user must write ICAO or Synoptic codes of the requested stations here. More than one station may be written by separating them with a blank. If the user doesn’t know the station number or code, he/she may find it by using two combo boxes on the right of the form.

Upper box contains country names. When country is selected second box filled with the station numbers and codes in the second box. ICAO or synoptic code automatically written when station name is selected.

Check box indicates whether only the latest ones of the observations or group of them for a time interval will be searched. If it is checked then only the latest ones are brought to the screen.
Results will be shown as follows.

If latest checkbox is unchecked then start and end date & times must be selected from the following section.

Number of bulletins controlled and how long it took to complete the search is written on the status bar of the interface.

Starts Search.

Cleans fields a new search

Prints found info
Saves found info in a file.

Changes program settings.

If some airports and/or stations are searched often, in order to prevent rewriting long infos again and again buton is clicked when stations and bulletin types are chosen and a name is written for this search. This name is added to `RecordedHeader`.

Any previously defined search may be done by selecting it from the list and clicking the Search button.

Deletes one of the recorded searches.

Closes “Station Search” module.
CHAPTER 4

MAPPING

Map display is the basic of meteorological product display software. METCAP+ has a mapping tool that may be adjusted by the users. Appearance of the map may be designed and changed easily.

In order to open a new map window, “New Map” sub item of the “Metcap” item of main menu is clicked. Default map is brought to the screen.

When a new map design or some changes for the default map settings is needed “Map Settings”->”Settings” item is selected. By using the opened dialog box new map may be created, appearance of the map may be changed, topography colors may be changed and many other jobs may be done.

Lists defined map names

Enables users to enter or change map boundary values.

Determines whether lon/lat values will be drawn or not

If lon lat values will be drawn, then line
intervals must be chosen from this combo box. If lon lat values will be drawn, labeling interval of the lon/lat lines chosen from here.

This list is used to choose font size.

This part is used to determine whether city names are written on the map or not, if yes in which format and size.

Map Drawing Colors

- Land color, in order to choose a new color double click on the panel. This color are used when there is no topography.
- Sea color
- Coast line color
- Border color
- Lon/Lat line color
- Font color of the city names
- Province border color

- Paint lands and seas: If checked and no topography is chosen, map is painted with land and sea colors else an empty map created.
- Draw Country Borders: If checked country borders are drawn in defined color.
- Draw Province Border: If checked province borders are drawn in defined color.

Thickness section is used to thickness of the Coast, Border, Lon/Lat and Provinces border lines. The bigger values represents the thicker lines.
Second tab of the map settings dialog box changes whether topography is put on the map, elevation color settings and map projection type.

Accept temporary changes for the current map and closes the dialog.

Saves the changes with a new name.

Changes as saved as default and used by new maps.

Closes without change.

Following images are some sample maps created by METCAP+.
4.1 ADDING NEW MAP REGION

Users may work many map regions or sub regions to analyze weather map. In order to add a new region, a user needs to update rgns.txt in the ini directory. Structure of the file is “Region Name * Western_Lon Southern_Lat Eastern_Lon Northern_Lat”. When the file is saved, a new region is added to the region item under “Map Settings” of the main menu. If any region is obsolete any more, it may be removed by updating the same file.
4.2 CHANGING MAP REGION

When a map Windows is opened, status bar contains five buttons as default. It is possible to zoom in, zoom out or changing center of the map in working region or returning to the original area by using four of these buttons.

Zoom in

Enables user to zoom in a region. Cursor changes. One click on the map is enough to zoom in. In order to stop zooming, the user must press this button once more.

Zoom out

Enables user to zoom out a region. Cursor changes. One click on the map is enough to zoom out. In order to stop zooming, the user must press this button once more

Original region

Returns original map region

Center change

Changes center of the map without zoom in or out.

Delete observation

“Delete observation button” is used to delete wrong observation in order not to use it for contouring. (See contouring section)

Fixed status bar

When a map Windows is opened, status bar is not seen unless cursor brought down. If the user wants the status bar to be fix, this button is used. First click makes it fixed and second auto hide again.

Cursor position, as longitude, latitude, is shown in status bar.
4.3 CALCULATING DISTANCE ON THE MAP

In some cases like to see the move of a low pressure center, users may want to see the distance on the map. To do this user may use “Calculate Distance” Item of “Map Settings” of main Menu. The distance from the first click point and the last one will be shown on the status bar.

Following figure shows motions of hurricanes “Leslie” and “Michael” over Atlantic Ocean between 7 September 2012 12Gmt and 10 September 2012 00 Gmt by using GFS data. Leslie passes total nearly 690 km in 60 hours.
CHAPTER 5

ACTUEL METEOROLOGICAL MAPS

METCAP+ creates many maps from synoptic, METAR and upper air observations. Appearance of observation plot may be prompted by the users.

In order to create an actual chart, first a map window must be opened. Then “Observation” of the main menu is selected. Following charts may be chosen from the sub menu of “Observation”:

5. 1 SYNOPTIC OBSERVATIONS

Hourly, Intermediate or main synoptic observations in the form of “FM 12-IX” and BUFR decoded and plotted by METCAP+. (Since dissemination of Synoptic observation in classical Text format will be ceased soon it is a must to decode BUFR format. METCAP+ programmers developed a module to decode and use synoptic observation in BUFR format. This module has been being used by METCAP+ since 2010) Users may choose to use Synop in text format and/or BUFR format just by setting a parameter in settings file.

Following interface is used to create a synoptic charts

When the dialog box is opened, current date and time is default for the map. If the user want to create an old dated map, “Day / Hour” part is used. Map type is selected from “Type” list. Option “All Synop” is used for classical synoptic plotting.

This section is used to set plotted observation density on the map. The lower the value is the more observations are plotted onto the map.
If checked, synops from ships are plotted on the map; else ship observations are ignored.

If checked, synops from mountain station are plotted. A mountain station codes elevation of 850 hPa instead of MSL pressure. Values from these stations are quite different from the normal ones especially in temperature and wind speeds.

All synoptic stations have different priorities varying from 1 to 5. 1 is for the highest while 5 is the lowest. Data from priority 1 stations are thought to be more reliable compared with the lower ones. Priority of a station may be changed by modifying the station database file.

This group is used to set display of observations.

This part is used to change observation font.
Plotting font is Arial Comic Sans MS

This box determines the size of plotted observations.

Font size 10 and not bold Font size is 20 and bold

Parameters Box is used to which synoptic parameters will be plotted. All parameters are plotted as default option. All check parameters are plotted.

☑ Cloud Amount ☐ MSL Pressure
☐ Wind ☐ Pressure Tender
☐ Visibility ☐ Cloud Height
☑ Met.Even ☐ Low Cloud
☑ Past Weather ☑ Medium Cloud
☑ Temperature ☑ High Cloud
☐ Dew Poin ☐ Station No

Observations plotted according to the selection

☐ Plot Change for the chosen parameter This part is used to see the difference between two time interval for a parameter like temperature, MSLP etc. If this box is checked period will be either 12 Hour or 24 Hour. The period will be selected from left box.

Some examples for this section will be shown below pages.

Finishes the selection and prepares the synoptic map.
5.1.1 LIMITATIONS

When synoptic or other maps are being plotted, user may want to see some special cases in weather conditions like rainy places, stations that has temperature value under or lower a limit etc.

In order to fulfill these requirements, “Limitations” tab of the observation dialog box may used. When a criteria set for a parameter, observations are checked and only some of the observation which meet the limits are plotted.

In order to lift limitations lift all limitation” button must be pressed.

Here are some examples (7 September 2012, 06 Gmt Synoptic charts)

5.1.1.1 Regional Limitation : If the observation of some special regions are needed to be plotted, this may be performed by filling “Block numbers top lot” area of limitation tab. Following example force software plot the observations from listed countries.
5.1.2 Map Types Created From Synoptic Observations

5.1.2.1 Standard synoptic chart: Some examples has already been displayed above.

5.1.2.2 Icon Plot: Summarized weather conditions with icons. Synoptic code, temperature and an icon for current condition is displayed.

5.1.2.3 2m Temperature: Temperature values of the synoptic code is plotted. Contouring will be explained in next chapters.

5.1.2.4 Chill factor: Calculates a value from temperature and dew point. The higher values indicates risks for the people.

5.1.2.5 Dew Point: Creates a chart from dew point values. A closer dew point to temperature is a sign of a wet weather conditions.

5.1.2.6 Humidity: Calculated from temperature and dew point.
5.1.2.7 Pressure Tendency: Represent the change in MSL Pressure in last 3 hours. Sign and tendency figure are also plotted. Decrease plotted as red while increase color is blue.

5.1.2.8 6/12 Hour Precipitation: Plots 6 or 12 hour precipitation values from synoptic codes.
5.1.2.9 24 Hour Precipitation: Plots 24 hour precipitation values from synoptic codes.

5.1.2.10 Minimum Temperature: Plot min temp values from the 06 Gmt synoptics.

5.1.2.11 Maximum Temperature: Plot max temp values from the 18 Gmt synoptics.

5.1.2.12 Cloud Amount: Plots total cloud cover.
5.1.2.13 Wind: Plot wind barbs depicting direction and speed and temperature value.

5.1.2.14 T – Td (Spread Value): Calculated from 2 m temperature and dew point values. This chart is very useful to see the areas where humidity is high.

5.1.2.15 Humidity Transfer: Transfer of humidity from one point to any other place by means of winds. Higher values are important.
5.1.3 ANALYZING AN OBSERVATION ON THE MAP

When observation plotting completed, user may see any observation in raw format and decoded by clicking on the map. If there is no observation on click point the nearest one will be brought to screen.

5.1.4 OBSERVATION BUTTON ON STATUS BAR

A button on status bar which enables the user to control observation is created when observation plotting completed. When cursor is moved on the button a description string is read. When right button of the Mouse is clicked a popup menu with three items is open.

“Properties” option opens “Choose Observation” dialog box with current observation properties and let user to change observation time, displayed parameters and many other things.

“No Plot” removes observation layer from the map, “Plot” re-plot the observation

“Close” closes the selected observation and removes button from the status bar.

5.2 METAR OBSERVATIONS

METAR observations may be used to observe weather conditions hourly. Following map types may be created from these observations:

- METCAP+ 2012 25
5.2.1 METAR plotting: All METAR parameters are displayed on the map with station color code. Station color code may set by the users for visibility, cloud base, wind speed etc. Blue indicates good weather conditions and red shows risky weather.

5.2.2 Icon Plotting: Depicts weather conditions with icons.
5.2.3 2m Temperature: Temperature values of the METAR is plotted.
5.2.4 Chill factor: Calculates a value from temperature and dew point.
5.2.5 Dew Point: Creates a chart from dew point values.
5.2.6 Humidity: Calculated from temperature and dew point.
5.2.7 Wind Speed
5.2.8 Weather Events: Plots METAR observation that contains weather events and color code.

5.2.9 Significant Clouds: Plots METAR observation that contains CB or TCU clouds color code.
5.2.10 SNOWTAM Reports: SnowTam reports give information on runway conditions. These information are very useful especially in winter conditions METCAP+ decodes SnowTam reports and show them in colors. When any observation is clicked decoded report is displayed.

Contouring for some parameters (QNH, 2m Temperature, humidity, wind speed etc) of METAR observation may be made.
When a METAR observation map is created, a button on status bar is created to help user to make necessary changes when needed. By right clicking on this button many changes may be done as explained in synoptic plotting section.

5.3 UPPER LEVEL OBSERVATIONS

METCAP+ creates upper level charts for all standard levels starting from 1000 hPa up to 100 hPa using measured parameters like geopotential height, temperature, wind speed and direction and spread (t – td value). In addition to standard levels, Maximum Wind, tropopoz and other derived parameter charts are also generated.

“Upper Level (TEMP)” Item of “Observations” is selected to create upper level selection dialog box. This box is very similar synoptic and METAR selection boxes. First date and time and then chart type is selected from the related areas. The box below the chart type one contains parameters for selected level. Here are the short description of them:

Standard : Geopotential height, temperature, wind speed and direction and spread value of chosen level is plotted on the map.
Temp. : Only temperature value of the level is plotted.

Air Mass : This value is calculated and plotted for the level.

Spread : The difference between temperature and dew point is plotted.

W.Speed: Wind speed is plotted in knots.

Theta Temperature : Theta temperature in K calculated and plotted.

Icing Prob. : Icing probability is calculated and plotted.

Icing : Intensity of icing (between 1-5) is calculated and plotted.

Wet Bulb : Wet Bulb temperature of the level is calculated and plotted.

Subsidence : Vertical motion value is calculated and plotted.

Contouring for above parameters is also possible. Change in a parameter like geopotential height or temperature may be also plotted for any level by filling “Changes” part of the dialog box.

Some examples of standard upper level charts are given below.
Many other useful parameter or instability indices are derived from TEMP observation and plotted. These values are contoured as well.

a) Vertical Total (VT)
b) Cross Total (CT)
c) Total Total (TT)
d) K Index
e) Sweat Index
f) Lifted Index
g) PW (Perceptible Water)
h) Thomson Index
i) Boyden Index
j) KO Index
k) Miller Index
l) S Index
m) O C Height
n) Wet Bulb 0 C Height
o) CAPE Total
p) CAPE (0 – 300m)
q) CAPE (0 C - -20 C)
5.3.1 THICKNESS CHARTS

Change of a parameter between two atmosphere layers may be calculated and plotted by METCAP+. It is very easy to create thickness charts by using the software.

a) Thickness: geopotential difference between two levels.

Thickness (1000hpa – 500hpa) Geopotential Height.

b) Lapse rate: Change in temperature
c) Temperature change in 1000m

Temperature change in 1000m between 850-500hpa
5.4 LIGHTNING CHARTS

Lightning detection systems gives very important information about cloud structures and intensity of meteorological events when combined with radar and/or satellite data. There are many lightning data sources. METCAP+ uses data from UK Met Office which is generated every 5 minutes and distributed through the GTS.

In order to plot lightning data, “Lightning” option of the “Observations” must be selected.

Following dialog box appears on the screen when the selection is done.

“Time” section of the box is used to select time of the lightning. The latest observation is the first as default. Day and time may be changed by using the list boxes. Plot period may be chosen from the “Latest” part. Time periods show the difference between last and first time of the lightning observation. For above example, if 30 min is chosen, lightning observations between 0535Gmt and 0605Gmt of 17th day will be displayed.

Plot colors shows the periods of the lightnings. For below example red indicates lightning in last 5 minutes, blue in last 10 minute and green shows older than 10 minutes.
draws gray circles around the lightning points.

Type and color of the plotting may be changed by the users. Lightning point may be plot as cross, rectangle, circle, triangle. Size of the plot figure may be adjusted by using “Size” tool. “Filled” checkbox fills the selected figure. “Set as default” button sets selected plot options as default. Following two figures show lightning on Radar and MSG products.

Istanbul Radar PPI for 07:12 Gmt on 17th Sep. 2012 and Lightning data
5.5 PW CHARTS

PW (Perceptible Water) values are calculated by Turkish Army and sent to Meteorology service every hour for many cities in Turkey. These values may be plotted and contoured by METCAP+.

5.6. ANALYSING CHANGE OF A PARAMETER BY TIME

Intensity of change in a meteorological parameter is important to forecast weather. A deep decrease in MSL pressure may indicate approach of a powerful low pressure centre. METCAP+ enables users to analyze change in many measured or calculated parameters in actual and NWP charts.

The procedure is almost the same as creating a meteorological map. A meteorological parameter is selected for synoptic, METAR or Upper Level (TEMP) charts. “Plot Change for the chosen parameter” of “Changes” on the lower left side of the dialog box is checked. And then time
interval is selected. For below example, MSL Pressure change between 16.09.2012 06 Gmt and 15.09.2012 06.Gmt is calculated and displayed on the map. It is possible to contour the change.

Some examples of analyzing the change in a parameter are given below.
5.7 FRONTS

The frontal analysis and forecasting bulletins (ASXX and FSXX) created by UK Met Office and distributed thru GTS may be plotted by METCAP+. Smoothing is not provided for frontal drawings yet. “Actual” or “Forecast” of “Fronts” option of the menu is selected to plot fronts and then time is selected from the box.

![Frontal Analysis and Forecasting Bulletins](image)

5.8 SHOW SYNOPTIC & METAR STATIONS

Positions of the synoptic and Metar stations are plotted on the map by clicking “Show Synoptic Stations” or “Show METAR Stations” of the “Observation” Item of the main menu.

![Actual Surface Synoptic Chart](image)
5.9 CLIMATOLOGICAL VALUES VS ACTUAL DATA

METACAP+ compares climatological values with the measured ones and plot the values on the map. Monthly average minimum and maximum temperature values, measured monthly lowest and highest temperature values, monthly average total rainfall values are compared with the measured ones. Upper left value indicates measured value, lower left climatological value and right one indicates the difference.

Measured Minimum temperature values compared with the monthly average minimum temperatures

24 Hour total precipitation vs monthly average total precipitation values. Left value shows percentage of the daily rain to monthly value.
5.10 OBSERVATION+ MSG DUST RGB+FORECASED DUST CONCENTRATION

The 8-particles Dust Regional Atmospheric Model (BSC-DREAM8b) had been operated at TMS by using ECMWF initial and boundary data. BSC-DREAM8b is an integrated modeling system designed to describe accurate dust cycle in the atmosphere. The system is in operational use that providing 72 hours forecasts for the Mediterranean region covering Europe, Northern Africa and the Middle East. The results may be displayed by METCAP+.

The product contains hourly measured values for wind, visibility, meteorological event, cloud amount, forecasted dust concentration and MSG RGB product for dust. It is also possible to create contours for forecasted values.

20 : Meteorological visibility (Km)
85 : Forecasted dust concentration for observation hour. Color indicates intensity of forecasted dust value.
CHAPTER 6

CONTOURING

METCAP+ contouring routines enable user to create meteorological maps by using actual observations and NWP data.

6.1 ACTUEL DATA CONTOURING

When a parameter of any observation type (Synoptic, Metar or Temp) is plotted on the map, contouring dialog box opened directly.

The box contains three pages, “Contour”, “Colors” and “Borders”

“Observation” list contains plotted observations on the map. These observations are listed according top plot order. The first observation is selected by the software.

“Parameter” combo box contains the parameter list for the observation. If plotted observation is Synoptic, this list contains MSL Pressure, 2m Temperature, dew point, relative humidity etc.

“Contour Interval” determine contour drawing interval for the selected parameter. Every parameter has default interval values like MSL pressure 4, Temperature 5, relative humidity 5.

“Line Thickness” is used to set pen thickness of the contours. The thinnest value is 1.

“Thick Contour” is used to select which contour values will thicker than the selected value. Right image shows a map contoured with contour interval is 1 and “Thick contour” is 4. A Thicker contour is drawn fort his example.

“Contour Smoothness” determines the smoothness of the contours. The larger the value results in the smoother the contours. Lower left contour smoothness value is 30 and 90 that of the right one.
“Contour Sensitivity” is used to increase or decrease number of observations that will be used in contouring. When the value is increased, the number of observation used for contouring increases, i.e sensitivity of the contours are better. When the contour sensitivity is decreased, smoothness of the contours are better. Contour sensitivity is lower for the left image while that of the right is bigger.

If “Don’t use values from mountain stations for contouring” box is used the values from mountain station is ignored for contouring.

If “Put Label” checked then contour values are written on contours, else just contours are drawn.

Second page of the “Contouring” dialog box is used to select contour type and colors.

“Contour Fill” is used to select contour type. If it is checked contoures filled with the selected panel. Right map was drawn with “Contour fill” value checked.
“Contour Color” is used to select contour color when “Contour fill” is not checked. “Thick color” panel is used to select color of the thick contours.

“Make Shadow” puts a shadow for the contours. Color of shadow is selected from “Shadow Color” panel.

When “Contour Fill” is selected, contour color pallet is chosen from “Pallets” list. When item of the pallet list box is changed, chosen pallet is displayed on the bottom of the list box. Upper and lower values are put for the selected panel.

If “Don’t draw contours on the sea” is checked then the software creates contours only on the lands.

“Separate Contours with thin lines” draws thin black lines between the contours if checked.
Third page of the “Contouring” dialog box is used to select upper or lower limits of the contouring, determining the contouring area.

“Lower limit” sets contour minimum value. Contour lines are not created for the lower values than this value.

“Upper limit” sets contour maximum value. Contour lines are not created for the higher values than this value. The upper right map contains 300 hPa Wind Speeds equal or higher than 50 knots.

“Region” box is used to determine area borders that contours will be drawn on.

Left settings will create the following map.

When contouring is completed, a button for each contour is put on the status bar. When right clicked on this button a popup menu with three options are read.

Properties : Enables users to change appearance of the contours.

No Draw : Remove contours from the window.

Close : Delete this contour object and remove contours from the window.
6.2 NWP DATA CONTOURING

When a NWP parameter is selected, contour dialog box explained 6.1 is opened with a small change on “Contour” page. Contour types are selects as explained above.

6.3 DELETING WRONG OBSERVATIONS

While contouring actual values, some observation values cause abnormal contouring. In these cases observation with faulty values must be deleted or fixed. In order to delete or fix observation, eraser buton on the status bar is clicked. Cursor shape changes to eraser. When the area containing faulty observations is clicked, list of the observation in the area is brought to the screen. Possibly wrong observations are shown. One or more observation may be deleted. By clicking on an observation in the list, It is possible to change the faulty value. When below map is checked as an example, absurd contouring may be seen on three areas. These areas marked with red circles.

Erase button is clicked to fix the problem. When clicked on the Eastern Turkey, left dialog box with
station number and MSL Pressure value appears. When “Ok” button is clicked, this value ignored while contouring. Contouring dialog box is opened. Since there are two more regions to be fixed, “Cancel” button is clicked. Then East of Ireland is clicked and some procedure is repeated. In this case following box appears with possible two wrong observations. After deleting wrong observation in Russia, “Ok” button of the contouring box is clicked and following map is seen.

6.4 MARKING OBSERVATIONS THAT HAS BEEN USED FOR CONTOURING

Not all but most of the observations are used for contouring. “Mark observation used for contouring” item of “Contouring” displays the observation whose values has been used for contouring.

6.5 ADDING/CHANGING A CONTOUR PALETTE

The users may need to add or change palettes. “Add new contour palette” item is used for this purpose.
6.5.1 CHANCING AN EXISTING PALETTE

Pallet number is written in “Pallet No” section and “Get” button is clicked. Pallet colors and values are displayed on the left side of the box. The value that will be changed is written “Value” section and value is changed by clicking “Color” panel. Then “Fix / Add” button is pressed.

If there is a need to add a new value and color to an existing palette, the same procedure is repeated.

6.5.2 CREATING A NEW PALETTE

If the users want to create a new color palette, the value is written and color is set for each item and “Fix / Add” button is pressed. Every new item and its color will be displayed on the left. “Save” button is clicked to save new palette.
CHAPTER 7
NUMERICAL CHARTS

Many meteorological centers or institutions generate weather forecast products for different periods, resolutions, areas and parameters. These products (Numerical Weather Prediction NWP) are in different format like GRIB1, GRIB2, Text and BUFR. METCAP+ decodes and generates forecast maps and charts from numerical forecast data in different formats.

7.1 NWP CONTOURS

“NWP Contours” item of “NWP Product” is selected to create forecast maps. All necessary fields must be selected one by one starting from the “Center”. “Center” contains the list of the centers that their NWP products are ready to be displayed. 3 or 4 letter codes of the centers are listed (EGRR – Exeter UK, ETAX – NATO Germany, KWBC – Washington USA, ECMF – Reading UK, GFS – USA).

When a center is selected date field are filled with forecast run hours. Some centers creates forecast twice or four times a day. The user must select which forecast data will be used.

“Level” List box contains present products for different levels. When level is selected “Parameter” field is filled with existing forecast parameters.

“Period” displays time differences of the forecast from the starting (run) hours.

“Increment” is used to determine contour interval. Default values are filled depending on the selected parameter.

“Change in two time intervals” calculates the changes for a parameter between two selected time and creates an image. When this button is clicked a list box appears to select time interval.

“Just Text” writes point values of the parameters on the map instead of contouring.

“Prepare” button is pressed when all the selections are completed. Then contouring dialog box is opened and contour style is determined from it.
It is possible to draw many forecast parameters from different centers on the same map. When a NWP charts has prepared, following panel may be seen on the upper right corner of the window.

- Creates a new image for the previous period with the selected parameter(s) and level(s). If the selected period is D+24 hours and center is ECMWF, pressing this button will create a new map with period D+21 hours.

- Creates a new image for the next period with the selected parameter(s) and level(s). If the selected period is D+24 hours and center is ECMWF, pressing this button will create a new map with period D+27 hours.

- Create a new map for upper level of the current level with the same parameters and periods. For example if the level is 850 hPa and parameters are geopotential height and temperature, when this button is clicked same parameters for 700 hPa will be prepared.

- Create a new map for lower level of the current level with the same parameters and periods.

- Starts animation for the selected parameters.

- Creates cross section for the selected route on the map. (See Cross-section section)

- Creates meteogram for the selected point. (See Meteogram section)

- Creates SkewT logP diagram for the selected point. (See SkewT section)
7.1.1 ECMWF PRODUCT SAMPLES

7.1.1.1 Surface Level Parameters

Some of the ECMWF Surface parameters that may be displayed by METCAP+

- MSL Pressure
- 2m Temperature
- CAPE Value
- Snow Cover
- Cloud Amount
- Precipitation Amount (3/6 hours)
- Snowfall amount (3/6 hours)
- Wind Speed & Direction

D+12 Forecast from 00:00 Gmt on 19th Sep 2012 (Cloud Amount >= 40%, 3 hour total precipitation and MSLP)

D+18 Forecast from 00:00 Gmt on 19th Sep 2012 (Wind Speed, CAPE value and MSLP)
7.1.1.2 850 hPa Level Parameters

- Geopotential Height
- Relative Humidity
- Temperature
- Wind Speed & Direction

7.1.1.3 700 hPa Level Parameters

- Geopotential Height
- Relative Humidity
- Temperature
- Wind Speed & Direction
7.1.1.4 500 hPa Level Parameters
- Geopotential Height
- Relative Humidity
- Temperature
- Wind Speed & Direction

7.1.1.4 300 hPa Level Parameters
- Geopotential Height
- Relative Humidity
- Temperature
- Wind Speed & Direction
7.1.2 UK-METOFFICE AND USA-WASHINGTON PRODUCTS

These two organizations creates NWP data for avional purposes four times a day and disseminate them thru GTS and SADIS. The parameters are Geopotential height, temperature, relative humidity and wind speed + direction. Coverage area of the products are all globe.

7.1.3 GFS DATA

METCAP+ has a module to download GRIB2 data from NOAA public ftp site four times a day. The parameters to be downloaded and forecast periods may be set by the users. Received GRIB2 data decoded and displayed by METCAP+. Data coverage for GFS is all globe.
7.1.4 PLOTTING DATA FROM DIFFERENT CENTERS ON THE SAME CHART

Sometimes it may be useful to see forecasts from different centers for the same parameter and the same date. METCAP+ draws GRIB forecast data from different centers.

7.2 CROSS SECTION

There are two ways of the getting cross section of a route.

7.2.1 Choosing “Cross Section” item of the “NWP Products” button of the panel is clicked and then route is marked on the map.
When the last point of the route marked button is clicked once more. Then selection box appears.

“Lower Level” determines from which level cross section starts.
“Upper Level” determines which level cross section ends.
“Center” is used to determine which GRIB data will be used for the process.
“Day” and “Hour” show forecast base time.
“Period” Shows the forecast period

“Ok” prepares cross section image. Humidity and Wind Speed cross sections may be seen by pressing radio buttons on the form.
7.2.2 Second way is easier. When a NWP chart is created, button is pressed, route is marked and the same button pressed again and cross-section is prepared.

7.3 SkewT LogP DIAGRAM FROM NWP DATA

If a NWP chart is created, when button is clicked and then any point on the map is clicked SkewT diagram for the point from the NWP are created and necessary calculations are done. (See SkewT LogP Section)
7.4 METEOGRAM

If a NWP chart is created, when button is clicked and then any point on the map is clicked, Meteogram (Ten day weather forecast from ECMWF GRIB Data) for the point from the NWP are prepared. (See Meteogram Section)
CHAPTER 8

AVIATION CHARTS

Weather conditions are very important for air transport safety. Thousands of aerodrome observations and forecasts are issued daily all over the globe. Many numerical models run by different Met. Services and hundreds of forecast products are created.

METCAP+ uses data from different sources to inform about both actual weather conditions and weather forecast for different places. Following sections describe the products generated by the software.

8.1 SIGNIFICAT WEATHER CHARTS (SWC)

Two meteorological center, Exeter (EGRR - UK) and Washington (KWBC/KKCI - USA), create global weather forecasts for whole world every six hours and transmit through GTS and SADISware systems.

METCAP+ receives, decodes the SWC information in BUFR format and creates visual aeronautical charts.

“SWC Charts” item of “Aviational” is selected to create a chart. A sub menu containing “Screen Region”, “SWC Creating” and list of predefined SWC charts are listed.

8.1.1 CREATING SWC FOR “SCREEN REGION”

When first item is selected, SWC is created for the region displayed on the screen. Following dialog box is shown on the screen.

“Day” is used to select SWC creation date and “Hour” for creation hour. “Center” indicates the center that produced SWC in BUFR format. Default center is Exeter-EGRR. If data from Washington-KWBC will be used this field must be changed.

“Level” box is used to select SWC level. Medium indicates the levels between FL100 and FL450 and high indicates flight levels between FL250 and FL630.

Checkboxes are used to determine whether related parameter is shown on the map or not. If any parameter is checked, it will be displayed on the map.

“Thickness” lists are used to define line thickness of the related parameter.

“Color” states the line colors of the parameters.
When “Ok” button is clicked SWC is created on the screen. Map regions may be changed if needed and SWC is recreated for the new region.

8.1.1.1 SAMPLE CHARTS

Following images displays SWCs created by Exeter-UK and Washington-USA at 06:00 GMT on 18th Sep 2012.
8.1.2 DEFINING A NEW SWC

The user may define SWCs for their own purposes. For this “Create SWC” is selected and fields of the dialog box are filled and finally saved. This new SWC is added to the defined SWC list.

8.1.3 PRE DEFINED SWCs

When a SWC defined, it is listed under the “SWC Charts”. It is enough to select needed chart from the list. Map region is set and chart with the latest data is created and displayed.

8.2 TEMPERATURE AND WIND CHARTS

UK and USA Met services generates global forecast for aviational purposes every 6 hours and these data distributed thru GTS and SADIS in GRIB format. METCAP+ decoded GRIB bulletins. Temperature and Wind values of these products are used to create Temp/Wind charts. Intensity of the plotted points are arranged by the software according to the selected area.
8.3 SIGMET REPORTS

SIGMET reports are issued by FIR centers when a significant meteorological event observed or forecasted in FIR area. These reports disseminated through GTS and SADIS.

When “SIGMET Reports” item of “Aviational” is selected valid SIGMET, GAMET and Volcanic Ash reports are shown on the map. (SIGMET with a blank thick dot, GAMET with a rectangle and Volcanic as with a trapezoid)

When the any Icon on the map is clicked nearest SIGMET or GAMET reports are displayed.

8.4 VOLCANIC ASH REPORTS

When a volcano started to erupt ash, some centers creates volcanic ash reports for their area. These reports disseminated to all meteorological centers. METCAP+ decodes volcanic as reports from different centers and displays forecasts on the map. When “Ash Forecast” of “Aviational” is selected, the following box is seen on the screen. This box contains daily Ash reports from different centers. “Day” is used to change report day, “Center” is used to get reports of some special centers. If this part is empty, all reports are listed. “Volcanic Ash Reports” contains all report headers. When any of them is clicked, Ash report in text format can be read.
In order to see ash forecast on the map, “Show on the map” button is clicked. Ash area automatically set and two arrows on the upper right of the screen appear. By clicking these arrows 6, 12, 18 and 24 hour forecasts can be seen. If Ash distribution is forecasted for different levels, these levels are displayed in different colors.

The following images are produced by text forecasts issued by UK Met Office for volcanic eruption in Island.
8.5 TROPICAL CYCLONE/HURRICANE

WMO designated some meteorological centers to forecast tropical cyclones, hurricanes and typhoons for their regions. These centers issue warning and forecast reports regularly when any significant case occurred. These reports are in text format and disseminated by GTS.

METCAP+ warns the users when a cyclone/hurricane report received. The users may create forecast from these text reports.

The user selects “Tropical Cyclone/Hurricane” item of “Aviational” to see cyclone/hurricane forecasts on the map. Then a box containing hurricane names is opened.
When any of the hurricane name of the list is clicked, forecasted path, location and wind speed of the hurricane/tropical cyclone are shown on the map. Map region is changed to the forecast areas by the software. It is also possible to combine these maps with other products. Lower right image displays path of hurricane “Sanba” with GFS D+24 MSL pressure forecast.
8.6 PIREP/AMDAR REPORTS

PIREP/AMDAR reports are created automatically by some special instruments mounted on the airplanes of commercial airlines. These reports may be in text, BUFR or GRIB formats, contains information about wind speed, temperature, turbulence and icing for the flight level and distributed thru GTS. METCAP+ decodes and displays these reports on the map. “PIREP/AMDAR” Item of the “Aviation” must be selected to see these reports on the map.

After choosing date and time, PIREP/AMDAR reports for chosen time are decoded and plotted on the map if exists any. Following image displays aircraft reports at 09:00 Gmt on 16th Sep 2012.

When any point on the map is clicked reports are printed in a time sequence. Following image displays reports from the plane coded EU3487 and ascending from Moscow airport. Flight levels are printed on the left, time on the top and locations on the bottom. Wind speed, direction and air temperature are displayed in the graph.
8.7 SNOWTAM REPORTS

SNOWTAM reports are given in METAR observation to give information about the airport runways. These reports are decoded and displayed by the software. Runway conditions are displayed with color varying from blue to red. Blue shows a good runway condition while red a dangerous one. If there are more than one runways, each of them displayed with a box with runway number.

When any of SNOWTAM report is clicked, detailed information about the runways is displayed.
8.8 TAF REPORTS

Forecast reports received from airports in TAF format decoded and displayed as icons or colors.

When “Icon” is selected, the worst weather conditions are displayed.

When “Color Code” is selected weather forecast for each hour displayed in colors changing from blue to red.
Any TAF report is clicked on the map, detailed information is displayed.
CHAPTER 9

MSG PRODUCTS

METCAP+ has a powerful tool to display different satellite data from EUMETSAT satellites. Some of these products may be listed as channel values from MSG, RGB composite products created by channel differences, MPF products, products created by Nowcasting SAF of EUMETSAT. Many other products like NWP, actual charts, radar products etc may be put as a new layer on the MSG products.

In order to plot MSG data, “MSG Products” of main menu must be selected.

9.1 SINGLE CHANNEL PRODUCTS

Data received from different channels of the MSG satellites may be displayed on maps with different projections when “Channels” is selected. Left dialog box appears on the screen. “Date and Time” list is used to select date and time of the product. The latest product is default. Channel Name is selected from “Channel” list. “Prepare” button creates the products. Depending on the size of the data the image may be created in a few seconds.

When area is changed, image is recreated to fit the new area.

Instead of using all full disk data, It is possible to adjust area of interest to decrease volume of data. Here the area was adjusted to 15W – 55E and 20N-60N. A special software decrease the area automatically when new data received.

When Image is created, the channel value of the point where the mouse is displayed on the status bar.
Channel Vis0.6 Value for point 25.4E/42.7N is 76.9

Channel VIS0.6 without any limitations (Gray Scale) Projection is Polar

Channel VIS0.6 without any limitations (Gray Scale) Projection is Mercator
9.1.1 LIMITATIONS ON IMAGE DISPLAY

When any image is being created by using channels’ data, lower and/or upper limits may be set to create a specific image. These limitations may be done by scrolling “Lower Lim.” And/or “Upper Lim.” In “channel” box. Following setting (channel Vis0.6, lower limit 45) enables user to see only the cloudy areas.

Image of Channel Vis0.6 lower limit is set to 45 to see visible cloudy areas.

Image of Channel IR10.8 upper limit is set to 3 to see cloudy areas.

9.1.2 ADJUSTING IMAGE BRIGHTNESS

Brightness of an image may be changed by using “Brightness” scrollbar. Lowering the brightness value results in a darker image while increasing the value in a whither image.
9.1.3 CHANGING IMAGE COLOR SCALE

Different color scales are used to create satellite images. Default color scale is “Gray”. Different color scales may be defined for different channel values.

- **Channel IR10.8 Upper limit is 3 and color scale is Enhanced scale**

- **Channel VIS0.6 color scale is Rainbow**
9.1.4 SAMPLE IMAGES FOR THE MSG CHANNELS

9.1.4.1 Ch1 – VIS0.6

Vis0.6 with Surface Isobars of 09:00 GMT, 17th Sep 2012

9.1.4.2 Ch2 – VIS0.8

Vis0.8 With Weather Icons and temperature from METAR observations

9.1.4.3 Ch3 – VIS1.6

METCAP+ 2012
**9.1.4.4 Ch4 – IR3.9**

IR3.9 with QNH contours and wind values from METAR observations
9.1.4.5 Ch5 – VIS3.9

Vis 3.9 with Turkey radar mosaic

9.1.4.6 Ch6 - WV6.2

WV6.2 with cloud amount and wind values from synoptic observations.
9.1.4.7  WV7.3

9.1.4.8 Ch7 - IR8.7
9.1.4.9 Ch8 – IR9.7

IR9.7 with Turkey radar PPI data

9.1.4.10 Ch9 – IR10.8

IR10.8 with Enhanced color scale and lower limit is 3
9.1.4.11 Ch10 – IR12.0

IR12.0

9.1.4.12 Ch11 – IR13.4

IR13.4 with icon plots from METARs
9.1.4.13 Ch12 – VISHRV
9.2 RGB COMPOSITES

Special researches have been done to create products which are representing some special meteorological events. These researches create products by combining, extracting or reversing the channel values.

METCAP+ creates RGB Composites already studied and gives users chance to create their own RGB composite images. (See 9.3)

Following descriptions were cited from EUMETSAT site. Products are generated by METCAP+. To create a RGB Composite “RGB Application” item is selected from the “MSG Products”. Pre defined product list may be used to select the images.

9.2.1 AIR MASS

Air mass is an RGB composite based upon data from infrared and water vapor channels from Meteosat Second Generation. It is designed and tuned to monitor the evolution of cyclones, in particular rapid cyclogenesis, jet streaks and PV (potential vorticity) anomalies. Due to the incorporation of the water vapor and ozone channels, its usage at high satellite viewing angles is limited. The Air mass RGB is composed from data from a combination of the SEVIRI WV6.2, WV7.3, IR9.7 and IR10.8 channels.
9.2.2 ASH CLOUDS

Ash is an RGB composite based upon infrared channel data from the Meteosat Second Generation satellite. It is designed to detect ash and sulphure dioxide (SO2) from volcanic eruptions which can be used for the provision of warnings to aviation authorities. The Ash RGB is composed from data from a combination of the SEVIRI IR8.7, IR10.8 and IR12.0 channels.

9.2.3 DUST

Dust is an RGB composite based upon infrared channel data from the Meteosat Second Generation satellite. It is designed to monitor the evolution of dust storms during both day and night. The Dust RGB is composed from data from a combination of the SEVIRI IR8.7, IR10.8 and IR12.0 channels.
9.2.4 HRV CLOUDS

E-View is an RGB composite based upon data from the Meteosat Second Generation satellite. It is dedicated to detailed cloud monitoring of the European region. It is based on data from the SEVIRI High Resolution Visible channel combined with data from the IR10.8 channel.

9.2.5 SNOW

The main application of the Snow RGB is the detection of fog / low clouds and snow during day-time. In this color scheme snow appears red because of the strong absorption in the NIR1.6 and IR3.9 channels (no green and blue), while fog / low clouds appear whitish. Small particle ice cloud appears orange, while large particle ice cloud appears with greater red component. Snow on the ground appears as full red, because its grains are usually much larger than cloud ice particles.
9.2.6 NATURAL COLORS

The Natural Color RGB makes use of three solar channels: VIS0.6, VIS0.8 and NIR1.6. In this color scheme vegetation appears greenish because of its large reflectance in the VIS0.8 channel (the green beam) compared to the NIR1.6 (red beam) and VIS0.6 (blue beam) channels. Water clouds with small droplets have large reflectance at all three channels and hence appear whitish, while snow and ice clouds appears cyan because ice strongly absorbs in NIR1.6 (no red). Bare ground appears brown because of the larger reflectance in the NIR1.6 than at VIS0.6, and the ocean appears black because of the low reflectance in all three channels.

9.2.7 CONVECTIVE STORM

The Convection RGB combines the brightness temperature difference (BTD) between the WV6.2 and WV7.3 channels (on red), the BTD between the IR3.9 and IR10.8 channels (on green) and the reflectance difference between the NIR1.6 and the VIS0.6 channels (on blue). Severe convective storms appear bright yellow in this color scheme because of the near zero BTD WV6.2-WV7.3 of overshooting Cb clouds (high red). The strong updrafts in these clouds produce small ice particles at cloud tops due to homogeneous freezing of cloud drops, resulting with large BTD IR3.9-IR10.8 (high green). Finally, large negative values of NIR1.6-VIS0.6 because of the large absorption at NIR1.6 by ice particles keeps the blue very low. Please note that small ice crystals of Cirrus clouds should not be confused with vigorous convection. Inferred small ice crystals that are not associated with anvils of Cb clouds must form by elevated strong updrafts, such as in high altitude orographic wave clouds.
9.2.8 FOG

Fog / Low Clouds is an RGB composite based upon infrared channel data from the Meteosat Second Generation satellite. It is designed and tuned to monitor the evolution of night-time fog / low stratus. Other (secondary) applications are the detection of fires, low-level moisture boundaries and cloud classification in general. It should be noted that as the product is tuned for night-time conditions, its use during day-time is very limited. The Fog / Low Clouds RGB is composed from data from a combination of the SEVIRI IR3.9, IR10.8 and IR12.0 channels.
9.2.9 MICROPHYSICS (SUMMER - WINTER)

The Day Microphysics RGB was inherited from Rosenfeld and Lensky (1998): the VIS0.8 reflectance in red approximates the cloud optical depth and amount of cloud water and ice; the IR3.9 solar reflectance in green is a qualitative measure for cloud particle size and phase, and the IR10.8 brightness temperature modulates the blue. This color scheme is useful for cloud analysis, convection, fog, snow, and fires. In this color scheme water clouds that do not precipitate appear white because cloud drops are small, whereas large drops that are typical to precipitating clouds appear pink, because of the low reflectance at IR3.9 manifested as low green. Super cooled water clouds appear more yellow, because the lower temperature that modulate the blue component. Cold and thick clouds with tops composed of large ice particles, e.g., Cb tops, appear red. Optically thick clouds with small ice particles near their tops appear orange.
When the users need to create or study on a special RGB Composite, it is very easy to do this with METCAP+. They use “RGB Application” button and click “Special Product”. Then Dialog box will become as follow. The user must fill channels from the list boxes. If two channel differences will be taken then “2nd Channel” list will be selected. Otherwise only first channel value will be used. If lower or upper values are needed for the product related fields must be filled. If inverse of the calculated value is needed then inverse check box of the related value must be checked.

We may fill “Air mass” product as an example (upper right image). When a product is defined, it may be saved for future use. For this purpose “Save” button is clicked and a name is given. Then it will be added to RGB Composite product list. When we click “Prepare” we get the following image.
9.4 MPEF (Meteorological Products Extraction Facility) PRODUCTS

METCAP+ may visualize MPEF products which are generated and disseminated by EUMETSAT. "MPF Applications" Item of “MSG Products” is used to display these products. When Mouse moves on the image, product value of the current point is shown on the status bar. Some of the products are listed below:

9.4.1 INSTANT PRECIPITATION RATE

This product is used to estimate amount of precipitation for the current situation.

![Instant Precipitation Rate](image1)

9.4.2 CLOUD MASK

This product shows cloudy and clear areas.

![Cloud Mask](image2)
9.4.3 CLOUD TOP HEIGHT

This product estimates cloud top height in feet.

It is possible to plot one of the MSG channel value and anyone of MPEF products together. Following sample image contains IR10.8 and Instant Precipitation Rate products together.
9.5 NOWCASTING SAF PRODUCTS

Nowcasting SAF produces and disseminates many useful side products by using Satellite data. These products are displayed by METCAP+.

When Mouse moves on the image, product value of the current point is shown on the status bar.

When the user clicks on the description panel, only those clicked values are displayed on the image.

9.5.1 CLOUD TYPE

The cloud type (CT), developed within the SAF NWC context, mainly aims to support nowcasting applications. The main objective of this product is to provide a detailed cloud analysis.

The CT product contains information on the major cloud classes: fractional clouds, semitransparent clouds, high, medium and low clouds (including fog) for all the pixels identified as cloudy in a scene. A second priority (not implemented in the current version) is the distinction between convective and stratiform clouds, and the identification of clouds for which the top mainly consists of water droplets.

Full display of Cloud type nowcasting product.
Only Very Low Cloud areas are displayed by clicking "Very Low Cloud" color on the right.

9.5.2 LIFTED INDEX

The Lifted Index (LI) is defined as a rising parcel's temperature when it reaches the 500 milibars level (at about 5,500m or 18,000 feet ASL), subtracted from the actual temperature of the environmental air at 500 mbar. If the Lifted Index is a large negative number, then the parcel will be much warmer than its surroundings, and will continue to rise. Thunderstorms are fueled by strong rising air, thus the Lifted Index is a good measurement of the atmosphere's potential to produce severe thunderstorms.

9.5.3 PRECIPITABLE WATER (PW)

Precipitable water is the depth of water in a column of the atmosphere if all the water in that column were precipitated as rain. As a depth, the precipitable water is measured in millimeters or inches.
9.5.4 INTENSITY OF CONVECTIVE PRECIPITATION

The objective of the CRR product is to estimate the precipitation rate associated to convective clouds. This product provides to forecasters complementary information to other SAF NWC products related to rain and convection monitoring as Precipitating clouds and Cloud type.

9.5.5 CLOUD MASK

The cloud mask aims to support nowcasting applications, and additionally the remote-sensing of continental and oceanic surfaces. The Cd Mask allows identifying cloud free areas where other products (total or layer precipitable water, land or sea surface temperatures, snow/ice cover delineation) may be computed. It also allows identifying cloudy areas where other products (cloud types and cloud top temperature/height) may be derived.
9.5.6 EFFECTIVE CLOUD

9.5.7 CLOUD TOP HEIGHT (m)
9.5.8 CLOUD TOP HEIGHT (hPa)

9.5.9 CLOUD TOP TEMPERATURE (K)

9.5.10 TOTAL PRECIPITABLE WATER
9.5.11 PW BETWEEN 1013 – 840 hPA

9.5.12 PW BETWEEN 840 – 437 hPA

9.5.13 PW LOWER THAN 437 hPa
9.5.14 CLOUDS WITH PRECIPITATION POSSIBILITY (0.1 mm > )

The objective of the PC product is to support detailed precipitation analysis for nowcasting purposes. The focus is on the delineation of non-precipitating and precipitating clouds and not on quantifying precipitation amount. Particular attention will be given to also identifying areas of light frontal precipitation.

The product provides probability results for precipitation occurrence. It is not intended to provide information on the type of precipitation.

9.5.15 K-INDEX
CHAPTER 10
RADAR PRODUCTS

METCAP+ displays Radar data received in BUFR format. Images are created for one or more stations (composite). Radar data is combined with other meteorological data like MSG products, lightning, synoptic or NWP. METCAP+ also checks all received radar data and controls them for predefined thresholds. If any point exceeds the threshold value the users are warned (see warning section).

Some of the basic radar products are briefly described below.

10.1 PPI Product

The Plan Position Indicator (PPI) product is a natural radar product. In other words, PPI is the most common (classic) display of radar data. It is used primarily for weather surveillance purposes. It is produced in much shorter time than volume scan. So, this product is available for display immediately on completion of the scan (quick). Therefore, PPI is advantageous product for especially airport meteorology services. This is most widely used form of weather radar display. A typical PPI shows the distribution of the selected data parameter (Z, R, V, W or ZDR) on a constant elevation angle surface (near to 0°). PPI product is possible for all elevations at which data are collected.

10.2 SRI Product

Surface rainfall intensity (SRI) product shows the rainfall intensities based on Z-R relation for a user-defined layer. The SRI generates an image of the rainfall intensity in a user selectable surface layer with a constant height above ground.

10.3 CAPPI Product

The Constant Altitude Plan Position Indicator (CAPPI) is a horizontal cut through the atmosphere; therefore, it requires a volume scan at multiple elevation angles. The number of angles and their spacing depends on the range and height of the CAPPI you want to produce.

A CAPPI radar image shows precipitation at a nearly constant altitude above ground. In the case of the 1.5 km CAPPI image, it displays precipitation which is located approximately 1.5 km above the ground. In other words, a CAPPI product is a slice through a volume scan in a plane parallel to the earth’s surface at a desired altitude set by users. It is used for surveillance and severe storm identification.

10.4 Maximum Reflectivity

Maximum Reflectivity product is the maximum reflectivity between two altitudes for each cell of a volume. In other words, it shows the maximum detected reflectivity (echoes) over each pixel between user selected heights, and includes East-West and North-South profiles of the maximum in side panels. The product is based on a volume scan. A minimum and maximum height may be user-defined and defaults to
zero and 30 kilometers. It is especially useful for depicting areas of severe weather. This product is a useful, quick surveillance of regions of convective precipitation to locate both infant and mature thunderstorms.

10.5 CREATING RADAR IMAGES

In order to create a Radar Image, “Radar Products” of the main menu is clicked. Then radar product selection dialog box appears on the screen.

First station or stations are chosen. Ctrl + Station name must be clicked in order to choose more than one station. “Choose all stations” is clicked to select all radar stations.

After station or stations are chosen, product type Radar product time is the latest as default. If a previous time product is required, first “Get latest product” is unchecked and then “Date, hour and minute” lists are used to change date and time.

“Looping Period (Hour)” is used to determine looping period.

“Reflection Limits” set upper and lower value of the products. Normally these values are automatically calculated. In some special cases the users may want to see some areas which has a powerful radar echo.

If “Arrange map when 1 station chosen” is checked map area automatically set to radar coverage area when only one station is selected, otherwise radar image is displayed on current area.

When “Draw Radar Area” is checked, radar coverage area is drawn roughly.

“Radar Labels” are displayed on the right side of the map if this box is checked.
10.5.1 SINGLE RADAR STATION DISPLAY

Upper selection generates the image on the left side. When mouse moves on the radar area, point value is displayed on the status bar.

If any point on the map is clicked, the maximum value of the nearest point, and nearest cities, towns, villages and districts and their coordinates, distances to the selected point are listed.

When single station is plotted, below panel is appears if mouse is moved to upper right of the window.

Latest Image of the period is displayed.
Previous image of the current image is displayed.
Next image of the current image is displayed.
Starts animation. Then button becomes . This button is used to pause/stop the animation. When animation is started, a new product is automatically created and inserted in the looping when it is received. The oldest product of the loop will be removed from the animation list when a new one is received.

Increases the animation speed.
Decreases the animation speed.
Marks echo areas with black lines to analyze movement of the air masses. Following two PPI images from Hatay Radar shows how echo areas changed between 11:42 Utc and 12:36 Utc.

When a value is written here and button is clicked, the points that have values equal to or greater than the value are marked on the map.

When name of a district is written and button is clicked, the location of the district is shown on the map. The little box near to the area (value box) must be empty. (Upper right figure)
10.5.1.1 PLOTTING OTHER CHARTS WITH RADAR PRODUCTS

Radar products may be combined with other meteorological parameters. Below Image displays Istanbul/Catalca Radar PPI product, Lightning data, MSG IR10.8 Channel (upper limit is 4) and synoptic observations all together.

10.5.1.2 DISPLAYING FOUR RADAR PARAMETER ON DIFFERENT WINDOWS

It is possible to display different radar products on different Windows. While any parameter is being analyzed on one screen, the same point values of the other radar parameters on the other screens are displayed on the status bars.
10.5.1.3 SETTING LOWER&UPPER LIMITS FOR A RADAR PARAMETER

Lower & upper limit for a radar product may be adjusted. Following PPI Image (left) is created by setting lower limit 25 dBz, i.e values lower than 25 are not displayed on the map. The Image on the right displays the echoes without any limitations.

10.5.1.4 SAMPLES FROM RADAR SITES

Izmir PPI 18th Sep 2012 09:40 Gmt
(Radar values more than 50 are marked)

Izmir Max 18th Sep 2012 09:40 Gmt
(Radar values more than 45 is marked)

10.5.2 MULTIPLE RADAR SITES

More than one station may be plotted together. Other meteorological parameters may also be displayed on the same chart.
10.5.2.1 ALL RADAR STATIONS TOGETHER

10.5.2.2 FOUR WESTERN RADAR STATIONS

10.5.2.3 RADAR PRODUCTS WITH SATELLITE DATA
CHAPTER 11

WINDOWS DESIGN

METCAP+ Mapping module creates many products separately in many sub Windows. Choosing “New Map” Item of the “Metcap” main menu item will open a new map sub window. Using these Windows many actual meteorological map, NWP chart, radar or satellite image may be created.

Following image displays four different upper level charts.

Follow image displays a multi window screen that contains, actual charts, NWPs, radar and satellite image and lightning chart.
11.1 REMOVING SUB WINDOW HEADERS

When a sub window is opened, it contains header that contains window caption and system icons as shown below figure

When many sub Windows are opened, it may be necessary to remove these header bars to get more space for the windows. For this purpose, “Remove window border” of “Map Settings” main item is selected. Then header section of the active window is removed and caption of sub item becomes “Draw window borders”. The same item is clicked once more to put headers.

The image in section 6.2 displays four sub Windows without headers.

11.2 SETTING CURSOR POSITIONS FOR MULTI WINDOWS

When many windows are opened, it may be sometimes useful to see the same positions and values on all the windows. When “Fix Mouse on the same location for open Windows” item of “Metcap” is clicked, Mouse position on active window will be marked on the other windows and point values of the position is displayed on the status bar.
CHAPTER 12
SINGLE BUTTON PRODUCTS AND AUTO CREATING

Some meteorological maps are used very often. It is possible with METCAP+ to create those charts very easily instead of losing time to create them.

12.1 RECORDING SINGLE BUTTON PRODUCTS

When any meteorological product is created in one or more Windows, they may be saved for future use. For this, first chart or charts are created in Windows and “Add One Click Product List” item is chosen.

When this procedure is done, left dialog box is opened. “Group” contains group name. “→” button is clicked to choose an existing group. Then product name is written in “Product” section. If an existing product is wanted to be changed “→” button is clicked. Group and product name should not contain blanks. Third button on the right is used to send created product to other users by using email or ftp, or to run a batch file. If there are more than one mail addresses to send, they must be separated with blanks.

“Close when completed” enables Windows to be closed when the product is created. This part is used for creating maps at special times.

After pressing “Ok” button, the product(s) on the screen is added to “One Click List”.

12.2 CREATING ONECLICK PRODUCTS

In order to see recorded products easily, “One Click Products” of the main menu is clicked. After choosing the group name, product is selected and created without doing any extra job.

Following samples are created by using “One Click”.

METCAP+ 2012 105
12.2.1 RADAR DISPLAYS

Group name is Radar, product name is “Ankara+Istanbul+PPI+Max”

12.2.2 ACTUEL CHARTS

Group Name is Actuels, Product Name is 4Panel
12.2.3 NWP CHARTS

Group Name is NWP and product name is ECMWF4Panel

12.2.4 SATELLITE PRODUCTS

Group name is Satellite, Product Name i 6panel
12.3 AUTO CREATING

METCAP+ automatically generates any product at specified time. For this, the user must create a one click product and then modify “ScheduledTasks.txt” in ini directory. This file contains lines for each product. Format of these lines described below

Y M 7G 24H Min ProgramName TypeofJob OneClickName.xml

Y is Year. * represents every year

M is month. * represent every month

7G consists of 2 character for each day (1/0 and blank). It represents the day of weeks. “1 “ for day means program will be run that day while “0 “ will not be run. Week days start from Sunday. The following string for 7G means program will be run every Sunday, Wednesday and Saturday “1 0 0 1 0 0 1”

24G is similar to 7G. It represent 24 hour starting from 00. “1 “ must be set for thours when the product will be prepared.

ProgramName displays the name of the program.

TypeofJob displays what the program will do. AUTOSEND will create and send the products and CREATE will create and save the products.

OneClickName is the name of oneClick Product.

Following line will run Newmap program to create 6 products displayed on 12.2.4 and send them to the users.

* * 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 30 NewMap AUTOSEND \ini\definedscr\Satellite\6Panel.xml
CHAPTER 13

DRAWINGS

METCAP+ enables users to create their own charts like SWC or add some meteorological symbols to a prepared map.

“Drawing” item is clicked to make charts. Then following tool bar will be opened on the top of the window. Charts are created by using icons and tabs.

13.1 TOOLS

- Draws line on the map when Mouse is down and moved.
- Fills clicked area with chosen color.
- Draw an empty ellipse line on the map when Mouse is down and moved.
- Draw an empty rectangle line on the map when Mouse is down and moved.
- Draw a filled ellipse line on the map when Mouse is down and moved.
- Draw a filled rectangle line on the map when Mouse is down and moved.
- Increase pen thickness
- Decrease pen thickness
- Show or remove reference points
- Closes the drawing module

13.2 JET STREAM

This Tab is used to draw jet streams on the map.
Starts a new Jet Stream drawing. This button must be pressed to start drawing new jet stream. After pressing this button, jet stream points must be clicked on the map.

Puts wind barbs on the line of jet stream. When this button is clicked, a dialog box is opened to enter wind speed. After wind speed is written, reference rectangle the jet stream line is clicked and wind barb is inserted there.

Puts arrow to head of the jet stream line

Enables making changes on drawn Jet stream. Reference rectangles are used to change line points. By clicking and moving the rectangles will change the direction of the lines. If right Mouse button is clicked then that reference rectangle will be deleted.

13.3 CLOUDS

Cloud Tab is used to draw cloud images on the map. It contains two icons.

Start new cloud drawing. Then cloud point are marked on the map.

Changes cloud points. By clicking and moving the rectangles will change the direction of the cloud lines. If right Mouse button is clicked then that reference rectangle will be deleted.

13.4 FRONTS

Starts front drawing

Cold front (surface)

Warm front (surface)

Occluded front (surface)

Stationary front

Cold front (upper)

Warm front (upper)
Intertropical convergence zone  Convergence line  Severe line squal
Changes front points.

13.5 TROPOUSE, PRECIPITATIONS, ICING, TURBULANCE AND OBSTACLES

Draws High, Low, Standard tropopause and elevation of 0 °C. When one of the symbols is chosen, first elevation string is written, then this height and relevant symbol are put on the map together.

Standard tropopause  High  Low  0 °C Height
Thunderstorm  Tropical Cyclone  Drizzle  Rain
Snow  Showers  Hail  freezing rain
Drifting snow  Sandstorm(light)  Sandstorm  Haze
Haze/Smoke  Mist  Fog  ash Cloud
Volcano  Moderate turbulence  Severe Turbulance
Light Icing  Moderate Icing  Severe Icing
Change Image coordinates or delete any figure from the map

13.6 TEXT
Any text in any font, size and color may be written and tilted on the map.
CHAPTER 14
TRANSFERS

Any product created by METCAP+ may be send to anyone by using email, ftp, or save in different formats. “Transfer” Item is selected for this purpose.

14.1 KML FILE

METCAP+ creates a KML file for the product on the screen. Location and name of the file and is determined by the user.

Generate KML file may be seen by using google Earth.

14.2 PNG, JPG AND BMP FILE

METCAP+ saves Screen image in a PNG, JPG or Bitmap files. Location and name of the file is chosen by the users.

14.3 COPY

METCAP+ Copies the image in to memory to make it use by different pros like MsPaint . This image may be inserted into the image or document files by just pressing Ctrl+V buttons.

14.4 SEND WITH EMAIL

METCAP+ sends a created image to different email addresses. Dialog box on the left is used to send image. “Load mail list from file” brings mail addresses from a text file. Mail addresses must be separated with blanks.
14.5 SEND WITH FTP

METCAP+ sends the image to an ftp site. Necessary fields of the left dialog box must be filled.

14.6 RUN A BATCH FILE

METCAP+ runs a prewritten batch file after creating an image, if it is set by the users.

14.7 WINDOW SIZE

METCAP+ Changes window width and height.

14.8 CALENDAR

Displays date, local and Ght time, sun rise, sun set, moon rise and moon set for the current locations. It also display day and night parts of the world.
CHAPTER 15

IMAGE VIEWER

Many meteorological center creates different product in T4 (Fax format), JPG, PNG formats and disseminate these products thru GTS by putting a suitable header.

METCAP+ receives and displays these image files.

In order to see image files “New Picture” Item of “Metcap” menu is selected. Then an empty image viewer windows is opened. Selection tool bar may be seen by moving mouse upward.

There are two ways to see images

15.1 IMAGES BY HEADER

If the user knows the all or some part of the GTS header of the product, he/she writes it to Header section. When some of the header (at least first two characters) is written and button is pressed, all products starting with written portion are found and first one is displayed. All products are listed in “List” section.

Writing Center and hour simplifies the search.
When “Fit to screen” checkbox is checked, the image is stretched to the window. Otherwise it is displayed as its original size.

“Size” list box increases or decreases the image size from 10% to 500%.

Rotates image leftward.

Rotates Image rightward.

Displays previous Image in the list

Displays next Image in the list

Starts animation if there are more than one image in the list.

Increases animation speed.

Decreases animation speed.

Stops animation

Saves image in a file.

Prints the image.
15.2 IMAGE FROM LIST

When button is clicked Image selection box shown on the left is opened. Selecting from the columns brings image to the screen.

15.3 SAMPLE IMAGES

15.3.1 T4 (Fax format)
15.3.2 PNG FORMAT

15.3.3 JPG FORMAT
CHAPTER 16

WEATHER MONITORING

It is very important for a forecaster to know what the actual weather is. As explained in previous chapters, METCAP+ has many modules to see weather conditions by using different observation, radar and satellite product. "Weather Monitoring" modules combines many utilities to make the forecasters follow weather conditions and see measured values easily. Synoptic and Metar observations are used together.

When the program is run, it displays weather conditions for the defined area. It has an auto hided tool bar. When the mouse is moved to top of Windows main tool is seen and when it is brought lower left of the screen parameter tool bar is seen.

16.1 MAIN TOOL BAR

Main tool bar contains many buttons to manage the module. Brief description of them listed below.

Zoom in button enables users to selected areas on the map. When tis button is clicked upper left and lower right corners must be clicked respectively. When an area zoomed, it will contain much observation which are not plotted in order to prevent over plot. Following figure shows Ankara sub region of Turkey
This button is used when the main region is changed (by zooming or selecting a defined region) to come back to original region.

This button sets the screen region to one of the predefined regions. When this button is clicked, a dialog box with the name of the regions and any region may be selected. To return main area, pressed.

Date and hour boxes are used to change date or hour. When the module is run, observations of present date and time are displayed.

Display observations of previous hour.

Display observations of next hour.

Finds and displays the worst weather conditions, precipitations, strongest wind, maximum or minimum temperature, lowest visibility between time interval. Some examples are listed below:

a) Worst weather conditions

b) Only precipitations
c) Maximum/Minimum measured temperatures for an interval

Filters the displayed values. When this button is clicked a dialog box is opened and filter value for the parameter and type of filtration (lower or higher) is selected. After filter dialog box closed only the observations that meet the condition are displayed. Lower left image displays the places where temperature is 20 or lower, right one shows the places where temperatures are 30 or higher for the same hour.

Displays the observations that reports significant weather, clouds or strong winds with a relevant icon. When any of displayed icon clicked, details of the observations may be seen in both raw and decoded form.
Displays the lightning areas. Red symbols display the newest lightning while gray ones for the oldest. City and town names put automatically. When any lightning point is clicked, coordinates and time of the lightning is displayed.

Shows change in temperature between two times. Left value shows the latest, and right one the previous value. Decrease is depicted as blue and red for increase.

Displays all stations and their values with selected parameter whether they are plotted or not. It is possible arrange list. List may be sorted alphabetically, increasing or decreasing order. First one of the following images displays stations in an increasing order and second one in decreasing order. Using this button it is easy to see warmest, coldest stations, maximum precipitation wind speed values etc.
Display satellite image animations. It is possible to stop and control images one by one by using the buttons on the upper right of the window.

Display Radar image animations. It is possible to stop and control images one by one by using the buttons on the upper right of the window.

Displays airport forecasts by using TAF reports. The software displays the worst forecasted weather. When an icon is clicked, detailed forecast is displayed for the period.
Displays weather forecast generated by “Central Forecast Center” for Turkey and other countries. Previous or next day forecast may be seen by using arrows on the panel. It is also possible to just weather conditions, Max or Min temperature values. When “Show only significant event” is checked, software displays only the places where a significant weather forecast. When contour button is clicked contour lines are drawn for max or min temperature values.
Displays 5 day forecast in tabular form.

<table>
<thead>
<tr>
<th></th>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISTANBUL</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>BURSA</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>EDIRNE</td>
<td>14</td>
<td>15</td>
<td>17</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
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<td>15</td>
<td>16</td>
<td>18</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>CANAKKALE</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>19</td>
</tr>
</tbody>
</table>

Saves screen images in selected form (.jpg,.png,.Bitmap)

Changes program and map settings. Settings Dialog box is very similar to the one explained in “Mapping” section except “Observation” tab. This section is used to determine distance between observations, path of data files, observation size, 2 letter codes of the countries whose observations will be shown on the map, the site address where data is downloaded (this is necessary if this module is run free of METCAP+.), which observations will be plotted.

Get data from defined center manually

 Starts animation. Weather conditions, temperatures, satellite and radar images, forecasts are displayed in turns.
16.2 PARAMETER TOOLBAR

Following tool bar is displayed when Mouse is moved to lower left of the screen it is used to select which parameter will be plotted on the map.

- Displays weather summary with icons.
- Plots 2m temperature values from METAR and Synop observations.
- Plots de point temperature values from METAR and Synop observations.
- Calculates and plots heat index
- Calculates and plots wind chill values
- Calculates and plots wind Relative Humidity values
- Plots wind speed and directions
- Plots 6/12 hour precipitation values. (Main Synops)
- Plots 24 hour total precipitations (06 Gmt Synops)
- Plots Maximum temperature (18 Gmt Synop)
- Plots Minimum temperature (06 Gmt Synop)
- Plots or removes observations from map
- Plots Cloud amounts
- Plots Visibility
- Plots MSL and QNH values
- Plots only foggy stations
- Plots only rainy stations
- Plots only snowy stations
- Plots stations that reports thunderstorm or lightning
Plot all precipitations

Plots windt stations Wind speed > 25 knots

Plot fresh snow depth

Plots Total snow depth

Creates contours for plotted parameter.
CHAPTER 17

SKEW T LOGP DIAGRAM

METCAP+ retrieves TTAA and TTBB sections of the upper level observations and plots SkewT LogP Diagram. It also calculates many instability indices and useful parameter for weather forecasting.

17.1 CREATING A DIAGRAM

In order to create a SkewT LogP diagram, upper toolbar of the interface is used. When the program is run, present day and time is taken for observation search as default. Date and hour may be changed when it is necessary. When time is changed, all temp bulletins are checked and “Stations” list box is filled with station numbers. If there are more than one bulletin for a station (CCA, RRA or duplicated), all of them are put the list separately. Choosing station number is not enough to create diagram. “Prepare” button must be click to finish the job. Then TTAA and TTBB parts of the stations are decoded and diagram is plotted.

When Mouse is moved in plot area, pressure, temperature, dew point, height, relative humidity, Equopotential temperature (ePT K), potential temperature (PT) and mixing ratio of the point is calculated and displayed on the upper left of the diagram.

After plotting a temp diagram, the user may plot another one. If “Clean” button is clicked diagram is cleaned. Otherwise second observation is plotted on the first one with a different color. If two observations are plotted together, calculations are done for the first one.
Plots previous station of the plotted observation.

Plots next station of the plotted observation is plotted.

17.2 SETTINGS

17.2.1 PROGRAM SETTING

This section is used to change diagram appearance.

"Main Frame" is used to change main frame thickness, frame color and box (drawing area) color.

If "Draw Pressure Lines" checked, pressure lines are drawn. Interval of pressure lines is defined from "Line Interval". "Main line Interval" value determines which lines will be drawn thicker. Line and Main Line thickness set pen width for the lines. Line color may be changed by clicking the color panel.

Procedure is the same for Temperature, Dry adiabats, Moisture adiabats.

Elevation Control lines is drawn if box is checked

This box is used to set the calculation of convective condensation level (CCL). Value may be 0 (from ground), 50 etc.

If “Set as default” is clicked for all uses, if just “Ok” is clicked changes are applied for this use.
17.3 ANALYSIS

When a temp observation is plotted, analysis of the temp is shown on the right of the diagram. This part contains Surface information, Maximum Wind, Tropopause level information, Lifting Condensation Level (LCL – Calculated), CCL (calculated), Level of Free Convection (LFC), Level (el=Equilibrium Level), Convective Available Potential Energy (CAPE), Precipitable Water (PW), Mean RH for Surface 500 hPa level, Level winds.

When Mouse clicked on any parameter, description about that parameter is shown as hint.

Brief description of some calculated parameter are given below.

**LCL** is the *height* at which a parcel of air becomes saturated when it is lifted dry adiabatically. The LCL is associated with mechanical lifting (such as frontal lifting, wind convergence or orographic lifting). The LCL for a surface parcel is always at or below the CCL.

**LFC** is the *height* at which a parcel of air lifted dry adiabatically until saturated and then moist adiabatically thereafter would first become warmer than the surrounding environmental air. The air after LFC would then rise freely without further need for forced lift. Not all soundings have a LFC.

**EL** is the *height* where the temperature of a buoyantly rising parcel again becomes equal to the temperature of the environment. Above this level, the parcel is cooler than the environment and will not rise freely.

17.4 INSTABILITY INDICES

There are many instability indices that are used to forecast dangerous weather phenomena. METCAP+ calculates some of them listed in left figure.

Each index line is colored according to their thresholds. Colors vary from blue to red. Blue indicates stable weather (no thunderstorm or no severe weather) but red indicates a dangerous case.

When any of the indexes is clicked a brief description and thresholds are given as shown in left figure.
SkewT LogP has a bar on the left of the main graph which shows instability types for levels. Blue represents stable region, while green displays conditionally unstable levels and red shows unstable levels.

17.5 INVERSION LEVELS

Inversion levels determined by the sounding and their type listed.

Thickness and temperature change for each 1000 m is calculated and displayed.

Forecasted maximum wind speed when air temperature reaches max. Convective temperature is found and printed.

Wind speed &direction and temperature of the levels starting from 1000 feet are calculated and listed.

17.6 TEMPERATURES

Levels of Some standard temperature values are calculated from the observations and listed in both meter and hPa.

Convective temperature values are calculated. “Recalculate for Tc” button redraws SkewT LogP diagram changing surface temperature to “Convective Temperature”. All calculation are renewed. The same button is clicked once more to return normal case. See below Left diagram.
“Recalculate for Tx” button does above procedure replacing surface temperature with Max Temperature. See below right diagram

17.7 CHANGES

It is possible to graph changes in last 24 hours for temperature, height, RH and Wind Speed.

17.8 CHANGING ACTUEL OBSERVATION

When an observation is plotted, its raw and decoded forms may be seen by clicking “Observation” item of the main menu. Third box contains level values starting from the ground level. Any parameter value in this box may be changed and by pressing “Redraw” button, diagram is redrawn and calculations are renewed for new values.

The same procedure is done by using “Modify” item of the main menu. First parameter is chosen and then anyone of the selected parameter is moved by using Mouse.
When “Delete Level” is chosen, any level is deleted by clicking the level line.

17.9 OTHER APPLICATIONS FOR SKEWT BY USING SETTINGS ITEM

17.9.1 VIRTUAL TEMPERATURE

Virtual temperature may be calculated and drawn on the diagram when “Virtual Temperature” item is selected. Its color is Green.

17.9.2 WET BULB TEMPERATURE

This value may be calculated and drawn on the diagram when “Wet Bulb” item is selected. Its color is Light Blue.

17.9.3 RELATIVE HUMIDITY

RH values for each level is calculated and a bar graph is created on the right of the diagram.

17.9.4 WIND SPEED

Wind Speed values are shown in graph on the right side of the diagram.

17.9.5 CLOUD AMOUNT

Cloud amount (%) is calculated by using temperature and dew point values. A line graphic is created on the right of the diagram.

17.9.6 ELEVATION LINES

This line gives information about sounding. If is smooth, then sounding is accepted as good. When this item is clicked, height of the standard levels are written on the left of the diagram.

17.10 HODOGRAM

Hodogram for the sounding is prepared and displayed on the upper left corner of the graph. When this graph is clicked, it is drawn on full plot area. A brief information on hodogram is given below (Cited from Vikipedia)

“In meteorology, hodographs are used to plot winds from sounding of the Earth’s atmosphere. It is a polar diagram where wind direction is indicated by the angle from the center axis and its strength by the distance from the center. In the figure to the right, at the bottom one
finds values of wind at 4 heights above ground. They are plotted by the vectors $\vec V_0$ to $\vec V_4$. One has to notice that direction are plotted as mentioned in the upper right corner.

With the hodograph and thermodynamic diagrams like the tephigram, meteorologists can calculate:

Wind shear: The lines uniting the extremities of successive vectors represent the variation in direction and value of the wind in a layer of the atmosphere. Wind shear is important information in the development of thunderstorms and future evolution of wind at these levels.

Turbulence: wind shear indicates the possible turbulence that would cause a hazard to aviation.

Temperature advection: change of temperature in a layer of air can be calculated by the direction of the wind at that level and the direction of the wind shear with the next level. In the northern hemisphere, warm air is to the right of a wind shear between levels in the atmosphere. The opposite is true in the southern one (see thermal wind). So in the example hodograph, the wind $\vec V_3$ from southwest meet the right side of the wind shear which means a warm advection and thus warming of the air at that level. “
CHAPTER 18  

METEOGRAM  

METCAP+ Meteogram shows some of the forecasted parameters in time/value graph form for any location. It enables users to analyze forecasted values better. It uses ECMWF GRIB product, when it is required it may be use others center data like GFS with small modifications.

18.1 CHOOSING LOCATION  

Left Dialog box contains necessary information for creating meteograms.

Name : Location Name (may be left empty)  
Lati. : Latitude of the location. It must be filled.  
Long. : Longitude of the location. It must be filled.  
Center : Name of the center whose products are being used for meteogram.

Model day , Hour: Date and Hour of model run .

“Recorded places” box contains station names recorded in station database.

18.1.1 MANUEL ENTRY : The users fill upper dialog box manually if he/she knows the coordinates

18.1.2 SELECTING FROM LIST When any station is selected from the list, first three areas are filled automatically.

18.2 METEOGRAM DISPLAY

“Prepare” button retrieve data and creates meteogram. Information on location and forecast are given on the top of the graph. Date and days are on the bottom of the graphs.

Cloud amount and precipitation amounts are graphed as bar graph and others are in line graph.

When any graph is clicked, a detailed graphic is prepared for that parameter(s).
It is possible to change forecast period from 10 days to 1 day.

Meteogram uses following parameters: Cloud amount (%), RH of 850 hPa, 3 or 6 total precipitation (mm). If there is snow precipitations, it is shown as gray bar graph on the total precipitations, MSL pressure, wind barbs for Wind speed & direction, bar graph for wind speed, 2m and 850 hPa temperature.
CHAPTER 19
WARNINGS

METCAP+ decodes all received bulletins and check them to warn the users. Important weather events, wind speed, visibility, Radar values (PPI, MAX, SRI and CAPE) and cloud base thresholds are defined by the users. Coordinates of the control area are defined by the users too.

When any parameter exceeds the threshold a popup window is opened and users are warned with a beep message.

When any point is clicked on the map, nearest significant events, radar echo or lightning point is displayed as below figures. Status bar displays latest control time, number of bulletins observations checked. If “Popup for each warning” checkbox is checked, map automatically opened when a warning is necessary. If it is unchecked, the user must open the map to see the warnings. “warn with voice for each warning” creates a beep for each warning.
CHAPTER 20

DATA BACKUP

METCAP+ saves all kind of data for a specified time period varying from 1 to 365 days or keeps them on the disk without deleting if the disk size big enough. Especially for special cases, like a dangerous or extraordinary weather conditions, it is essential to save data for future use. The backup module retrieves selected data from the main disk and store them on a different location.

Date and hour in start box determines start time of the data and End box is used select last day and hour of the backup.

“Back up data type” is used to determine which type of data will be saved.

Target Directory defines where the data will be stored. Directory may be changed by either writing path manually or by choosing from dialog box.

It may take a few minutes to back up data depending on the selected time interval and data volume.

20.1 USING SAVED DATA TO CREATE MAPS

In order to use saved data to create meteorological map “Change Input Directory” Item is selected from “Map Settings. The directory where the data is saved selected. The Input directory for that map is the selected one until closing it or changing directory once more.
CHAPTER 21

FINDING STATION INFORMATION

It may be necessary to find information about some stations like ICAO or synoptic code. METCAP+ searches station database for different purposes and list found data.

When Station Info search module is run, the user must fill “String to Search” field. Then position to search may be selected to simplify the selection. When search button is clicked, all found stations are listed in the big box.

21.1 SEARCH IN ALL FIELDS

“All the fields” is the default search option. All parts of the records are controlled to find a match with written string when “All the fields” is selected.

Left example finds all stations whose Name, country or ICAO values contains “TURK” string.

When “Position is set to “Beginning”, that string is searched only at the beginning of the fields and “End controls the end of the fields.

21.2 SEARCH IN ICAO: Search the string for only ICAO codes.

21.3 SEARCH IN SYNOPTIC: Search the string for only Synoptic codes. The value must be numeric.

21.4 SEARCH IN IATA: Search the string for only IATA codes. The string must contain only character and must be at most 3 characters.

21.5 SEARCH IN NAME: Search the string for only Name fields. The string must contain only character no limit for the length.

21.6 SEARCH IN COUNTRY: Search the string for only Country fields. The string must contain only character no limit for the length.
CHAPTER 22

ANALYSING OBSERVATIONS FROM AN AIRPORT STATION

METCAP+ has a module to analyze observations from an airport stations. METAR reports from selected airport are listed and graphics are prepared for different parameters.

Station ICAO code is written “Station” box and time interval is chosen. When the “Search” button is clicked all METARs for that interval are found and printed from newest to oldest. When an observation is clicked it is decoded and displayed as explained previous chapters. How long did the search took, number of searched bulletins are written on the status bar.

Every tab of the module display different data. Some of those displayed below. When mouse is brought to a value on the graphs, raw METAR observation is displayed.
CHAPTER 23

METCAP+ AERO

METCAP+ AERO package was developed to create flight documents used by civil and military airport meteorology services in a short time. This software informs the users when any weather report from alternate airports received or any significant meteorological event in airport’s control area occurred. METAR/SPECI reports, lightning observations from different sources and Radar data (if exists) are used for his purpose. Warning criteria may be set by the users for different meteorological parameters like visibility, wind speed, cloud base, temperature, radar echo etc.

Latest METAR/SPECI reports, valid TAF reports, significant weather events and radar echos for defined area are shown on the map. In addition to actual data, Significant Weather Chart (SWC) created by World Area Forecast Centers, Wind and Temperature charts are also prepared and shown by the package. Valid SIGMET reports, volcanic ash reports, tropical cyclone and hurricane reports and SNOWTAM reports may also be seen on different pages of the interface.

Flight documents for any flight route may be created by the user at any time. It is also possible to create these documents automatically at defined times and sent to other users or nodes via email or ftp.

All prepared flight documents are kept on the disk for the period defined by the users.

The Software may create military flight form Model TA-M used by NATO pilots.

All data used by the software may be received from national meteorological communication networks or downloaded from Internet.

Appearance of the interface, area of interest and list of important airports may be set by the users.

23. 1 DATA SOURCES (For Singel Use of the METCAP+ AERO module)

METCAP+ Aero package may receive required data like METAR, TAF, SIGMETS, GRIB and BUFR bulletins from different sources and use them. Some significant data sources may be listed as follows:

23.1.1 TURKISH METEOROLOGICAL SERVICE COMMUNICATION SYSTEMS

Required meteorological observations, forecast reports, numerical weather prediction products in different formats are transferred to the airports via TurkSat satellite by using ftp and broadcast methods. All data received from this system are used by the software.
23.1.2 SADIS SYSTEM
Satellite Distribution System (SADIS) is run by UK Met Office on behalf of ICAO to transfer meteorological observations, forecast and other numerical data to end users at the airports in different countries. Distributed data includes both OPMET data from different countries and GRIB and BUFR forecast products produced by World Area Forecast Centers like Exeter and Washington. Target areas are Europe, Africa, Middle East and Indian Ocean. To get data from SADIS system the users must have either reception system (antenna, receiver etc) or a user name and password for accessing SADIS ftp site. If these requirements are fullfilled then Metcap+ Aero uses all data from this system.

23.1.3 RETIM SYSTEM
RETIM is run Meteo France and delivers OPMET, T4, GRIB and BUFR data to the users at airports, national met services and TVs. If the reception system was installed, all data received from system may be digested by the software.

23.1.4 NOAA INTERNET SERVICE
All meteorological data which may be used for aviational purposes generated by NOAA or collected from other sources may be downloaded from Internet freely. The software may download OPMET data like METAR, TAF and SIGMET from the ftp site.

23.2 MAIN STATION INFORMATION
Latest meteorological data of the main station are shown on the left side of the form. These information are updated instantly when a new report received.

ICAO code, name, longitude, latitude, elevation, position of the runways and position of the anemometers of the main airport may be set by the users.
23.2.1 DATE AND TIME

Local and UTC time periods are shown on the left of the screen. Sunrise and sunset time of the main airport are shown under the clocks in terms of UTC.

23.2.2 RUNWAY AND WIND DATA

Runway locations and the wind data of this runways of current airport are depicted on proper locations. The biggest circle is showing main wind direction.

23.2.3 THE LATEST METAR/SPECI OBSERVATIONS

In this section, METAR and SPECI observations are shown both coded and encoded forms. The current (present) weather condition is depicted by an icon on the right top side of the figure on the left. In this section the name of airport and its ICAO code, time of observation, wind speed and direction and gust (if it is available), visibility, meteorological events, clouds, weather temperature and dew point temperature and QNH values are shown in decoded forms. Also existing situation of METAR and SPECI (if available) reports are shown in the bottom of this section.

23.2.4 CURRENT TAF REPORT OF E AERODROME

Encoded current TAF report of aerodrome and forecast of next 12 hours are shown by hour and hour. For example if the time is 08.00 UTC, then 6. and 7. hours of 18.06/1912 TAF forecast (which are invalid) are not shown on the form.

23.3 METAR OBSERVATIONS OF SELECTED STATIONS

METAR and SPECI reports of aerodrome which want to be observed continuously are controlled and presented to the user. Representation consists of station name, ICAO code of
Which station want to be observed and caution limits are determined by user.
23.5. GRAPHICAL REPRESENTATION OF TAF REPORTS

Designated stations’ TAF reports are shown in the form of hourly forecasts with color and icons. All of these reports show period or a specific time interval determined by the user.

23.6 SIGNIFICANT WEATHER EVENTS

All received observations, lightning coordinates and radar echos are controlled continuously. When any meteorological event observed or any parameter exceeds the threshold or lightning observation or powerful radar echo is reported in the control are these information displayed on the map. Boundries of the area and threshold values are set by the users.

Icons summarizes the weather event. Clicking on the icon shows more information. In this case, if any point on the map is clicked, nearest METAR / SPECI observation, lightning, value, and the value of radar echo and radar station name are displayed with driving time.
23.7 MOST RECENT SWC

United Kingdom Met Office (EGRR) and the American Meteorological service (KWBC) create Significant weather events forecasts for aviational purposes in BUFR format and these data are distributed through the GTS and SADIS. These products are analyzed and presented by the program. The area on which SWC maps are shown and level of SWC are determined by the users.

23.8 MOST RECENT TEMPERATURE AND WIND CARD

United Kingdom Met Office (EGRR) and the American Meteorological service (KWBC) create temperature and wind forecasts for aviational purposes in GRIB format and these data are distributed through the GTS and SADIS. These products are analyzed and displayed by the program. The area on which SWC maps are shown and level of SWC are determined by the users. These cards refreshed every six hours, when the new products are received.
23.9 SIGMET, GAMET, SNOWTAM, TROPICAL CYCLONE BULLETINS

The software controls every bulletins received and classifies them according to their types. Those bulletins containing significant weather events for the defined area or those important for aviation are displayed when they received. It is also possible to see these bulletins when required.

SIGMET/GAMET reports prepared for significant events, volcanic ash reports, Tropical Cyclone, Hurricane and typhoon reports are displayed when they received. Outdated reports are removed from the list.

23.9.1 SIGMET / GAMET DISPLAY

Upper part of “SIGMET/SNOWTAM/CYCLONE” tab contains the list of SIGMET, GAMET and tropical cyclone, hurricane and typhoon reports. Contents of these reports are shown on the left box when any of them clicked.

Detailed search for any country may be done by writing ICAO code of the meteorological center of that country in the “Limitation” area. If Reports from Turkey is wanted “LT”, if reports from Esenboga FIR area is wanted “LTA” must be written.
23.9.2 REPORTS FOR TROPICAL CYCLONES and VOLCANIC ASH

All received volcanic ash and tropical reports are displayed to the users. These reports may be seen as text format. It is also possible for tropical cyclone reports on the map with their possible paths and wind speeds.

23.9.3 SNOWTAM REPORTS

SNOWTAM reports contain runway conditions for each runway of the airport, type of pollutants, its depth and braking conditions. These reports are given at the end of the METAR reports when needed.

METCAP+ decodes and display SNOWTAM reports. Runway conditions are summarized by colors.
23.10 CREATING FLIGHT FOLDERS

METCAP+ creates flight documents for both civil and military flights. These documents contain latest METAR and TAF reports for departure, arrival and alternate airports. Wind and temperature values for different levels of departure and arrival airports derived from GRIB bulletins. Sun rise, sun set, moon rise and moon set times are given in UTC. SIGMET reports, Significant weather charts and temperature wind charts for the flight region, cross-section containing temperature and wind data for levels of the route are also prepared for each flight.

Following screen is seen when “Flight Documents” tab is chosen

23.10.1 Starts creating a new flight document. All fields are cleaned. These empty fields must be filled and saved once to create a folder.

“Flight Info” contains the following fields

23.10.2 ICAO code of the departure aerodrome is written. When “New” button is clicked, code of the present airport is written automatically. It may be changed if the documents will be created for another airport. It is enough to double click this area in order to select ICAO codes from the list. Following box is brought to the screen. First country name then airport name is selected.
23.10.3 ICAO code of the destination airport is written. If the code is not known, it may be selected from the list as described above. When destination airport is written map region is changed and route is drawn on the map. Route may be changed and alternate airports may be chosen by clicking on the map (See below).

23.10.4 The name of the airline company that will use the documents is written. (like THY, Turkish Airlines, Pegasus)

23.10.5 Flight number is filled. (like TK9999)

23.10.6 Flight duration is written. The character “:” must be put between hour and minute values. (like 03:30). Flight duration is important to determine weather conditions of destination airport for landing time. It is also important to determine whether one or two period of forecast will be used for long haul flights. This area must be filled, otherwise documents are not created.

23.10.7 ICAO codes of the alternate airports are written. There are two ways to fill this area: by clicking the area to chose stations as described above or clicking on the map (first select alternates radio button must be selected). The nearest airports to clicked point are listed. When any airport is chosen, it is written in alternate airport area.

23.10.8 Arranging Route

Route of a flight may not be a straight line. “Select Route” radio button is clicked to change route. Marking the route must be started from departure airport. Clicking on the map adds a new point for the route. Position of a selected
point may be changed or deleted or a new point is inserted by clicking the right button of the Mouse.

Add new point: Inserts a new point to the route points.

Move nearest point here: Nearest route point is moved to new point.

Delete nearest point: Deletes the nearest route point.

23.10.9 Significant Weather Charts (SWC): This section is used to select which SWC charts, Medium/or Upper level, will be used for the flight. If both are unchecked no SWC is created for the flight. Otherwise SWC charts are created for the flight region by using the latest data.

23.10.10 Temperature Wind Charts: This section is used to select levels for which temperature and winds charts will be created. More than one level may be selected for a flight.

23.10.11 Map Projection: Map projection for SWC and temperature/Wind charts is selected.

23.10.12 Label position: Poon of the label is chosen. Label contains origin of data, validity and creation date/times etc.

23.10.13 Map Region: Map region is automatically arranged by the software. This section is used to change determined map areas. In order to change area coordinates, “Map region automatic” must be unchecked. Left indicates western longitude, Right indicates Eastern longitude, upper shows northern latitude and lower shows southern latitude. After filling the areas, “Redraw” button is clicked to see new area.

23.10.14 Time of Preparation: If the flight document is wanted to be created automatically at the special hours, Mouse is right clicked on the “Time of preparation”. Then “Add” is clicked and hour minute and days are chosen.
23.10.15 **sending with email:** If the documents are wanted to send someones with email, right button of the Mouse is clicked on the “Email List” and email adresses are written. The same procedure must be repeated for each person. Recorder adresses may be modified or deleted by using other options.

23.10.16 **Adding a new flight folder:** After filled the necessary fields “Add” button is clicked to save informations. This flight is added to flight folders and created automatically at defined times if autocreate is defined and sent to the users by email if requested.

23.10.17 **modifying an existing flight folder:** Any recorded flight folder may be changed by the users. First flight is selected, then modified and “Modify button” is pressed finally.

23.10.18 **Delete a Flight :** First a flight is chosen and “Delete” button is pressed.

23.10.19 **Old Documents:** Manuel or automatically created documents are saved and may be accessed at any time by clicking this button. Then a list containing prepared documents date and time is brought. Old documents just may be seen. Modification is not permitted.

23.10.20 **Create Flight Documents:** Flight document is created by using latest data.
23.10. 21 DESCRIPTION OF THE FIELDS ON THE DOCUMENTS

23.10.21.1 Page 1

COVER

FROM : Shows name of the airport and country where the flight starts.

TO : Shows name of the destination airport and country

Departure Date and Time : Shows flight start date and time. Date is filled by the software. Parture must be filled by the users

Estimated Flight Duration : Shows approximate flight duration

Forecasts : Shows weather conditions on the departure and landing airports at the start and end of the flight by using TAF reports for these airports.

Following example may be given to clarify the topic:

Departure airport is Esenboga (LTAC) current time is 12:45 Utc. Valid TAF report for LTAC is 12/12 that was created at 10:40 Utc. 12:00 is the depart time. In this case 12:00 and 13:00 hours of the TAF is displayed.

Destination is EGLL (Heathrow), flight duration is 03.30 hour. Valid TAF for EGLL is 12/18 and TAF length is 36 hour. So landing will be 15:30 Utc. 15:00 and 16:00 hours of the TAF will be listed.

Level temperature and wind values derived from NWPs for the above hours for both LTAC and EGLL.

23.10.21.2 Page 2

METAR/SPECI, TAF, SIGMET ve GAMET REPORTS

Valid METAR and SPECI reports(if exist) and TAF reports are printed for each airport. Name, country and longitude/latitude values are given on the top of the reports.

SIGMET and/or GAMET reports from the countries on the route are printed if there is any.
22.10.21.3 SWC CHARTS

SWC charts for the flight are created if requested. These charts contain the following informations.

- Significant cloud areas, base height and cloud types
- Severity of turbulence
- Icing areas
- Clear Air Turbulance (CAT) areas and severity
- Jet areas, upper and lower levels and wind speeds.
- Volcanic activity areas (if exists)
- Tropical cyclone, hurricanes and typhoons (if exists)
- Nuclear Leaks (if exists)
- Tropopause types and heights

Label part of the charts contains information on data center, time of creation, time of validity, issuing center. The software uses special areas for each flight instead of Standard regions. So much more information are put on the charts.

Flight route, alternate airports are put on the map.

23.10.21.4 TEMPERATURE WIND CHARTS

The software creates temperature and wind charts for the selected levels for the flight region. Label part of the charts contains information on data center, time of creation, time of validity, issuing center.

Flight route, alternate airports are put on the map.

23.10.21.5 CROSS SECTION

Starting from FL050 level

Temperature and wind values of the route points for different levels (starting from FL050 upto FL450) are derived from GRIB values and contoured and plotted.

Label part of the charts contains information on data center, time of creation, time of validity, issuing center.

0 degree contour is drawn with blue color.

One example of flight documents are given below.
FLIGHT FOLDER
FOR
TK0011

From : Esenboğa / TÜRKİYE ( LTAC )
To : Heatrow / İNGİLTERE ( EGLL )

Departure Date and Time : 25 Jun 2012 .....UTC

Estimated Flight Duration : 03:30 Hour

Time used in Flight Duration : 03:30 Hour

Forecasts

<table>
<thead>
<tr>
<th>Departure ( LTAC )</th>
<th>Destination ( EGLL )</th>
</tr>
</thead>
<tbody>
<tr>
<td>25/12:00 05012KT 9999 SCT040</td>
<td>25/15:00 28010KT 9999 SCT035</td>
</tr>
<tr>
<td>05012KT 9999 SCT040</td>
<td>28010KT 9999 SCT035</td>
</tr>
</tbody>
</table>

No meteorological event forecasted

No meteorological event forecasted

DATA PROVIDED BY WAFC LONDON VALID FROM 12 UTC ON 25 Jun 2012

<table>
<thead>
<tr>
<th>Level</th>
<th>Dir(^°)/Speed(Kt)</th>
<th>Temp.(°C)</th>
<th>Level</th>
<th>Dir(^°)/Speed(Kt)</th>
<th>Temp.(°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FL050</td>
<td>070/006</td>
<td>20</td>
<td>FL050</td>
<td>280/010</td>
<td>4</td>
</tr>
<tr>
<td>FL100</td>
<td>050/009</td>
<td>7</td>
<td>FL100</td>
<td>290/021</td>
<td>-2</td>
</tr>
<tr>
<td>FL140</td>
<td>030/007</td>
<td>-1</td>
<td>FL140</td>
<td>300/026</td>
<td>-7</td>
</tr>
<tr>
<td>FL180</td>
<td>290/004</td>
<td>-9</td>
<td>FL180</td>
<td>300/034</td>
<td>-15</td>
</tr>
<tr>
<td>FL240</td>
<td>310/007</td>
<td>-20</td>
<td>FL240</td>
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<td>-27</td>
</tr>
<tr>
<td>FL300</td>
<td>310/018</td>
<td>-36</td>
<td>FL300</td>
<td>290/083</td>
<td>-41</td>
</tr>
<tr>
<td>FL340</td>
<td>300/021</td>
<td>-46</td>
<td>FL340</td>
<td>280/105</td>
<td>-49</td>
</tr>
<tr>
<td>FL390</td>
<td>260/031</td>
<td>-52</td>
<td>FL390</td>
<td>290/086</td>
<td>-52</td>
</tr>
</tbody>
</table>

Sun Rise/Set: 02:20/17:22
Moon Rise/Set: 08:08/20:39

Prepared at 12:52 on 25 Jun 2012
LATEST METAR OBSERVATIONS AND TAF REPORTS

ESSENBJÖRN, TÜRKİYE 40°18′N 31°46′E
METAR LTAC 251220Z 09007KT 9999 SCT040 28/09 Q1014 NOSIG=
TAF LTAC 251200Z 251225 09012KT 9999 SCT040 BECMG 25152518 VRB02KT CAVOK BECMG 25062609 FWE040 =

VARNA, BULGARIA 43°07′N 27°29′E
METAR LEBI 251220Z 12007MPS 9999 SCT040 28/19 Q1012 NOSIG=
TAF LEBI 251030Z 251225 10006MPS 9999 SCT033 TEMPO 2512/2516 TSRA SCT025CB BKN044 BECMG 2519/2521 VRB02MPH TEMPO 2603/2605 4000 BR BECMG 2607/2609 02007MPS SCT030 BKN043 TEMPO 2609/2612 4000 TSRA SCT025CB OVC040 =

ATAKÖRÜK, TÜRKİYE 40°37′N 29°20′E
METAR LTBA 251220Z 02011KT 3560700 CAVOK 32/18 Q1012 NOSIG=
TAF LTBA 251040Z 25122518 03009KT CAVOK TEMPO 2512/2516 03015G25KT TEMPO 2506/2610 SCT020 TEMPO 2510/2614 03015G25KT =

BÖHRÉG, ROMANIA 44°56′N 26°10′E
METAR LROP 251220Z 23004KT 1700320 CAVOK 30/18 Q1012 88085/95 NOSIG=
TAF LROP 251100Z 25122512 VRB04KT CAVOK PROB30 TEMPO 2512/2516 VRB02G30KT 3000 TSRA SCT010 SCT030CB BKN035 TEMPO 2600/2604 3000 BR BECMG 2606/2607 26010KT TEMPO 2607/2612 VRB02G30KT 3000 TSRA BKN010 BKN252CB OVC030 =

BUDIŠEVP, MACEDONIA, 41°41′N 21°37′E
METAR LHMZ 251120Z 32010KT 9999 -RA FEW080 SCT035 BKN071 18/16 Q1014 NOSIG=
TAF LHMZ 251100Z 25122512 31012KT 9999 SCT035 BKN070 TEMPO 2512/2519 33015G25KT 6000 RA SHRA SCT015 BKN025 OVC050 BECMG 2515/2518 250600KT BECMG 2521/2524 30009KT CAVOK BECMG 2606/2609 SCT035 TEMPO 2607/2612 30012G22KT =

BRATISLAVA, SLOVAKIA 48°20′N 17°29′E
METAR LZZZ 251230Z 32010KT 9999 -RA FEW028 BKN035 19/13 Q1014 NOSIG=
TAF LZZZ 251100Z 25122612 31012KT 9999 SCT045 BKN080 TEMPO 2512/2515 -RA SCT030 BKN050 BECMG 2515/2517 FEW045 SCT010 BKN071 TEMPO 2522/2512 33015G25KT =

VÍVARNA, AUSTRIYA 40°10′N 16°57′E
METAR LOIW 251220Z 26006KT 9999 FEW028 BKN030 18/13 Q1014 NOSIG=
TAF LOIW 251110Z 25122510 28010KT 9999 FEW028 SCT040 BKN060 TX22/251211 TN15/2603Z TEMPO 2512/2520 28015G25KT TEMPO 2512/2514 -SHRA FEW028 BKN040 BECMG 2515/2518 FEW040 SCT050 TEMPO 2520/2506 CAVOK F3020600 31012KT 9999 SCT035 TEMPO 2506/2516 31015G25KT BKN050 =

PRAO, CEK,COHURIYETI 59°10′14′′E
METAR LKPR 251100Z 25122618 25012KT CAVOK TEMPO 2512/2618 9999 SCT040 PROB30 TEMPO 2512/2518 27014G24KT 8000 SHRA BKN030 =

FRANKFURT-AM-MAIN, ALMANYA 50°00′N 8°30′W
METAR NFDD 251220Z 25122518 25010KT 9999 FEW030 BKN075 20/10 Q1016 NOSIG=
TAF NFDD 251100Z 25122518 24012KT 9999 SCT040 TEMPO 2512/2516 9999 25015G25KT BECMG 2522/2601 25006KT =

AMSTERDAM, HOLLANDA 52°30′N 4°7′E
METAR EHAM 251225Z 29016KT 9999 FEW017 BKN022 16/11 Q1016 NOSIG=
TAF EHAM 251050Z 25122518 29017KT 9999 SCT018 BECMG 2517/2520 28007KT PROB30 TEMPO 2600/2605 VRB02KT 6000 MIFG =
METAR EGH@ NIL
TAF EGH@ NIL =

HEATROY, INGILISRE 51°50′5.4′′N 0.46′′W
METAR EGGL 251120Z 25122518 31008KT 9999 SCT043 21/09 Q1018 NOSIG=
TAF EGGL 251100Z 25122518 28010KT 9999 SCT035 BECMG 2519/2522 VRB03KT BECMG 2601/2604 17010KT PROB40 TEMPO 2608/2612 9000 -RA TEMPO 2512/2616 6000 -RA BKN1012 =
SIGMET REPORTS

WSTU31 LTAC 251100
LTAA SIGMET 3 VALID 251200/251600 LTAC-
LTAA ANKARA FIR SOL TS FCST EASTERN BLACK SEA AND EAST ANATOLIAN REGIONS MOV NE 10KT NC=
-------------------------------------------------------
WADL41 EDZM 251109
EDMM AIRMET 1 VALID 251100/251500 EDZM-
EDMM MUNCHEN FIR ISOL TCU OBS S OF N4800 TO FL145 STNR NC=
-------------------------------------------------------
WSHU31 LHBM 251115
LHCC SIGMET 01 VALID 251115/251315 LHBP-
LHCC BUDAPEST FIR ISOL EMBD TS OBS AND FCST N OF N4730
TOP FL320 MOV ENE WKN=
-------------------------------------------------------
WADL41 EDZM 251118
EDMM AIRMET 2 VALID 251125/251500 EDZM-
EDMM MUNCHEN FIR ISOL TS OBS N OF N5030 TOP FL200 MOV E NC=
-------------------------------------------------------
WSTU31 LTAC 251105
LTAA SIGMET 4 VALID 251100/251400 LTAC-
LTAA ANKARA FIR SOL TS OBS AT 1100Z LTAAJ FCST MOV NE 12KT NC=
-------------------------------------------------------
WSBU31 LBSM 251152
LBSR SIGMET 01 VALID 251155/251955 LBSR-
LBSR SOFIA FIR FRO TS OBS AT 1155Z SW OF LINE
N4310 E0230 - N4144
E02512 FL400 STNR INTSF=
-------------------------------------------------------
WSOS31 LOWW 251223
LOVV SIGMET 5 VALID 251200/251430 LOWW-
LOVV WIEN FIR EMBD TS OBS S PART TOP FL350 MOV ESE NC=
-------------------------------------------------------
WAOS41 LOWW 251233
LOVV AIRMET 4 VALID 251230/251630 LOWW-
LOVV WIEN FIR MOD ICE FCST SE PART FL110/220 MOV ESE NC AND
MOD ICE FCST N OF N4730 FL090/150 MOV E NC=
-------------------------------------------------------
WSTU31 LTAC 251227
LTAA SIGMET 5 VALID 251200/251600 LTAC-
LTAA ANKARA FIR SOL TS OBS AT 1200Z LTCL N37 - E039 AND
N37 - E037 FCST MOV NE 12KT NC=
23.11 Model TA-M FLIGHT FORM

METCAP+ prepares Model TA-M flight form which is used by military flights. Once a flight is created, it may be saved and used for future flights.

When Mode TA-M tab is clicked following screen appears

23.11.1 CREATING A NEW FORM

New button is clicked to define a new flight. In this case all the fields are cleaned. The users fills destination airport. Departure is filled by the software and it may be changed when necessary. ICAO codes of the airports may be chosen by double clicking the areas.

Fill the fields: The fields marked with red are filled by the software
GAMET reports are used to fill wind values, clouds SIGWX, visibility. The may change these areas.

23.11.1.1 General Met. Situation: This field is filled by the users. After writing the weather conditions double click saves the information. Double clicking once more brings the saved info to this area. This method is also used for Turbulance Icing, contrails and Jet Stream areas.

- **Print**: Creates the form after all fields are filled
- **Save**: Saves and add this flight to “recorded flight” list for future use.
- **Delete**: Deletes a flight from the list.
A: Issued By: Akinçi  
B: Route From: Akinçi  
C: General Met. Situation:  
- 880 hPa low over South and Eastern Anatolia, 1020 hPa high over Balkans  
- Relatively cold over Northwestern Regions at 500 hPa  

D: Route/Zone:  
- LTAE  
- LTAT  

E: Upper Winds and Temperature:  
- 1000 FT  
- 2000 FT  
- 3000 FT  
- 5000 FT  
- 7000 FT  
- 10000 FT  

F: Clouds:  
- FEW SCT CU 3000/6000 FT  
- SCT CU 3000-5000 FT  
- SCT AC 8000-12000 FT  

G: SIGWX:  
- TS Locally  

H: Surface Vis:  
- 0 °C  
- 14000 FT  

I: Sunrise: 02:22  
- Sunset: 17:24  
- Moonrise: 09:16  
- Moonset: 21:11  

J: Temp Dew: 11  
- RWY Temp: 48  

K: METAR LTAE 261050Z 24009KT 2100/2800 9999 FEW030CB SCT035 32/07 Q1012 NOSIG RMR 261200Z  
- METAR LTAN 261050Z VRB00KT 9999 SCT040 30/07 Q1014 NOSIG  
- METAR LTAT 261050Z VRB00KT 9999 FEW009 32/06 Q1012 NOSIG  
- METAR LTCC 261050Z 24009KT 2100/2800 9999 FEW009 32/06 Q1012 NOSIG  
- METAR LTAT 261050Z 12007KT 9999 SCT040 31/11 Q1009 NOSIG  

L: TAF LTAE 260714Z 2600/2618 VRB03KT 9999 SCT040 BECMG 2615/2617 35010KT CAVOK  
- TAF LTAR 260714Z 2600/2618 01000KT 9999 SCT040 BECMG 2615/2618 CAVOK  
- TAF LTAT 260714Z 2600/2618 02000KT 9999 SCT040 BECMG 2615/2618 CAVOK  
- TAF LTCC 260714Z 2600/2618 03000KT 9999 SCT040 BECMG 2615/2618 CAVOK  
- TAF LTET 260714Z 2600/2618 04000KT 9999 SCT040 BECMG 2615/2618 CAVOK  

M: Mission/Flight Nr: 1417-121  
- Rank & Name of Person and Sign: Yzb Kaşar  

N: Forecaster: K. Yazar  

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GENERAL MET. SITUATION:
600 hPa LOW OVER SOUTH AND EASTERN ANATOLIA, 1020 hPa HIGH OVER BALKANS RELATIVELY COLD OVER NORTHWESTERN REGIONS AT 500 hPa

ROUTE/ZONE

<table>
<thead>
<tr>
<th>LTBA</th>
<th>LTCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000FT 070/05KT PS25</td>
<td>1000FT 030/06KT PS33</td>
</tr>
<tr>
<td>2000FT 080/05KT PS24</td>
<td>2000FT 010/06KT PS31</td>
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<tr>
<td>3000FT 070/05KT PS23</td>
<td>3000FT 330/10KT PS28</td>
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<tr>
<td>5000FT 030/10KT PS18</td>
<td>5000FT 290/08KT PS23</td>
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<td>7000FT 360/10KT PS12</td>
<td>7000FT 290/07KT PS18</td>
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<tr>
<td>10000FT 280/05KT PS07</td>
<td>10000FT 020/05KT PS13</td>
</tr>
<tr>
<td>15000FT 280/10KT MS03</td>
<td>15000FT 280/03KT PS01</td>
</tr>
</tbody>
</table>

TURB
LIGHT, MOD IN CLOUD OVER SOUTH EAST

ICING
LIGHT, MOD IN CLOUD

12000 FT SHORT

CLOUDS
NIL
SCT CU 4000/6000FT

SIGWX

SURFACE VIS
NIL

0 °C
13900FT
15600FT

JETS
270/90 KT FL390

SUNRISE
02:36
01:59

SUNSET
17:42
16:46

MOONRISE
09:32
08:43

MOONSET
21:25
20:41

TEMP

DEW

RWY TEMP

METAR LTBA 261212Z 2501KT CAVOK 32/14 01011 NOSIG–
METAR LTAT 261212Z 0901KT 9999 SCT035 32/11 01010 BECMG TL300 32013KT–
METAR LTAE 260950Z 24000KT 2900280 9999 FEW030CB SCT035 32/07 01012 NOSIG RMR RWY21 26012KT
220290–
METAR LTBC 261050Z 39000KT 2700600 9999 SCT040 31/12 01013 NOSIG RMR RWY09 30010KT 270V340–
METAR LTCC 26111202 VRB00KT 9999 FEW000 35/09 01006 NOSIG–

TAF LTBA 260418Z 26062712 VRB02KT CAVOK BECMG 2614/2617 08012KT SCT030 PROB00 TEMPO 2700/2704
TSRA FEW025CB BK030 –
TAF LTBA 260414Z 26062706 VRB02KT CAVOK BECMG 2607/2609 SCT040 BECMG 2611/2613 32013KT BECMG
2617/2619 VRB02KT CAVOK –
TAF LTBA 260414Z 26062706 VRB02KT CAVOK BECMG 2607/2609 SCT040 BECMG 2611/2613 32013KT CAVOK –
TAF LTBA 260412Z 26062408 39012KT 9999 SCT040 –
TAF LTBC 260414Z 26062708 SCT000 PROB00 TEMPO 2614/2617 VRB15G25KT
TSRA FEW025CB BK030 PROB00 TEMPO 2613/2617 VRB15G25KT TSRA FEW025CB BK030 BECMG 2617/2619
CAVOK –

MissionFlight Nr:
Rank & Name of Person and Sign: Ysb Kaşar
Forecaster: K.Yazar

METCAP+ 2012
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