

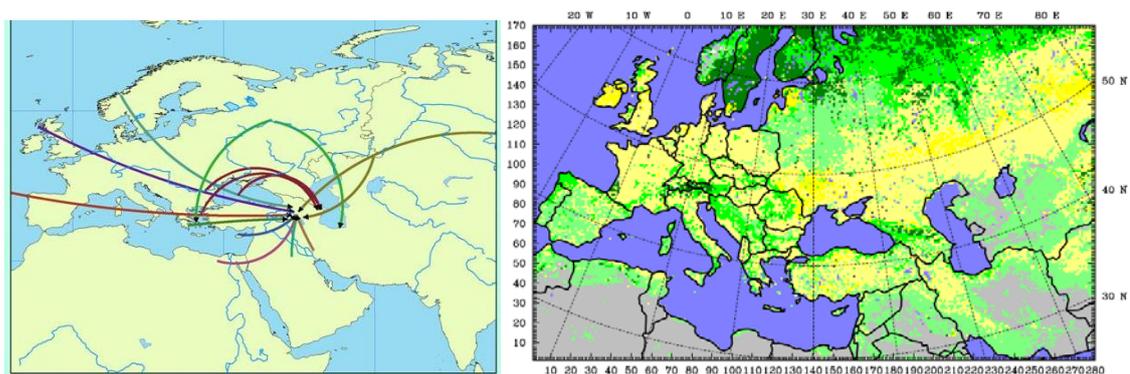
# Satellite data for hazardous phenomena prediction

Zarmandukht Petrosyan

## Armstatehydromet

Since 1997 for receiving satellite data in Armstatehydromet has been installed Tecnavia system providing geostationary and polar orbiting satellite data which significantly improves quality of weather forecasting. Despite satellite data used before did not allow postprocessing, integrating this images into NWP maps and was based on shape, brightness and structure of images, nevertheless they were very important for forecasting weather and especially severe weather events .

In NWP maps using by Armstatehydromet Armenia is located on the very edge of it, that doesn't allow the detailed analysis of the atmosphere systems affecting the area. Moreover, above mentioned maps are outputs of global models with coarse resolution, which represent only broad features and patterns and are able to reproduce processes in the large scale. And here comes the great role of Satellite data which provides much finer resolution. Weather forecasting significantly benefit from information on the processes at spatial resolution.



The satellite imaginary range which covers the broad area from the Atlantic Ocean in the west to the Central Asia in the east, and from the Middle East in the south to the Polar Regions in the north, allows having the full understanding of processes that influence the weather conditions over Armenia region to trace air flow direction and cloud development.

First generation satellite data provides information of likelihood of precipitation using cloud top temperature analysis. High frequency thermal remote sensing imagery, provides information on cloud top temperatures which are correlated with the size of precipitation droplets in clouds and, hence, the likelihood of rain.

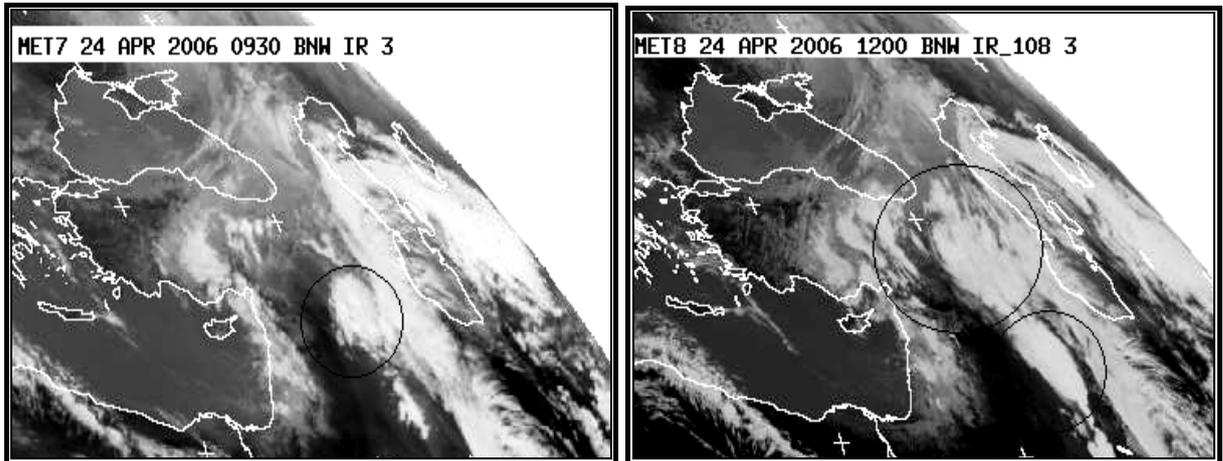
It is the good way of using such technique to achieve best results for prediction of weather condition in some cases:

The weather condition under influence of cyclon coming from South

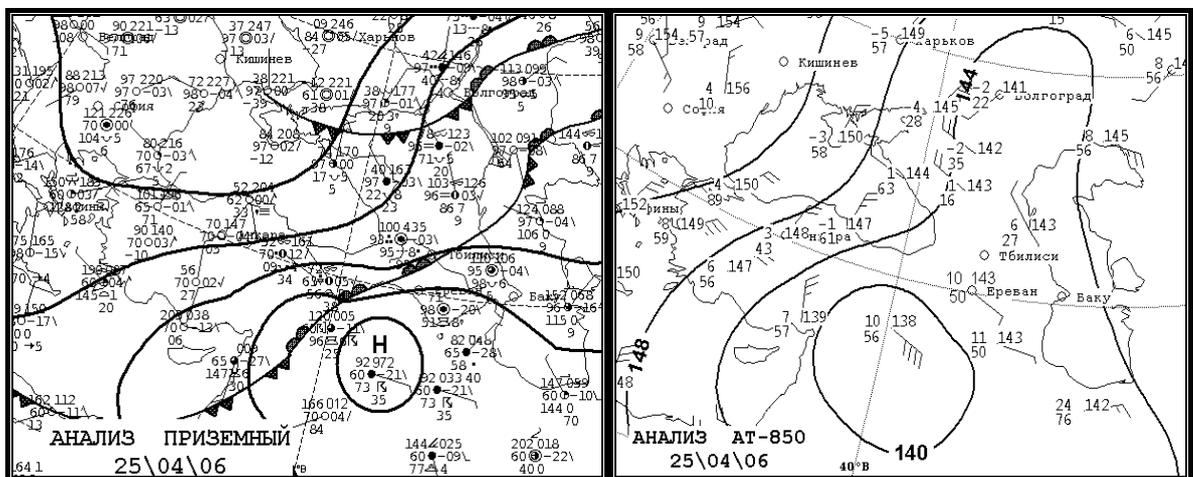
The precipitation started from South` Syuniq region and expanded to all territory of Armenia. Intensity of rainfall is higher in Sjuniq region and Ararat Valley, in Vajoc Dzor region; up to 50-60mm/6h, strong wind observed with speed 15-20m/s, sometimes 25-30m/s: Duration of influence of Low varied 12h-36h, then it moves to north even passing Great Caucasian Mountain Chain. This process observed on Armenia from October to May. Its formes

on north of Siria or Iraq on SE parth and moves by longitude from South to North toward Armenia. The pressure in centre is 1000-1005mb, somtimes 990mb:

On image shown below is demonstrated development of „South cyclon,, clouds on April 25, 2006. The cloud system of this cyclone haven't frontal character as it seen in satellite image and it is not convective type. So prediction weather events by common synoptic method is difficult and satellite data is only way for accuracy of forecasting.



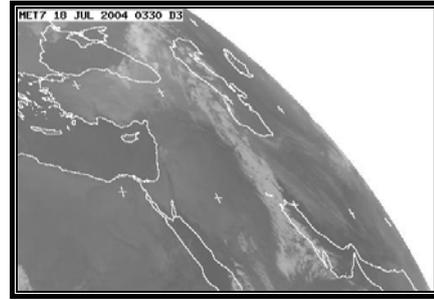
*The clouds of South cyclon*



The weather condition under influence of South Depression

In the end of July and the first half of August it is observed the thermic depression on territory of Armenia , when temperature can rich up to 39-43 and dry weather occurred. But in some cases we observed strong convection accompanied with precipitation, strong wind and hail.

In the satellite image below we can dedected clouds penetrated from East coast of Arabian Peninsula stretches directly to Iran and Armenia riching up to north of Kaspian See, July 18, 2004 which caused havy rain and tunderstorm. In Sevan and Gjumry the precipitation intensity reached 22-26mm/3h. Similar devolpment also impossible to define through other method. Only way to see the process is Satellite observation.

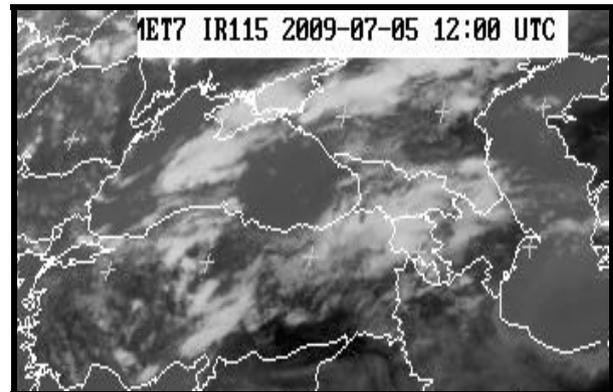
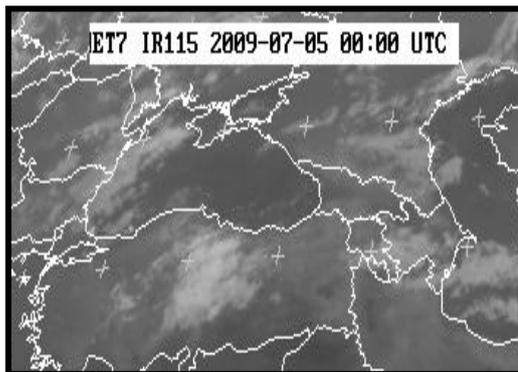


The clouds of South depression

The strong convection in 2009 summer caused 31 events of strong wind, 15 events of hail (with diameter of 20- 60mm ) and 15 events of heavy rain. July 5 2009 was observed a severe weather event in Armenia started with the creation of a large storm cell in the afternoon.

As a result of this severe storm there was a large amount of damage. In a period of less than one hour, 40 mm of rainfall (half the monthly average) was measured in Hrazdan. In Shirak region damage was caused by hail, in Yerevan heavy rain accompanied by flash-flooding, many streets were completely under water (in some cases up to half meter deep. In Yerevan wind speeds reached up to 90 km/h, several electrical and telecommunications lines were broken.

Agricultural losses were especially large.



The satellite images show the formation of a large convective system over the Armenia at 00:00, and 12:00 UTC, respectively.

This summer that was very unusual in regard to convective processes and couldn't be forecasted without MSG satellite data, which we were start obtaining directly only 2 months ago.

The prediction and warning of these phenomena was significantly improved in terms of accuracy and lead time, through implementation MSG.

#### Conclusion:

Due to complex topography and diversity of terrain the risk of occurrence of weather hazards especially thunderstorm-related severe weather phenomena, hail, straight-line winds, tornadoes, flash floods, lightning and so on) is very high in Armenia.

The implementation of MSG data (being undergo analyze by different methods) gives the opportunity to promote weather research and development of new tools that will be improve forecasting techniques and increase the utility of forecast information with an emphasis on high-impact weather.

The spatial resolution of satellite imagery which covers the broad area from the Atlantic Ocean in the west to the Central Asia in the east, and from the Middle East in the south to the Polar Regions in the north, allows having the full understanding of processes that influence the weather conditions over Armenia region to trace air flow direction and cloud development.

Weather forecasting would significantly benefit from information of MSG having processes at spatial resolution much finer than the coarse resolution of global models.

Using MSG satellite information many field of economy will face the challenges much more ready to withstand to climate impact.