DEVELOPING FORECASTER COMPETENCES: 
THE FMI TOPMET PROGRAMME

Tero Siili, Pirkko Pylkkö, Janne Kotro, Anni Simola

Finnish Meteorological Institute, PO Box 503, Helsinki, Finland

Abstract

One of the key education and training activities in the Finnish Meteorological Institute (FMI) in the 2012-2013 period is the project Taitava Operatiivinen Meteorologi (abbreviated TOpMet and "Proficient Operational Meteorologist" in English) for further improve the competences of our forecasters. The need and motivation for the programme stems from 1) continued improvement of services provided by FMI, 2) anticipated evolution of forecaster work profile (new and emerging technologies, new services and duties), 3) requirement to ensure flexible, well-targeted and timely institutional training responses to evolving needs, 4) the upcoming WMO certification requirements for forecasters, and 5) expansion of use of new learning and training methods & technologies (such as computer assisted learning or CAL).

The training will be tailored to address the needs of both individual employees as well as those of FMI forecasting units. The flexibility offered by distance learning and CAL methods will be extensively utilised to address the problems and constraints arising from division of FMI forecasters in four regional centres and the shift work character of forecasters.

One of the foci in 2012 will be satellite meteorology, observations and their utilisation by forecasters. This training area is planned to be based on in house contributions developed and tailored for FMI needs, supplemented by materials and modules available from external sources (such as EuMeTrain, EuMetCAL and the like). The training will comprise overview and summary lectures in the beginning and end, respectively, with main pedagogical emphasis in forecasting weather cases studied individually and in groups.

INTRODUCTION AND BACKGROUND: FMI AND ITS FORECASTING ACTIVITIES

The Finnish Meteorological Institute (FMI) is both the Finnish national weather and marine service (in the operational and safety authority sense) and an atmospheric & marine research institute under the Finnish Ministry of Transport and Communications (MTC). FMI's organisation reflects this by comprising of two primary divisions: the Weather & Safety (WS) and Research & Development (R & D). Forecasting operations are primarily part of the WS, with some special organisational arrangements in the regional offices.

FMI's main office and facilities are located in Helsinki with other significant facilities and groups of personnel at four other locations in Finland. In 2011 FMI's personnel comprised 660 FTE (Full-Time Equivalent) of which slightly less than 41 % were in the WS, approximately 53 % in the R & D and the rest in Administration.

The Institute's 2011 budget was approximately 69 MEUR, of which 62 % came from the MTC, the rest being external funding from national, European and other sources.
The portfolio of FMI’s public and private sector customers and stakeholders is very comprehensive and is not described here in detail. Relevant from the subject matter of this work it is, that FMI and its forecasters provide weather services for all groups of aviation users – both commercial and military. A more comprehensive overview of FMI and its activities can be found for instance in http://en.ilmatieteenlaitos.fi/about-us.

MOTIVATIONS FOR AND GOALS OF THE TOPMET PROGRAMME

In 2011 the need was identified for a Education and Training (E & T) Continuing Professional Development (CPD) programme focused on forecasters and their competences. Among the motivations behind the programme were:

1. Levelling off or slight dip in the forecast quality improvement trend of some forecast figures-of-merit,
2. anticipated change in the role of operational meteorologists caused by automation: from run-of-the-mill forecasting towards customer consulting and advising,
3. World Meteorological Organisation’s (WMO) certification requirements for certain groups of meteorological staff,
4. anticipated introduction of requirements in non-traditional areas such as air quality, marine, space weather, and
5. introduction, testing and expansion of new learning methods.

Regarding motivation 1, E & T was seen as part of corrective actions portfolio.

Goals of the programme were set to include

• evaluation and assessment of the level and adequacy of the knowledge & skills of operational meteorologists,
• evaluation and assessment of the maintenance and development of processes related to personnel know-how,
• identification and correction of potential gaps and shortcomings, as well as
• knowledge and skill updates and upgrades when necessary.

PARTICIPANTS, RESOURCES, PLANNING AND SCHEDULE

The programme titled Taitava Operatiivinen Meteorologi (TOpMet; in English: Proficient Operational Meteorologist) was approved and initiated in 2011 as a two-year programme, with kick-off scheduled for the beginning of 2012. The target and participant group of this CPD programme comprises primarily of current FMI forecasters (of the order of 70 employees) with some participation from, for instance, customer contact personnel and group heads. Most of the participants are from the WS Division. Training of new and entry-level forecasters is not part of TOpMet, but is addressed separately. Level of basic education of FMI forecasters is predominantly (∼95 %) M. Sc.

Coordination and overall planning of the programme is the responsibility of the FMI Human Resources Development (HRD) group and the TOpMet Programme Manager. Strategic oversight and planning input is provided by the TopMet Steering Group chaired by the head of the the Weather and Safety Centre and representation of relevant other stakeholders.

In-house trainer resources are drawn from both the WS and R & D Divisions, supplemented by select external trainers.

Work time allocation provided for the trainees is approximately 10 td/employee/year (td = training day).

The programme is divided for planning purposes into four six-month periods. The time-line along with E & T events already implemented or in planning are shown in Figure 1 below.

**Figure 1:** TOpMet timeline as well as the implemented and planned E & T events.
A baseline survey among forecasters and their line managers of needs, requirements, preferences, constraints and priorities was carried out in 2011 to collect planning input from the forecasters themselves. Issues surveyed included themes & topics, scheduling, learning methods and training locations (domestic vs. abroad). Survey encouraged and was expected to reflect both institutional (employer) and individual (employee) points-of-view. In addition to this one-time baseline survey, recurring planning input is solicited from the forecasters through their annual evaluation discussions, in which they are encouraged to formulate (together with their line managers) individual E & T plans.

E & T SUBJECTS AND METHODOLOGIES

Top-level themes and topics collected and presented in the baseline survey included (not in priority order):

- Customer needs and interaction
- Reliability evaluation of observations
- Interpretation and exploitation of model results
- Operational equipment and ICT systems
- Ensemble Prediction System forecasts
- Verification of basic forecasts
- Satellite observations and their use
- WMO certification
- Synoptics
- Case studies
- Weather radar observations and their use
- Dangerous weather and other natural phenomena
- Communications

In addition to these, some special themes & topics were identified. Language skills were treated as a separate group: Finland is a bilingual country with English being either required or otherwise necessary in some forecaster tasks. Some other foreign languages are needed in certain specialised tasks requiring forecasting expertise.

E & T events implemented in the programme are shown in Figure 1 and also listed in Table 1 in the following section.

Due to the shift nature of forecaster work, attendance in on-site, lecture type events has been anticipated to be in the range of 50-80 % of forecasters. To achieve better coverage, lecture-type E & T events are – when feasible – repeated at least once or recorded for later study. Videoconferencing has been used extensively to allow both remote participation in the E & T events from the regional offices and to record the events.

Learning methods used so far have included lecture-type instruction, supplemented by workshop components, self-study and group work, supported by use of online E & T packages and modules. Since majority of forecasters are posted in the FMI main facility, on-site E & T events have taken place there. FMI's Moodle-based Learning Management System (LMS; see https://moodle.org) has been used for E & T event support (information and materials dissemination), but exploitation of Moodle’s more advanced and group work features has so far been rather low among both trainers and forecasters; there is hence room for expansion.

TOPMET E & T EVENTS IN 2012

Overview

Three E & T events have been carried out at the time of writing (see also Figure 1), the fourth event (Numerical Weather Prediction) will start in November 2012 and continue to January 2013. These events and some of their features are listed below in Table 1.
<table>
<thead>
<tr>
<th>Subject/Title</th>
<th>Trainers</th>
<th>Duration</th>
<th>Target/focal group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe Storms Workshop</td>
<td>NOAA</td>
<td>2 days</td>
<td>All forecasters</td>
</tr>
<tr>
<td>Satellite Meteorology for the Contemporary Forecaster</td>
<td>FMI (in-house)</td>
<td>1 + 2 + 1 days (*)</td>
<td>All forecasters</td>
</tr>
<tr>
<td>Icing</td>
<td>External</td>
<td>2 days</td>
<td>Current and future aviation forecasters</td>
</tr>
<tr>
<td>Numerical Weather Prediction for Forecasters</td>
<td>FMI (in-house)</td>
<td>1 + 2 + 1 days (*)</td>
<td>All forecasters</td>
</tr>
</tbody>
</table>

*Table 1: TOpMet E & T events in 2012. (*) combination of 1) lectures, 2) group work and 3) group presentations.*

Severe Storms Workshop

This event was organised in March 2012, the primary trainers came from NOAA/NWS/Warning Decision Training Branch. The format used was lectures, case studies and exercises. Being the first TOpMet event, this was kind of a pilot event and highlighted the importance of case materials selection – preferably from on-the-job contexts – and the importance of language issues (the instruction was in English). Overall the trainees gave the event good marks in the post-event survey.

Satellite Meteorology for the Contemporary Forecaster

As outlined in Table 1 above, the Satellite course was implemented as a combination of traditional lectures (repeated once), studies carried out in small groups and group debriefing/presentations sessions (two sessions were organised).

Each group was given a topic for study and familiarisation, especially from the viewpoints of

- how satellite observations might add value to forecasters’ more traditional tools in detection, characterisation and forecasting of the phenomena, or
- what factors and features might limit the usefulness of satellite products.

The topics addressed by the groups were

- projections (of satellite imagery),
- ash clouds,
- forest fires,
- convection and convective clouds,
- fog(s),
- synoptic scale lows,
- cirrus clouds.

Although the time allocated for the group work was limited, the presentations were overall of high quality. Advance compilation of a large set of materials references (links, presentations, modules) by the trainers assisted in efficient use of the trainees’ limited time. Group work was most successful, when group members were able to meet face-to-face. The Moodle-based LMS was available, but saw only limited use.

Icing

In this event an external trainer from Leading Edge Atmospherics, LLC was invited to carry out a two-day intensive training for aviation forecasters together with FMI’s own icing experts.

Numerical Weather Prediction for Forecasters

This event will give an overview on current numerical weather prediction models. The format will be similar to the Satellite event with some shift from group work to self-study. Lectures will cover topics such as

- near-surface winds and gusts,
• temperature modelling in winter conditions,
• convective and precipitation processes,
• fog and visibility as well as
• post-processing of model variables in FMI.

This event acts also as a prologue/preamble to a TOpMet event on probabilistic forecasting slated for Spring 2013.

SUMMARY AND CONCLUSIONS

TOpMet is a programme with predefined duration addressing the present E & T needs of the FMI forecaster community in a targeted fashion. It is highly important, that lessons of such a project are – when relevant – taken into account and incorporated into the professional development, personnel management and quality processes.

Since a large fraction of the trainers come from in-house, a project like TOpMet has the potential of improving further the interaction between operational and research areas and advancing knowledge transfer from R & D to operational uses. This coin has also another side: preparation and implementation of E & T events as well as training the trainers themselves requires non-negligible – even significant – contributions from often highly sought-after experts and thus may in some situations and contexts be seen to compete for the time of R & D personnel resources. Appropriate and sufficient priority & incentives to E & T contributions need hence to be considered.

In the methodology areas, advance surveys carried out among the forecasters have been found to be highly useful for the trainers in planning and design of the E & T event content. Feedback from post-event surveys have also indicated the significance of mapping participants’ levels of background knowledge; this combined with pre-event study materials evens out the situation for the trainees and improves the efficiency of training. In exercises and case studies locally relevant cases and applications with clear practical implications have been highlighted.

From resource management perspective the shift nature of forecaster work has underlined the need for timely advance planning and freezing of E & T event schedules.