



Recent development of Weather Workstations at FMI

Finnish Meteorological Institute

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Context

- SmartMet Analysis
- SmartMet Alert
- SmartMet Aviation – Cross-section
- **SmartMet Aviation – SWC Editor**
- **SmartMet Aviation – TAF Editor**

- **SmartMet Workstation**

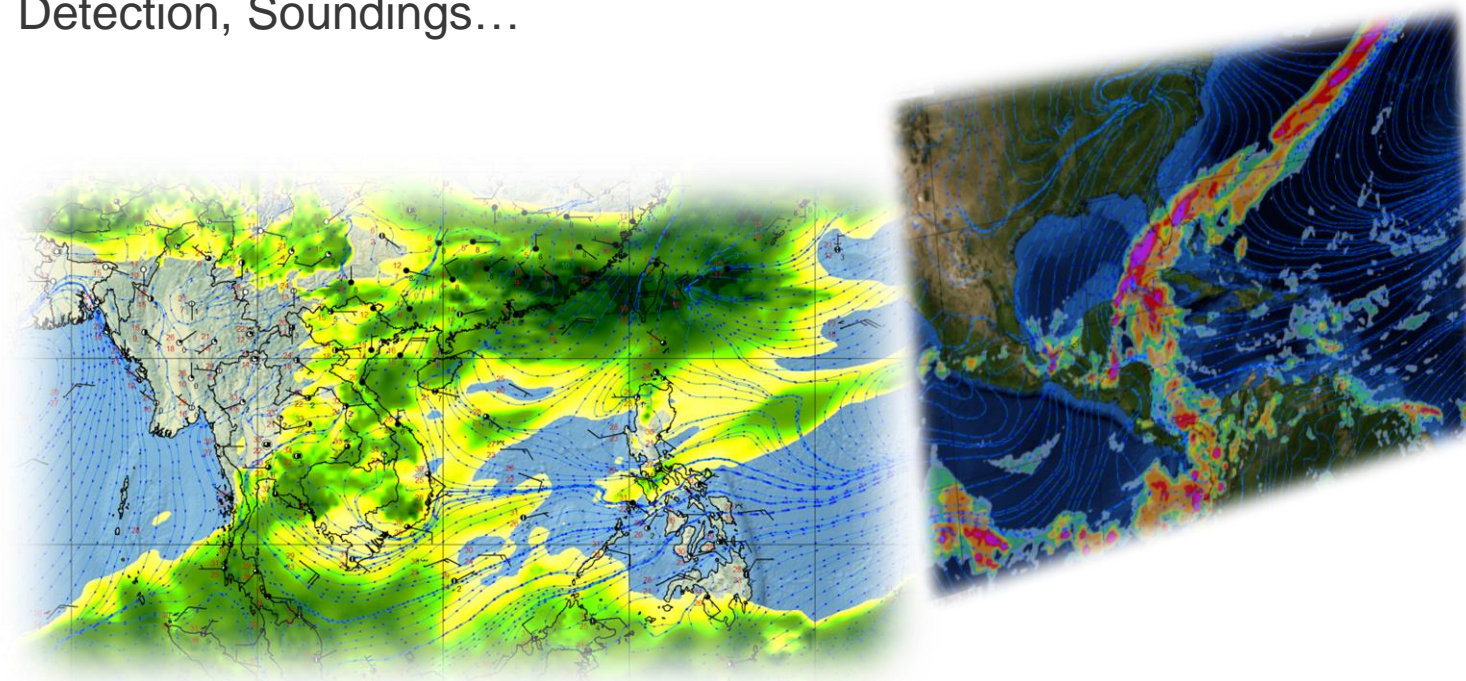
- **SmartMet Web**

- Vanadis



SmartMet Workstation

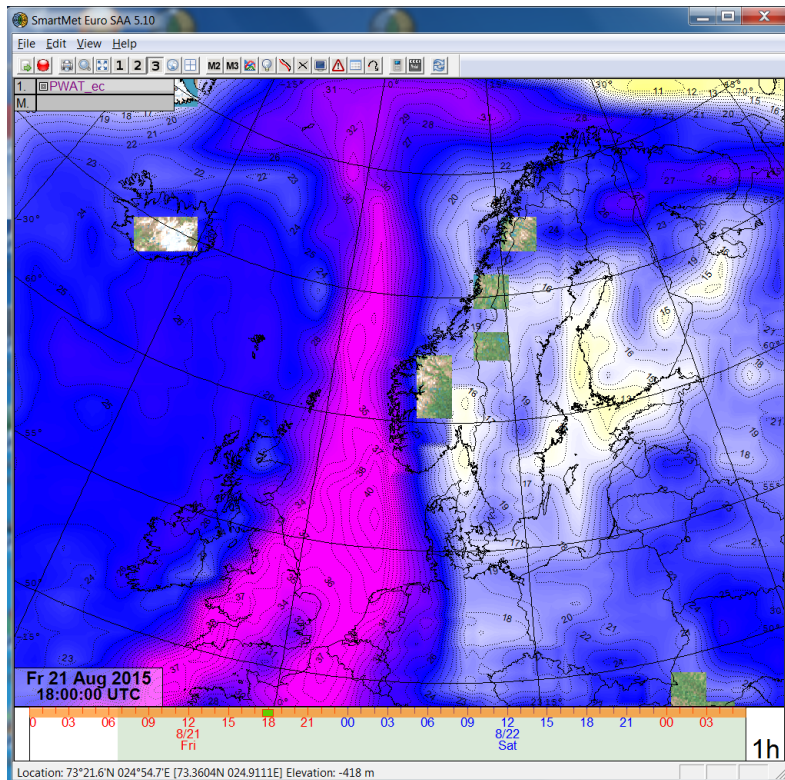
- Tool for visualizing and editing meteorological data
- Support for all kind of meteorological data
 - NWP, Satellites, Weather Radars, Observations, Lightning Detection, Soundings...





Smartmet Workstation, operational visualization of meteorological and environmental data

- Used by operational forecasting departments in Europe by FMI, Estonian Weather Service and Latvian Meteorological Service and several others around the world.
- Windows-based application. Data handling engine is also available as a Linux serverside module
- SmartTool language used to derive parameters from NWP



SmartTool Dialog

Execute SmartT Macro text Selected points

```
var z500 = z_ec_500
var z300 = z_ec_300

var dp = p_ec-850

//var e = 0.01*RH_ec*6.112*exp(17.67*T_ec/(T_ec+243.5)) // Tämä muuttuja ei toimi avgz-funktion sisällä, kos
var AVG_0_850 = avgz(0, z850, 622*(0.01*RH_ec*6.112*exp(17.67*T_ec/(T_ec+243.5)) / (p_ec - 0.01*RH_ec*6
var AVG_850_700 = avgz(z850, z700, 622*(0.01*RH_ec*6.112*exp(17.67*T_ec/(T_ec+243.5)) / (p_ec - 0.01*RH
var AVG_700_500 = avgz(z700, z500, 622*(0.01*RH_ec*6.112*exp(17.67*T_ec/(T_ec+243.5)) / (p_ec - 0.01*RH

IF(z850 != miss AND z700 != miss)
{
result = ( dp*100 * AVG_0_850 + 150*100 * AVG_850_700 + 200*100 * AVG_700_500 ) / 1000/9.81
}
```

Error text

Save SmartT Load SmartT Remove SmartT Save to DBChecker Show DBChecker

Apply DBChecker at send

Macro Parameters

Save MacroPar Name Q3

Remove MacroPar

Properties Data grid size

Refresh list X: 110 Y: 110 Use

Latest error

< KOKOELMA > 1 X
< Puuskat > 2 X
< t_eriik > 3 X
< a_Paavo > 4 X
< aarre > 5 X
< AJP > X
< alex > X
< Anttik > X
< anu_edit > X
< Aak > X

1 2 3 CrossSection



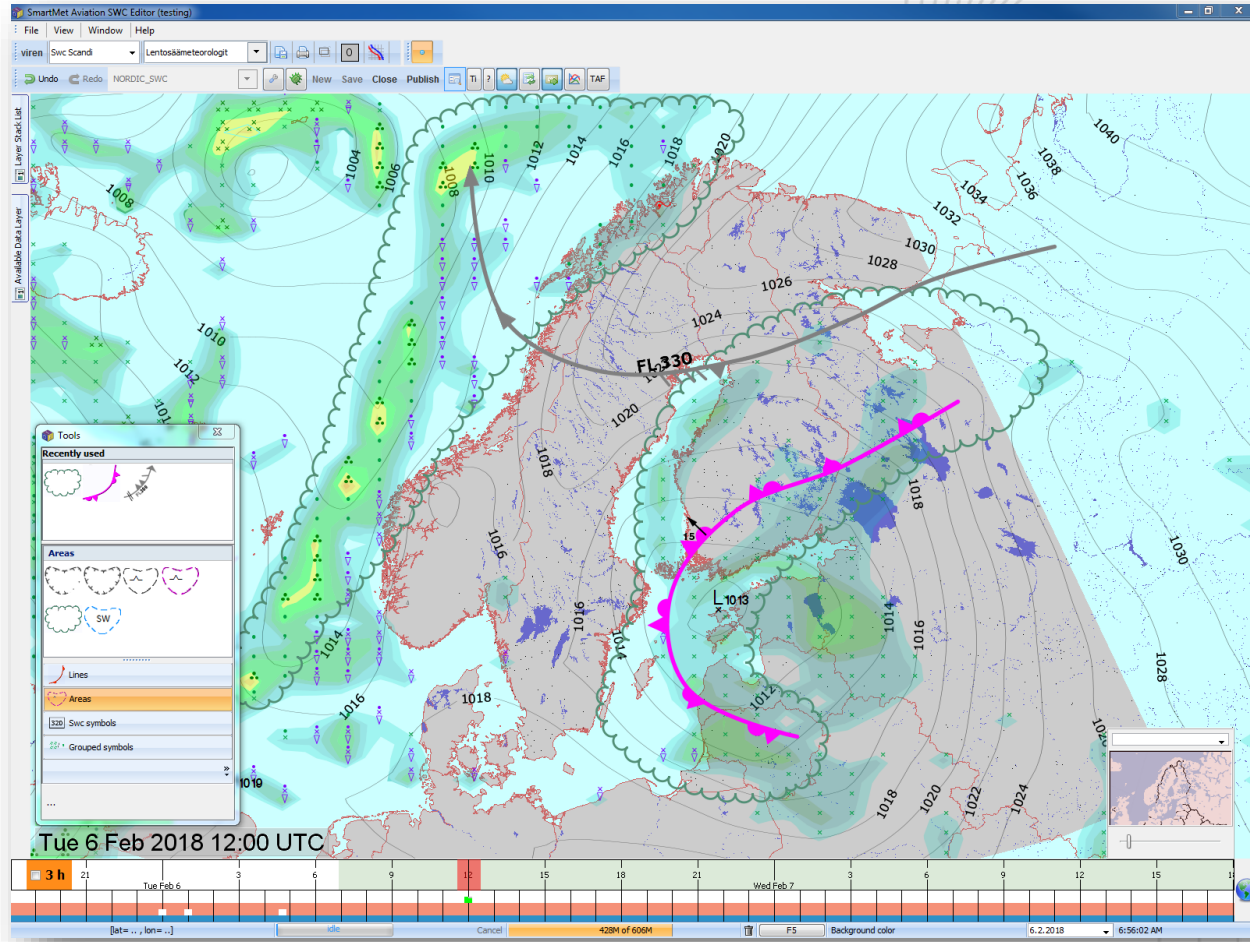
SmartMet Aviation (SWC)

- New tool for SigWx/SWC production
- Taken into production use May 2018 @ FMI and SMHI
- Installation and training in progress for Estonia (ESTEAS)
- Replacement for Adobe Illustrator
- Met objects saved in database, could be utilized for other products in addition to SWC
- Background fields and initial guesses to ease drawing
 - Model data, observations, satellite, radar, ...
 - 0°C level height, icing, turbulence, ...



Editing the product

- Study the data:
 - Model data
 - Observations
 - SIGMETs
 - Other already published charts
- Draw meteorological objects such as fronts and SigWX areas while seeing the data in the background

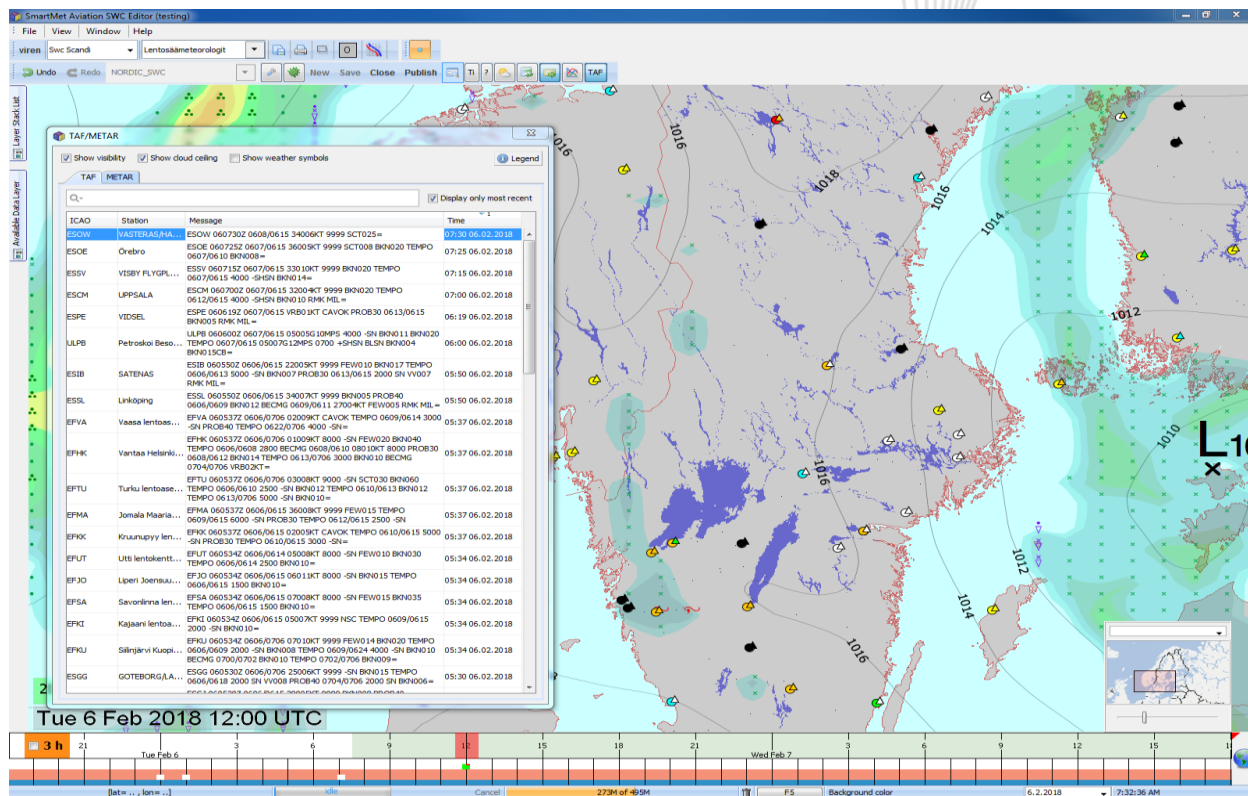


Editing the fronts, SigWX-areas, IMC-areas and other objects.



Editing the product

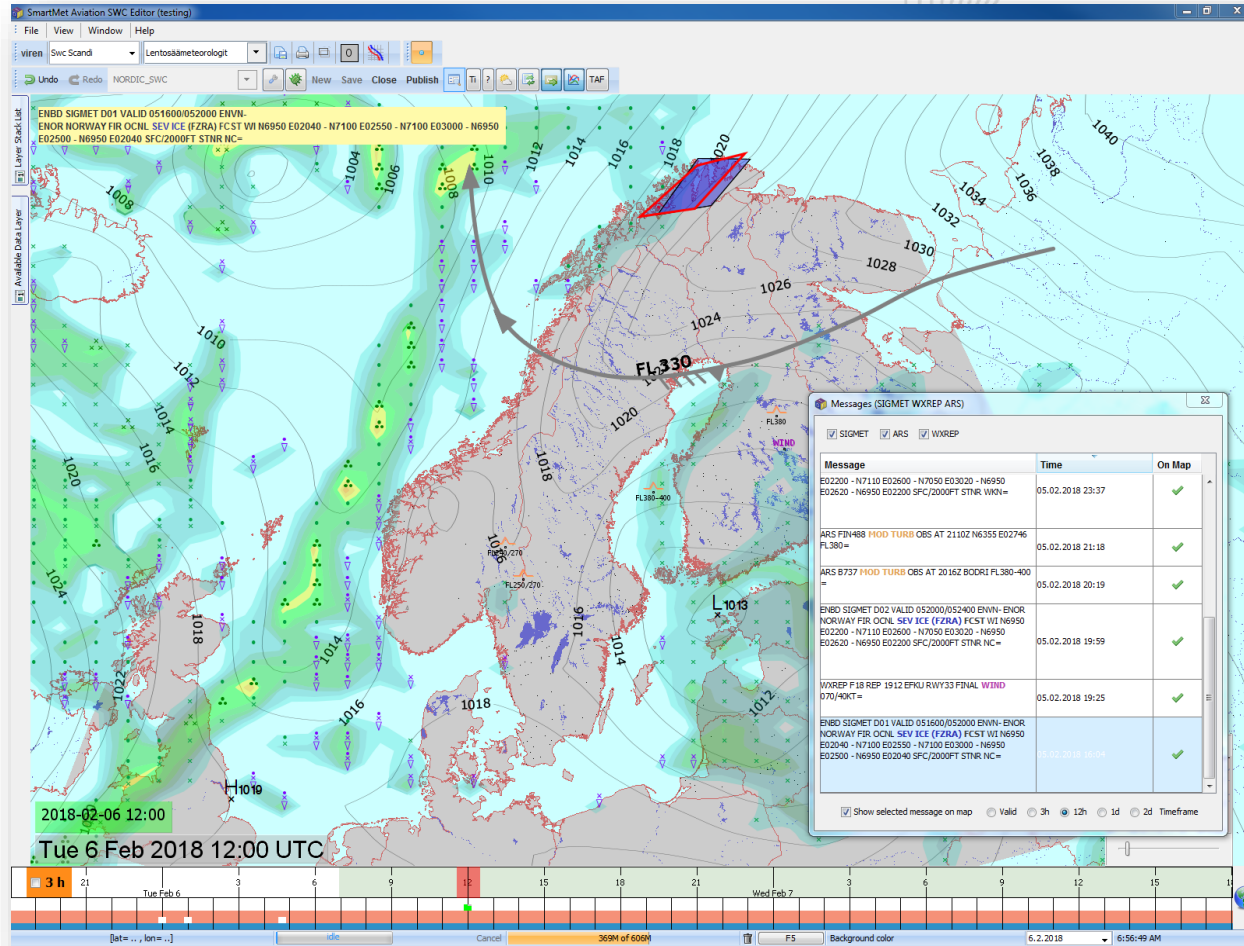
- Study the data:
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- Draw meteorological objects such as fronts and SigWX areas while seeing the data in the background



TAFs

Editing the product

- Study the data:
 - Model data
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 - SIGMETs
 - Other already published charts
- Draw meteorological objects such as fronts and SigWX areas while seeing the data in the background

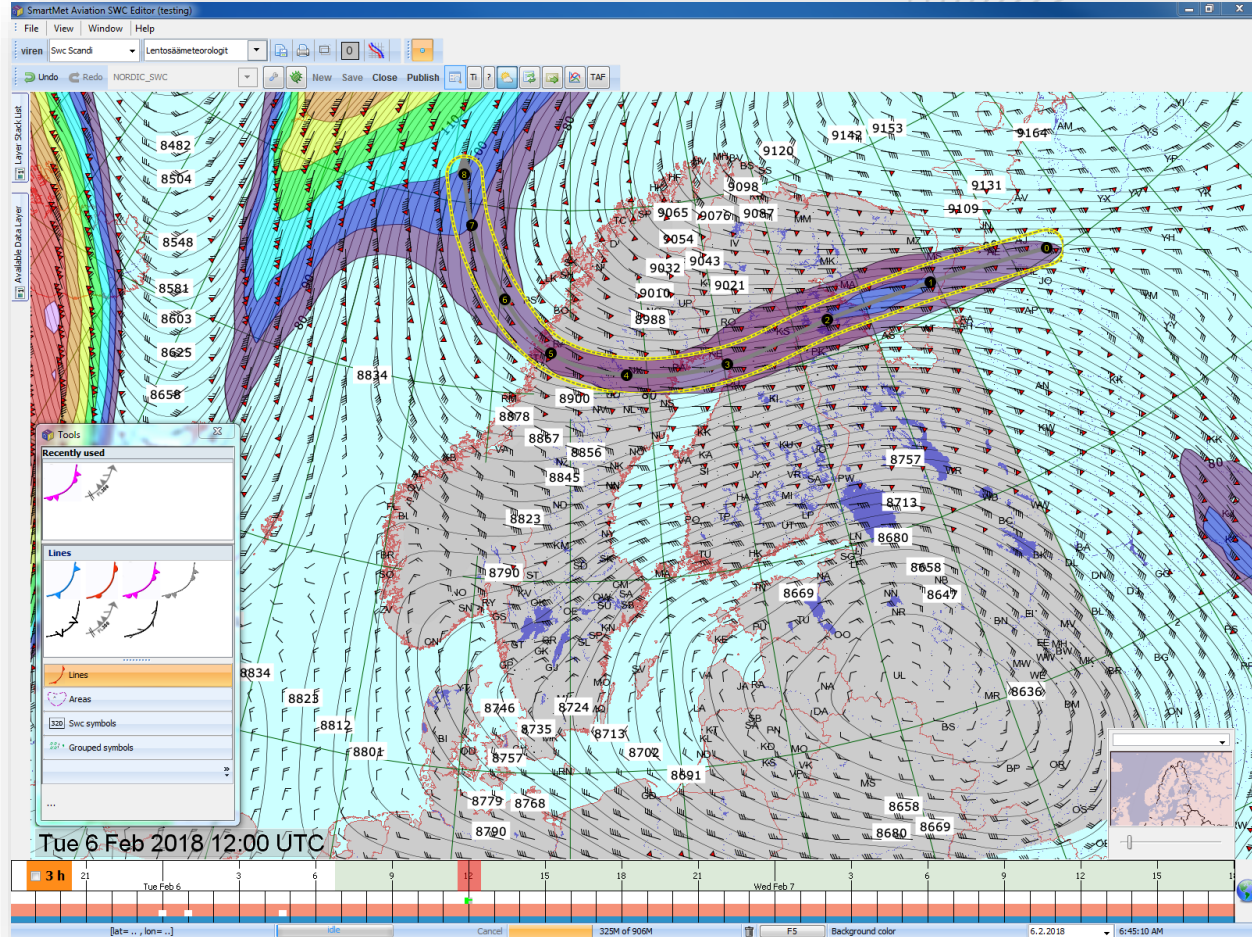


Valid sigmets on the same map.



Editing the product

- Study the data:
 - Model data
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- Draw meteorological objects such as fronts and SigWX areas while seeing the data in the background

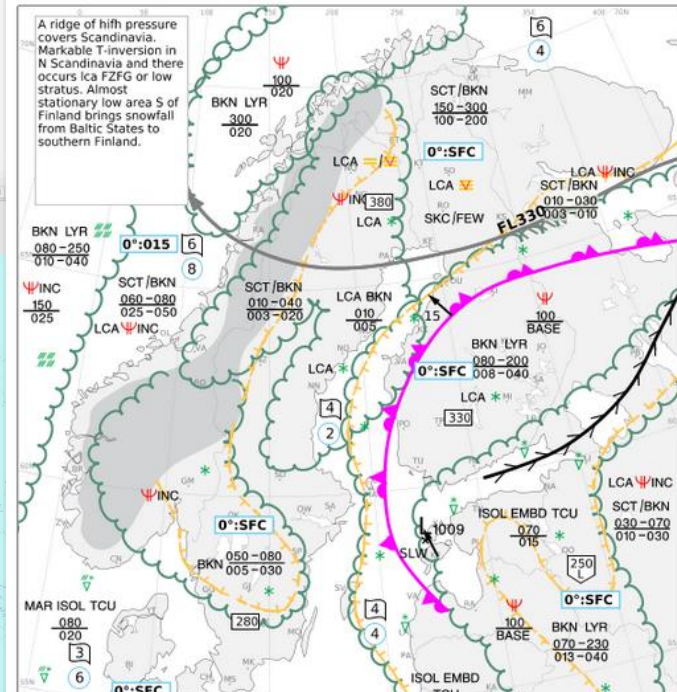


While seeing wind speed and vectors at 300 hPa in the background jet stream is easy to draw.

Publishing the product

- SmartMet Aviation automatically produces the necessary file formats and publishes the chart
- Different charts (different areas) can be published from the same data (e.g. Scandinavia and Northern Finland)
- Corrections/amendments are easy to make and publish

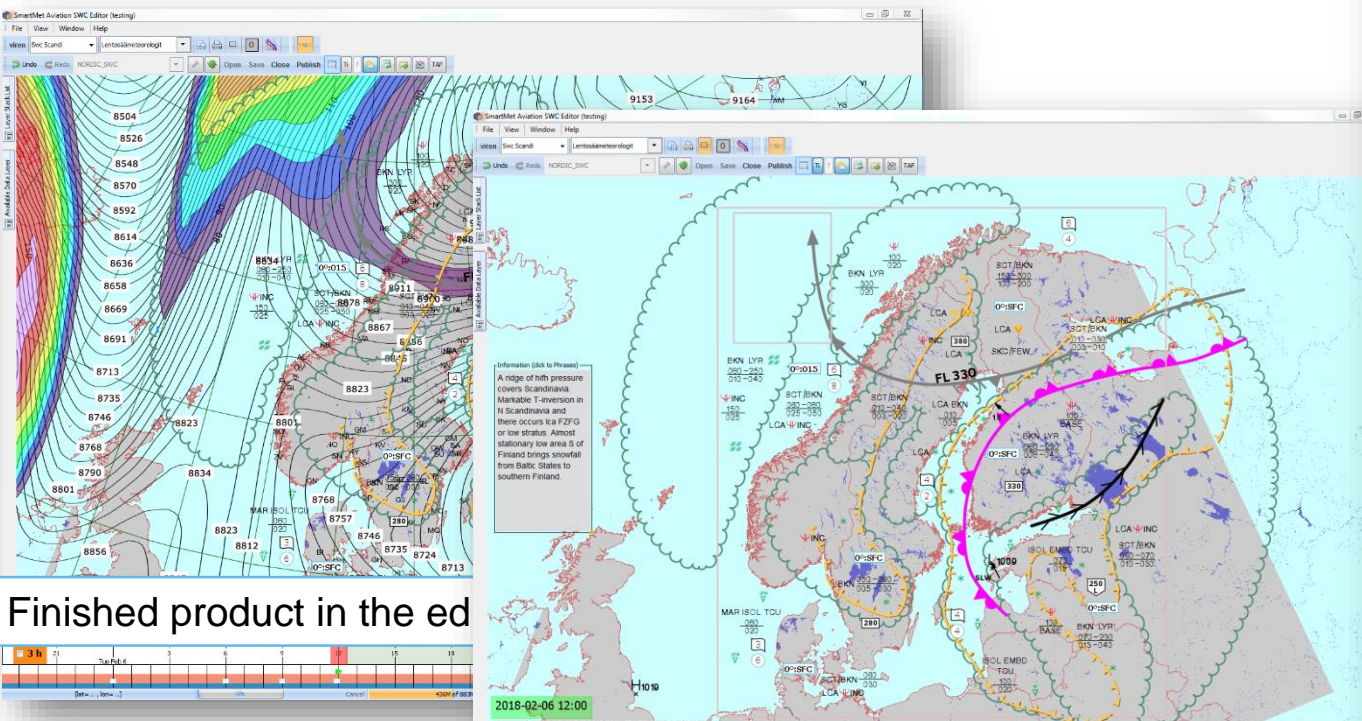
SWC SFC-FL450 valid time 12 UTC 06.02.2018
 Issued by FMI at 1130 UTC



The final product for customers

Fixed time prognostic chart

	Boundary for high level turbulence (ICL)		Level of max wind
	Boundary for moderate or severe turbulence (MSE)		Tropopause level
	Boundary for light level turbulence (LTL)		Tropopause high
	Boundary for moderate/severe turbulence (MSE)		Tropopause low
	Boundary for hail level turbulence (HLL)		Sea surface temperature
	Boundary for mountain waves (MW)		Sea state (index)
	Boundary for moderate/severe turbulence (MSE)		Radiative materials in the atmosphere



Finished product in the editor

Finished product without model data



SmartMet Aviation (TAF/SIGMET)

- New tool for TAF/SIGMET/AIRMET
- MVP scheduled for 12/2018, production use 2019
- Installation and training in progress also for Estonia (ESTE A)
- SESAR SWIM compliant native output (IWXXM 2.1) as well as traditional TAC



SmartMet Aviation (TAF/SIGMET) – TAF features

- Auto sync with TAF order (will be connected to SMHI TAF Planner via API)
- Sharing of TAF responsibility between forecaster or regional offices
- TAF split into hourly data -> could be used in another product
- Visualization of observation and model data for TAF valid time
- Automatic distribution of finished TAF within send window
- Graphical editing of TAF from hourly data
- Native IWXXM output in addition to traditional TAC



SmartMet Aviation (TAF/SIGMET) – SIGMET features

- Background fields to help choose SIGMET area
- More advanced SIGMET coordination between neighbouring countries
- Creation of VA-SIGMET from VAA message



Aviation Message Editor

tamplentc Finland Lentosäämeteorologi 07:38:19 UTC 0 AutoMetar 17 Ok 3 Not Ok

Layer Stack List

Group	Owners
name	...
STJ - Aerodromes (short) - na...	<input type="checkbox"/>
STJ - Base - namedlayers	<input checked="" type="checkbox"/>

Available Data Layer

Maps

Properties:

Event Manager Fra...

Event senders

eventtype.fi.fmi.mirri.core.event.da
component.Mirwa
component.Mirwa

Event subscribers

eventtype.fi.fmi.mirri.core.event.da
component.Mirwa

Events

fi.fmi.mirri.core.plugin.PluginEven
servicetype:unknownspec#fi.fmi.r
servicetype:spec#fi.fmi.mir

0 event(s) in queue

Thu 15 Mar 2018 06:00 UTC

3 h 9 12 15 18 21 Thu Mar 15 3 9 12 15 18 21 Fri Mar 16 3

[lat= .., lon= ..] idle Cancel 121M of 282M F5 Background color lar 15, 201 7:38:19 AM



TAF - monitoring

TAF Monitoring

TAF Status for Helsinki Siviili 07:38:51 UTC

0 AutoMetar 17 Ok 3 Not Ok

- TAF AMD EFVA 150630Z 1506/1606 36009KT 5000 -SN BKN005 BECMG 1506/1508 8000 BECMG 1508/1510
- TAF AMD EFOU 150609Z 1506/1606 34008KT CAVOK TEMPO 1506/1508 0600 -SN FEW010=
- TAF EFHK 150536Z 1506/1606 31010KT CAVOK TEMPO 1510/1517 35015G25KT=
- TAF EFTU 150536Z 1506/1606 32008KT CAVOK=
- TAF EFKK 150536Z 1506/1515 32005KT 4000 -SN BKN007 BECMG 1506/1508 8000 BECMG 1508/1510 SCT0
- TAF EFMA 150536Z 1506/1515 36001KT 9999 BKN030 TEMPO 1506/1515 4000 -SHSN SCT025CB=
- TAF EFJY 150531Z 1506/1606 32009KT CAVOK TEMPO 1510/1513 36015G25KT=
- TAF EFTP 150531Z 1506/1606 32008KT CAVOK PROB30 1506/1508 BKN009 PROB30 1511/1514 36015G25KT
- TAF EFPO 150531Z 1506/1515 33007KT CAVOK=
- TAF EFHA 150531Z 1506/1514 31009KT CAVOK=
- TAF EFKU 150527Z 1506/1606 34011KT CAVOK TEMPO 1508/1513 35012G24KT=
- TAF EFJO 150527Z 1506/1515 34011KT CAVOK TEMPO 1507/1513 35014G28KT=
- TAF EFKI 150527Z 1506/1515 34006KT CAVOK PROB40 TEMPO 1506/1510 36008G18KT=
- TAF EFSA 150527Z 1506/1515 32010KT CAVOK TEMPO 1510/1514 01013G25KT=
- TAF EFUT 150527Z 1506/1514 32009KT CAVOK TEMPO 1508/1514 35013G24KT=

TAF Monitoring

TAF Status for Helsinki Siviili 07:42:58 UTC

0 AutoMetar 17 Ok 3 Not Ok

- TAF AMD EFVA 150630Z 1506/1606 36009KT 5000 -SN BKN005
BECMG 1506/1508 8000
BECMG 1508/1510 SCT010=
- TAF AMD EFOU 150609Z 1506/1606 34008KT CAVOK TEMPO 1506/1508 0600 -SN FEW010=
- TAF EFHK 150536Z 1506/1606 31010KT CAVOK TEMPO 1510/1517 35015G25KT=
- TAF EFTU 150536Z 1506/1606 32008KT CAVOK=
- TAF EFKK 150536Z 1506/1515 32005KT 4000 -SN BKN007 BECMG 1506/1508 8000 BECMG 1508/1510 SCT0
- TAF EFMA 150536Z 1506/1515 36001KT 9999 BKN030 TEMPO 1506/1515 4000 -SHSN SCT025CB=
- TAF EFJY 150531Z 1506/1606 32009KT CAVOK TEMPO 1510/1513 36015G25KT=
- TAF EFTP 150531Z 1506/1606 32008KT CAVOK PROB30 1506/1508 BKN009 PROB30 1511/1514 36015G25KT
- TAF EFPO 150531Z 1506/1515 33007KT CAVOK=
- TAF EFHA 150531Z 1506/1514 31009KT CAVOK=
- TAF EFKU 150527Z 1506/1606 34011KT CAVOK TEMPO 1508/1513 35012G24KT=

Expanded TAF AMD EFVA 150630Z 1506/1606 36009KT 5000 -SN BKN005
BECMG 1506/1508 8000
BECMG 1508/1510 SCT010=

METAR EFVA 150720Z AUTO 02010KT 6000 -SN OVC008/// M12/M14 Q1023=
METAR EFVA 150650Z AUTO 01011 Mean wind direction difference too large Q1022=
METAR EFVA 150620Z AUTO 01011KT 7000 -SN BKN007/// M11/M13 Q1022=
METAR EFVA 150550Z AUTO 34009KT 8000 -SN BKN008/// M13/M15 Q1022=
METAR EFVA 150520Z AUTO 33005KT 4100 -SN BKN008/// M13/M15 Q1021=
METAR EFVA 150450Z AUTO 33006KT 9999 -SN SCT008/// M14/M16 Q1021=
METAR EFVA 150420Z AUTO 34007KT 9999 -SN FEW010/// M15/M17 Q1021=
METAR EFVA 150350Z AUTO 34008KT CAVOK M16/M18 Q1021=
METAR EFVA 150320Z AUTO 34007KT 9999 -SN NCD M15/M17 Q1020=
METAR EFVA 150250Z AUTO 35008KT CAVOK M16/M18 Q1020=



TAF – task list

Time	Task
04:00	
05:00	
06:00	
07:00	
08:00	EFHK 1509/1609, EFTU 1509/1609
09:00	
10:00	
11:00	EFJY 1512/1612, EFRO 1512/1612, EFMA 1512/1521
12:00	
13:00	
14:00	EFHK 1515/1615, EFRO 1515/1615, EFTU 1515/1615, EFMA 1515/1615, EFJY 1515/1615
15:00	
16:00	



TAF – editing view

EFHK 1509/1609 × EFTU 1509/1609

Location EFHK TAF valid 1509/1609 Test Toggle

▼ TAF

TAF in edit TAF EFHK 150741Z 1509/1609 200013KT 9999 FEW020
TEMPO 1512/1515

Reference TAF EFHK 101123Z 1012/1112 19013KT 9999 FEW040 BKN200
BECMG 1100/1102 08003KT
PROB30 1100/1103 2000 BR BKN002
BECMG 1107/1109 12014G24KT=

Done

► TAF history

▼ METAR history

METAR EFHK 150720Z 34010KT CAVOK M09/M12 Q1017 NOSIG=
METAR EFHK 150650Z 33009KT CAVOK M10/M12 Q1017 NOSIG=
METAR EFHK 150620Z 33009KT CAVOK M10/M12 Q1017 NOSIG=
METAR EFHK 150550Z 32010KT CAVOK M11/M13 Q1016 NOSIG=
METAR EFHK 150520Z 31010KT CAVOK M11/M13 Q1016 NOSIG=
METAR EFHK 150520Z NIL=
METAR EFHK 150450Z 31010KT CAVOK M11/M12 Q1016 NOSIG=
METAR EFHK 150420Z 32010KT CAVOK M11/M12 Q1016 NOSIG=
METAR EFHK 150350Z 32008KT CAVOK M10/M12 Q1016 NOSIG=
METAR EFHK 150320Z 31008KT CAVOK M10/M12 Q1015 NOSIG=
METAR EFHK 150250Z 31010KT CAVOK M10/M12 Q1015 NOSIG=
METAR EFHK 150220Z 31009KT CAVOK M09/M11 Q1015 NOSIG=
METAR EFHK 150150Z 32010KT CAVOK M09/M11 Q1015 NOSIG=
METAR EFHK 150120Z 32010KT CAVOK M09/M11 Q1015 NOSIG=
METAR EFHK 150050Z 32010KT CAVOK M09/M11 Q1015 NOSIG=
METAR EFHK 150020Z 32010KT CAVOK M09/M11 Q1015 NOSIG=



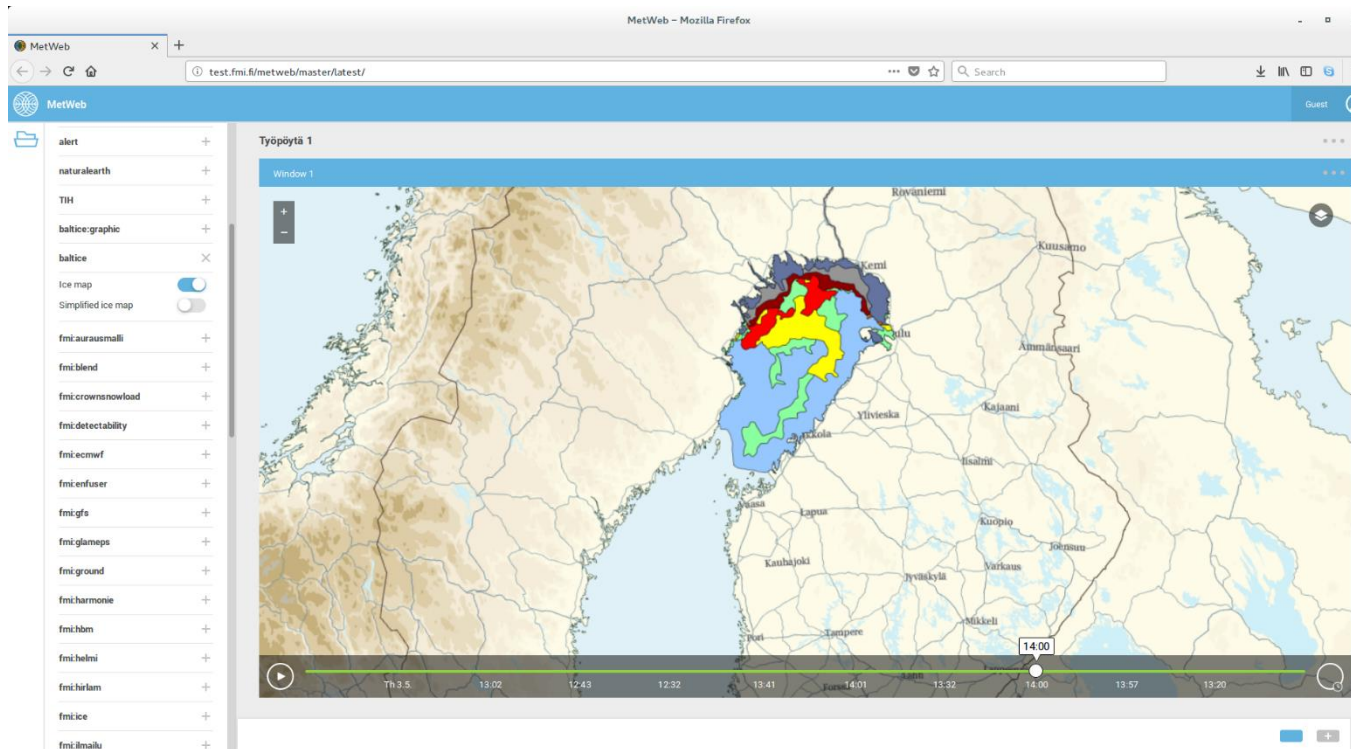
SmartMet Web

- SmartMet Web is a lightweight web application for visualizing WMS layer products. Key features of the design are user friendliness, speed and the ability to define user specific settings that can be shared with others.
- Initially built to replace all kinds of internal websites for radar, satellite etc. data
 - Instead make them available as WMS layers
 - Ease maintenance burden
- Project is open source and it can be found from GitHub.
- GitHub: <https://github.com/fmidev/metweb>
- Contact: joonas.karjalainen@fmi.fi



SmartMet Web

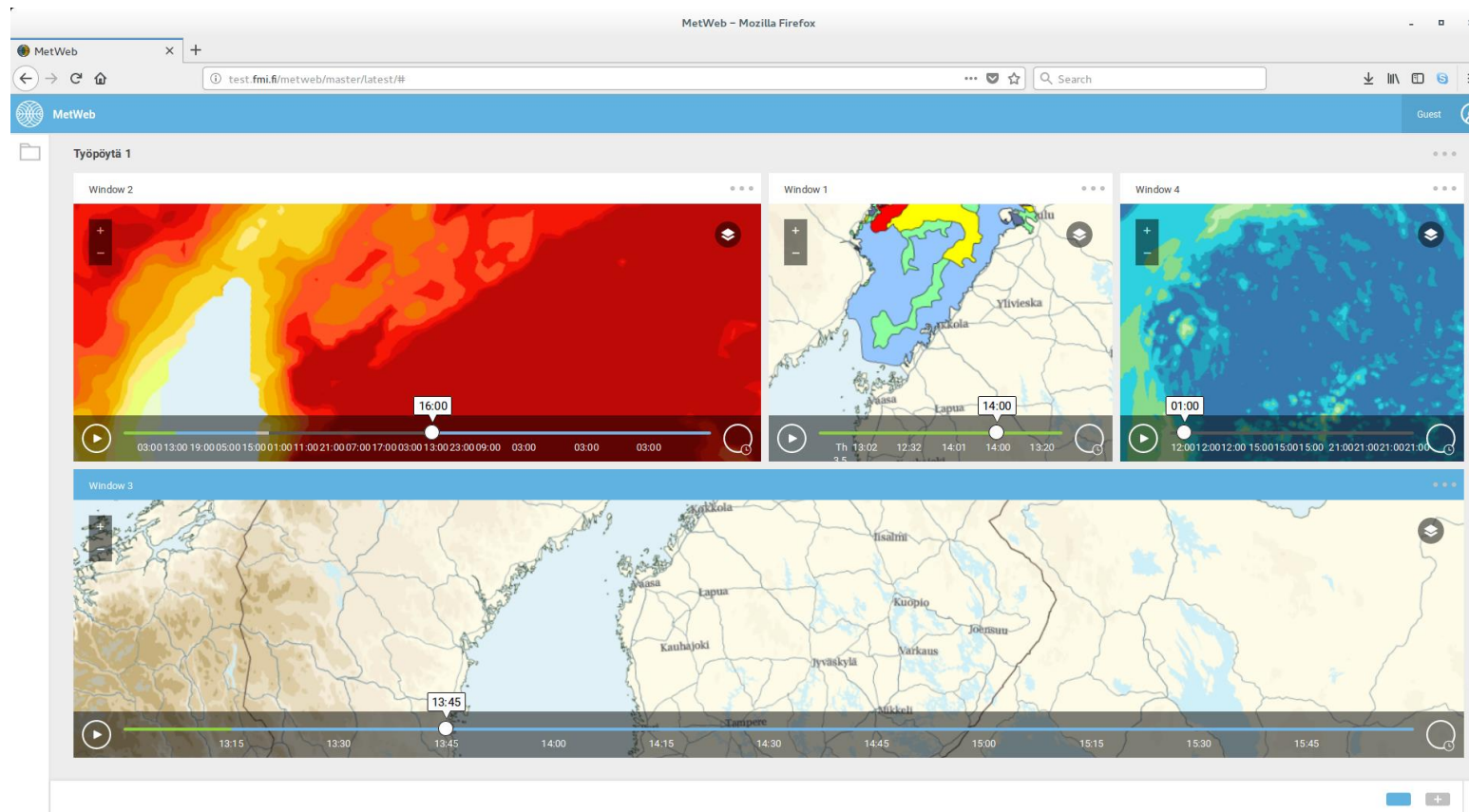
- WMS product layers can be easily activated from the product menu
- Multiple products can be displayed on top of each other
- Map view allows basic functionality such as zooming, panning and animating in different time scales etc.





SmartMet Web

- Several customizable product windows can be added to a workspace
- Multiple workspaces can be created and the configurations can be saved and shared between users





SmartMet Web

- Javascript
 - React – for building the user interface
 - Redux – manages state of application
 - Webpack – packaging
 - Babel – for compatibility with most browsers
- User API
 - NodeJS + Express + PostgreSQL + Atlassian Crowd (authentication)



Development process

- Scrum as base development process
 - Development in 2-4 week sprints
 - Three roles: product owner, scrum master and development team
 - Three products: product backlog, sprint backlog, product release
 - Four events: sprint planning, daily meeting, sprint review, sprint retrospective
 - JIRA Agile used as issue management
- Key success factors
 - Active product owner and good/frequent communication with end users
 - Test periods before production use
- Code in internal Subversion or GitHUB
- Development method very well received within users
 - In fact we have requests to develop more/all projects in the same manner



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