ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

MTGIRS - NRT Demo project meeting

FMI – “Short” Summary

Darmstadt 18-19 October 2017

MTGIRS – NRT project: FMI involvement

Overview of presentation:

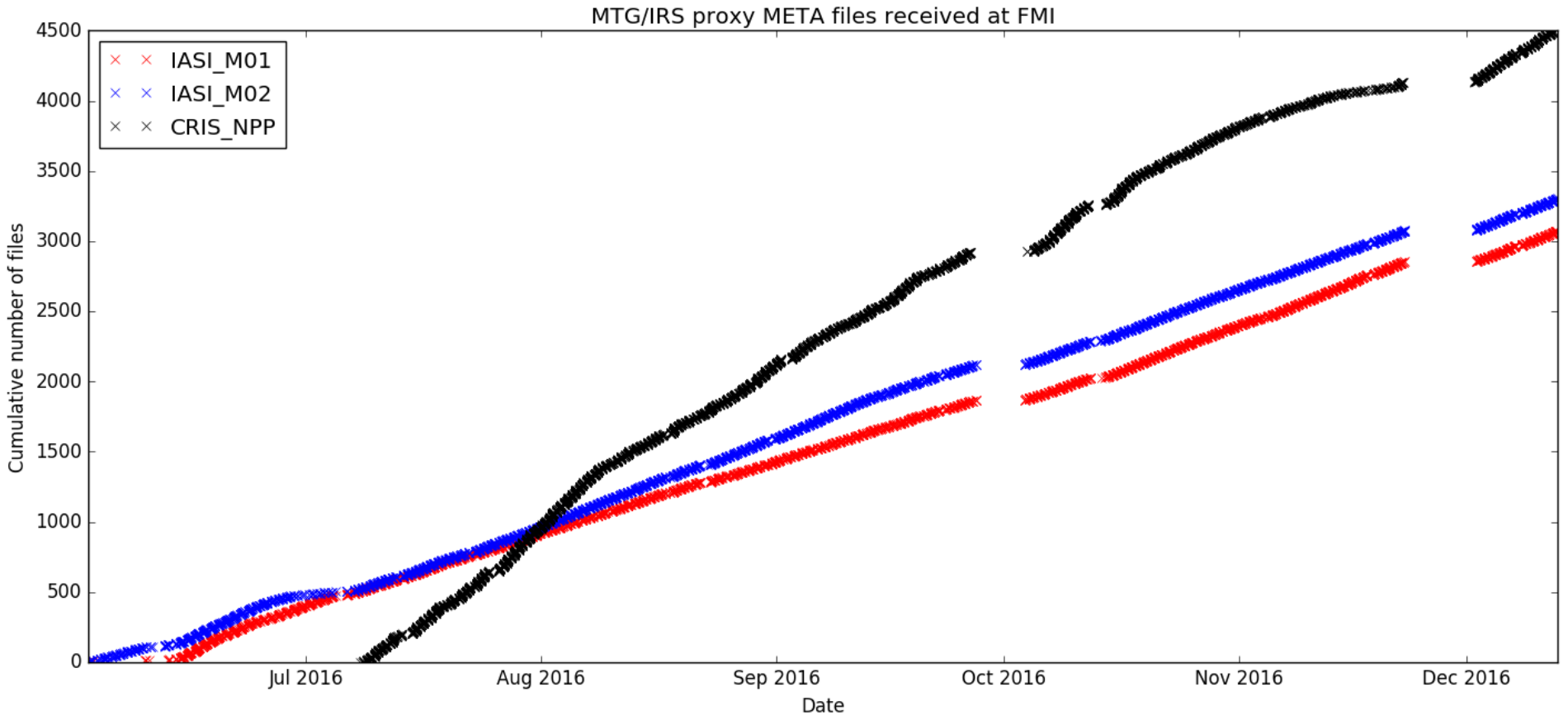
- NRT L2 Demo:
  - Proxy-IRS retrievals at FMI, SMARTMET visualization
  - Training of forecasters, preparation for usage of Proxy-IRS in shift-work
  - Main results/outcome by forecasters
  - Verification of Proxy-IRS with European sounding stations
  - Assimilation of Proxy-IRS in LAPS analysis system
    - Profile verfication
    - Stability index validation
- Recent progress with the IASI-L2 data at FMI
- Possible continuation of testing MTG-IRS L2 data

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

MTGIRS – NRT Demo: Proxy-IRS retrievals at FMI, SMARTMET visualization

Download of Metop 1 & 2 (IASI) and Suomi-NPP (CrIS) via EUMETSAT FTP-server

- Collect/check of available data every 5 min
- Received Proxy-data (both IASI and CrIS) at FMI, from beginning of summer 2016.
- Figure: Downloaded data from Eumetsat ftp-server (here META-file equal one orbital segment downloaded, gaps due to EUMETSAT upgrades)

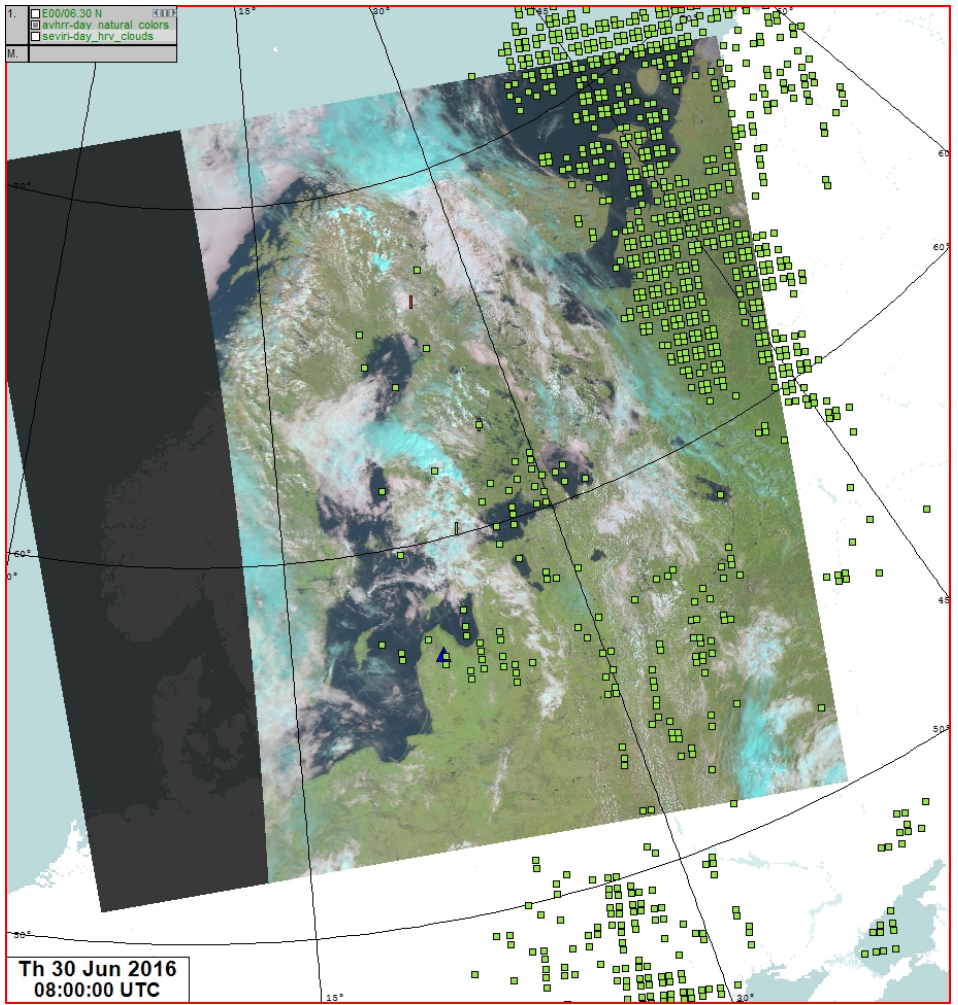


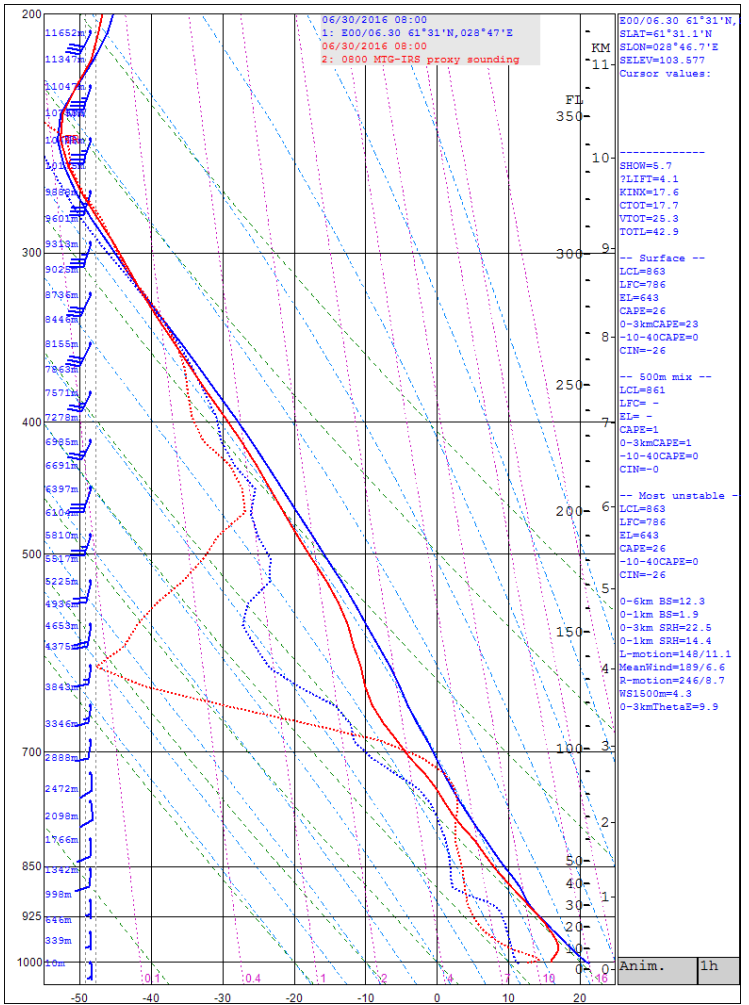
ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

MTGIRS – NRT Demo: Proxy-IRS retrievals at FMI, SMARTMET visualization

Note: FMI focussed on Metop 1 & 2 (IASI)

- More experience with Metop-datasets
- Do not want to mix different datasets, with possibly different quality “issues”
- Metop: sparse overpasses for our area of interest (~4-6 per day)
- Figure: Example of visualization in FMI-SMARTMET workstation (Metop-IASI)





MTGIRS – NRT Demo: Training of forecasters

FMI prepared training materials of the new sounding measurements (e.g. proxy-IRS & MTGT-IRS):

- Three parts/sessions of training:
  - An introduction to atmospheric soundings
  - Atmospheric temperature and humidity soundings from satellite
  - The Proxy-IRS data
- Presented to FMI forecasters in June 2016
- Delivered to the NRT Demo participants
- Delivered to EUMETRAIN (via contact: Aulikki Lehkonen & Lisa Haga)

Questionnaires were prepared:

- All NRT participating institutes contributed with input (FMI lead)
- 2 Questionnaires: 1 short (used during shift-work) & 1 more extensive (after project)
- Questionnaire available via on-line (Webropol tool), access by all institutes

Questionnaires evaluation (FMI lead):

- During shift-work: June-September 2016 (independent answers)
- End of project study + evaluation of specific cases (joint answers by forecasters + key-persons)
- Some highlighted answers....

MTGIRS – NRT project: Main results/outcome by forecasters

The positive feedback:

- The tropopause is mostly well captured by the Proxy-IRS, also boundary layer height could be determined
- Level 2 soundings (cloud free) can give considerably valuable information together with conventional sounding obeservations.
- Conditional instability from the soundings before convection emerges is of interest, nowcasting the evolution of cloud-top heights during the day is important. Proxy-IRS can help with this!
- The IR-soundings can help making the decision between which forecast-model to use during shift
- It would be very interesting for nowcasting if IR-sounding had the capability of creating profiles down to cloud-tops (give estimate of cloud-top heights etc)

MTGIRS – NRT project: Main results/outcome by forecasters

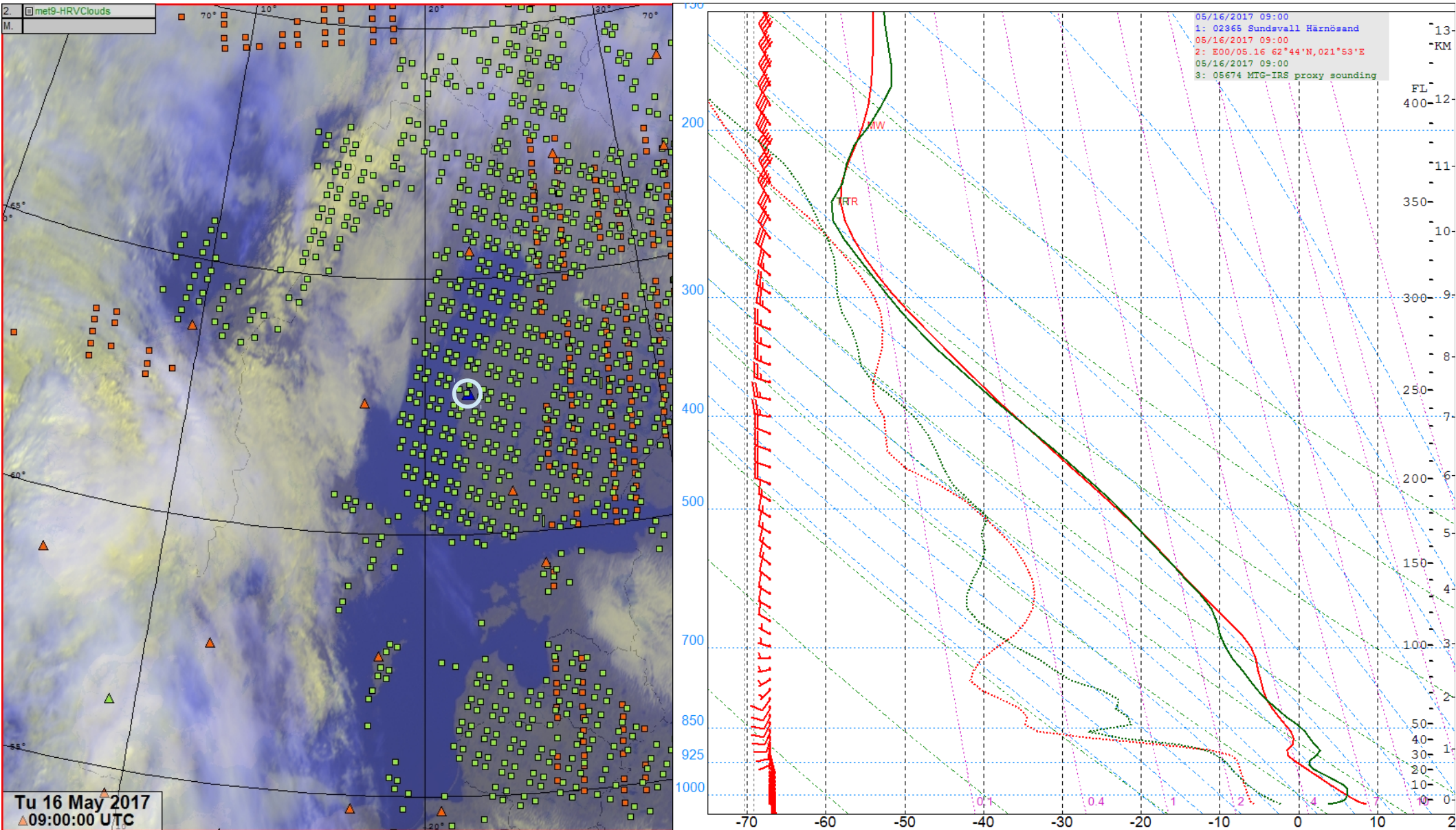
The negative feedback:

- A quality flag, which can be used to screen out undesired soundings, is needed. (forecasters do not have time to make much validation of data during shift-work, need to trust the data)
  - Note: Quality-flags is “available” but not used by FMI, on the TO-DO list
- Problems with humidity (Td) at ~700 hPa
- Seems like a systematic error/bias in Proxy-IRS temperature, when comparing profiles with forecast models and soundings.
- Sometimes cloudy retrievals (cloud-scheme?) & sometimes too few(?) retrievals in cloud-free areas
- The quality of profiles seems to depend on the undelaying surface being land or sea (emissivity?)
- The timeliness of Proxy-IRS is too long (>2,5 h) for nowcasting purposes. Preferred timeliness is < 1,0 hours for proxy-IRS data and <15 minutes for the real future operational L2-product (MTG-IRS timeliness from download of dwell).
- It is very important that the future MTG-IRS tackles the slant-angle problems, with appropriate correction routines being implemented (can it also be simulated in future proxy-IRS data?).

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

MTGIRS – NRT project: Proxy-IRS retrievals at FMI, SMARTMET visualization

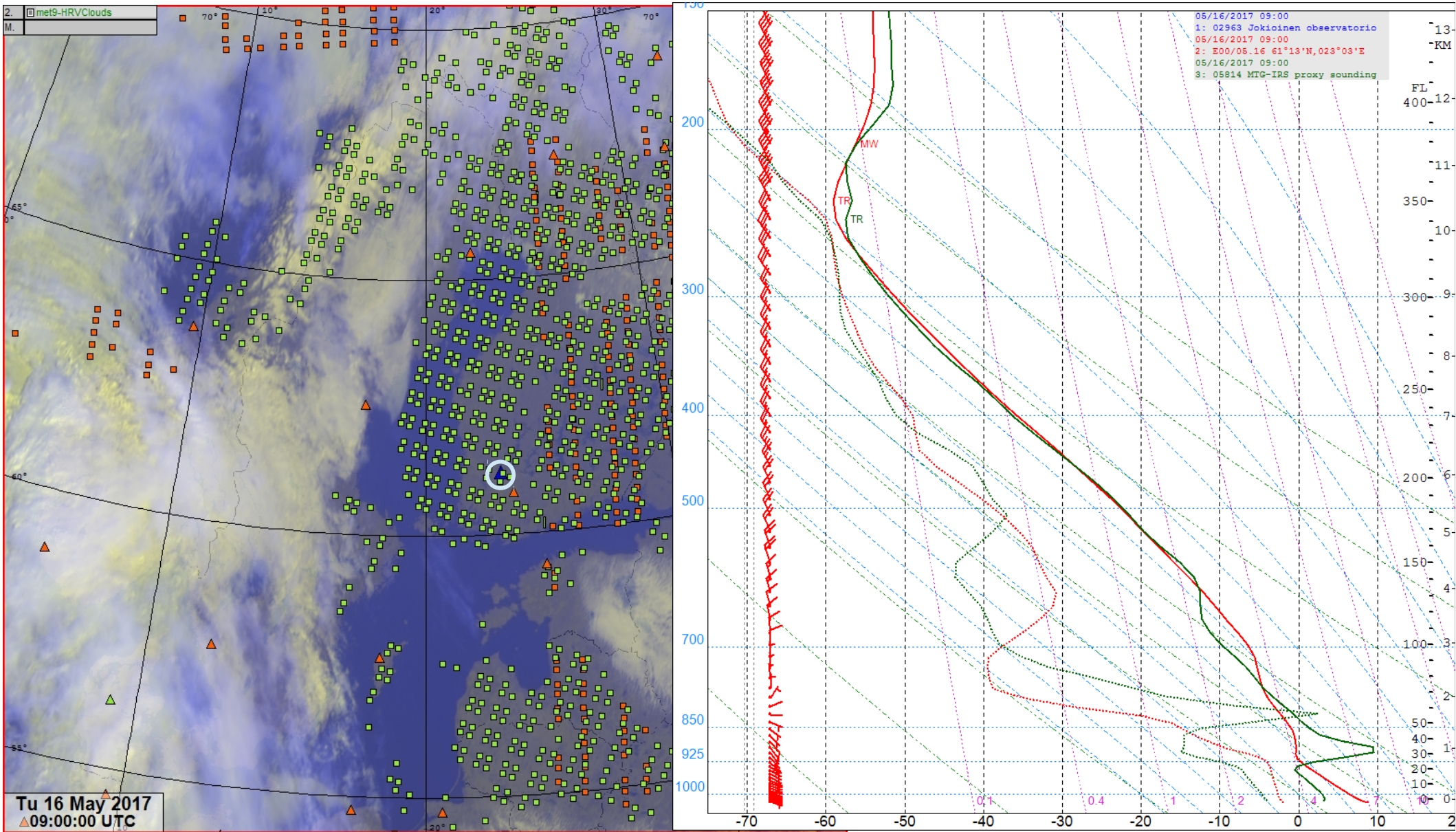
Figure: Example of visualization in FMI-SMARTMET workstation (MetopB-IASI)



ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

MTGIRS – NRT project: Proxy-IRS retrievals at FMI, SMARTMET visualization

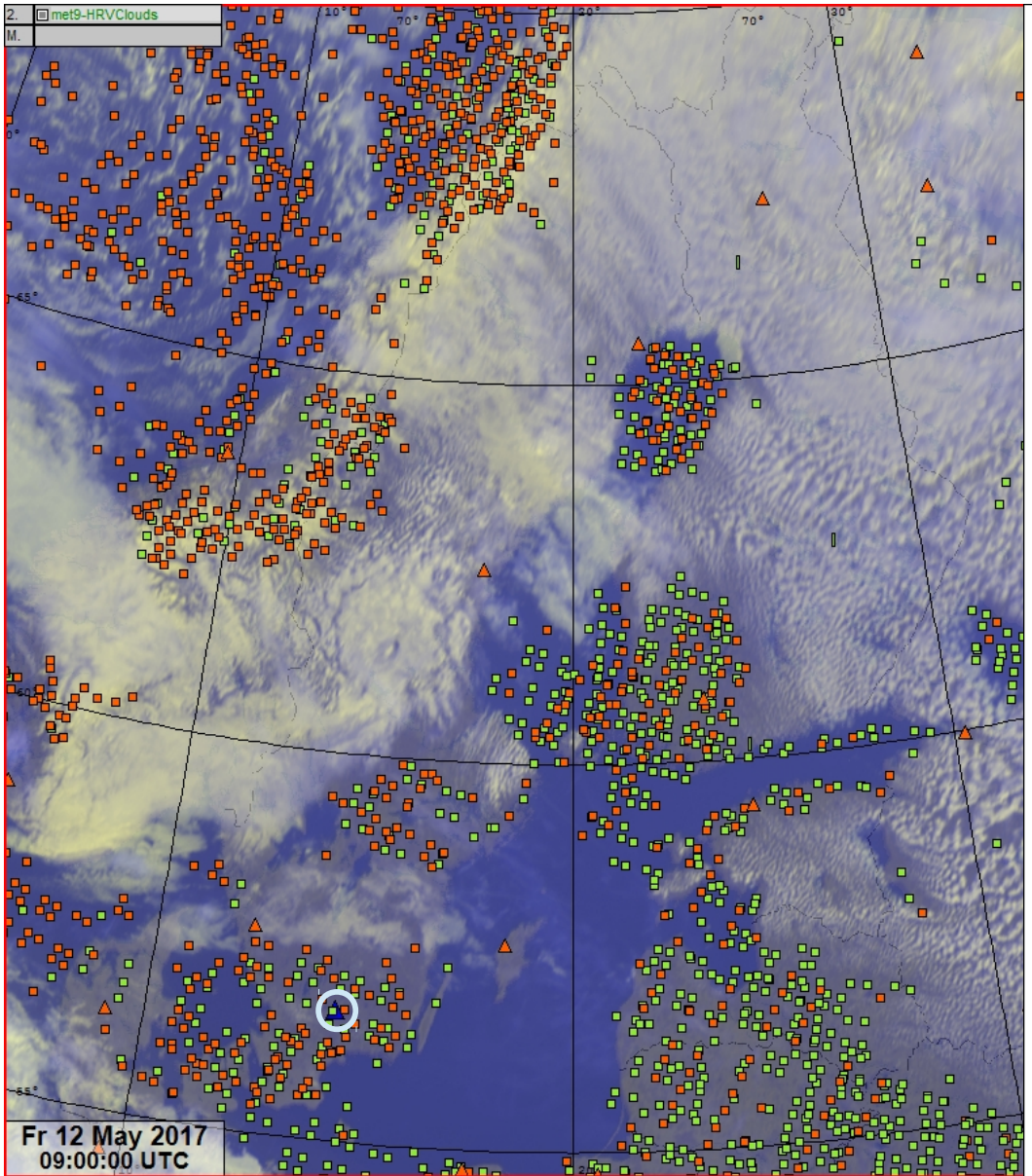
Figure: Example of visualization in FMI-SMARTMET workstation (MetopB-IASI)

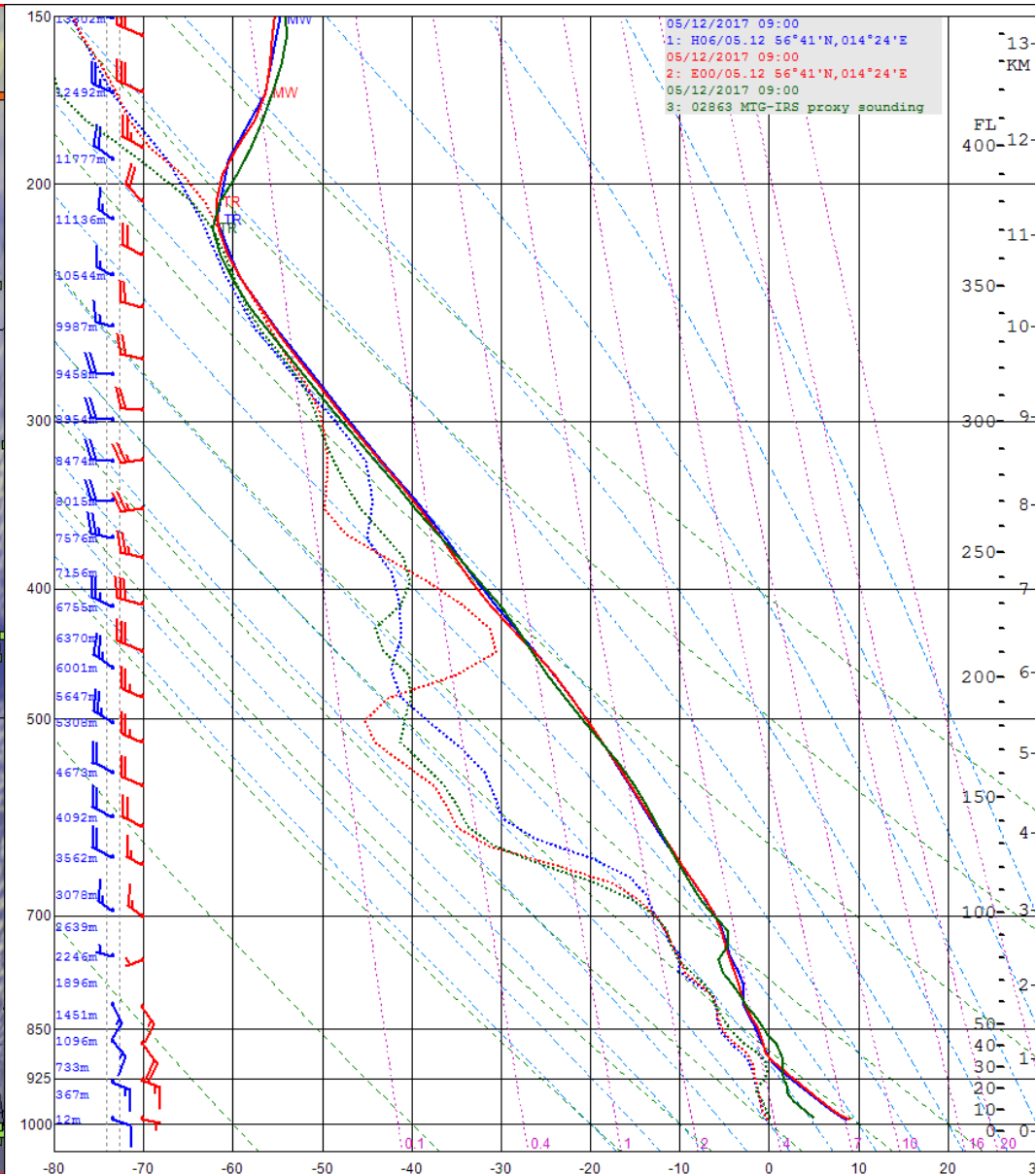


ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

MTGIRS – NRT project: Proxy-IRS retrievals at FMI, SMARTMET visualization

Figure: Example of visualization in FMI-SMARTMET workstation (MetopA-IASI)

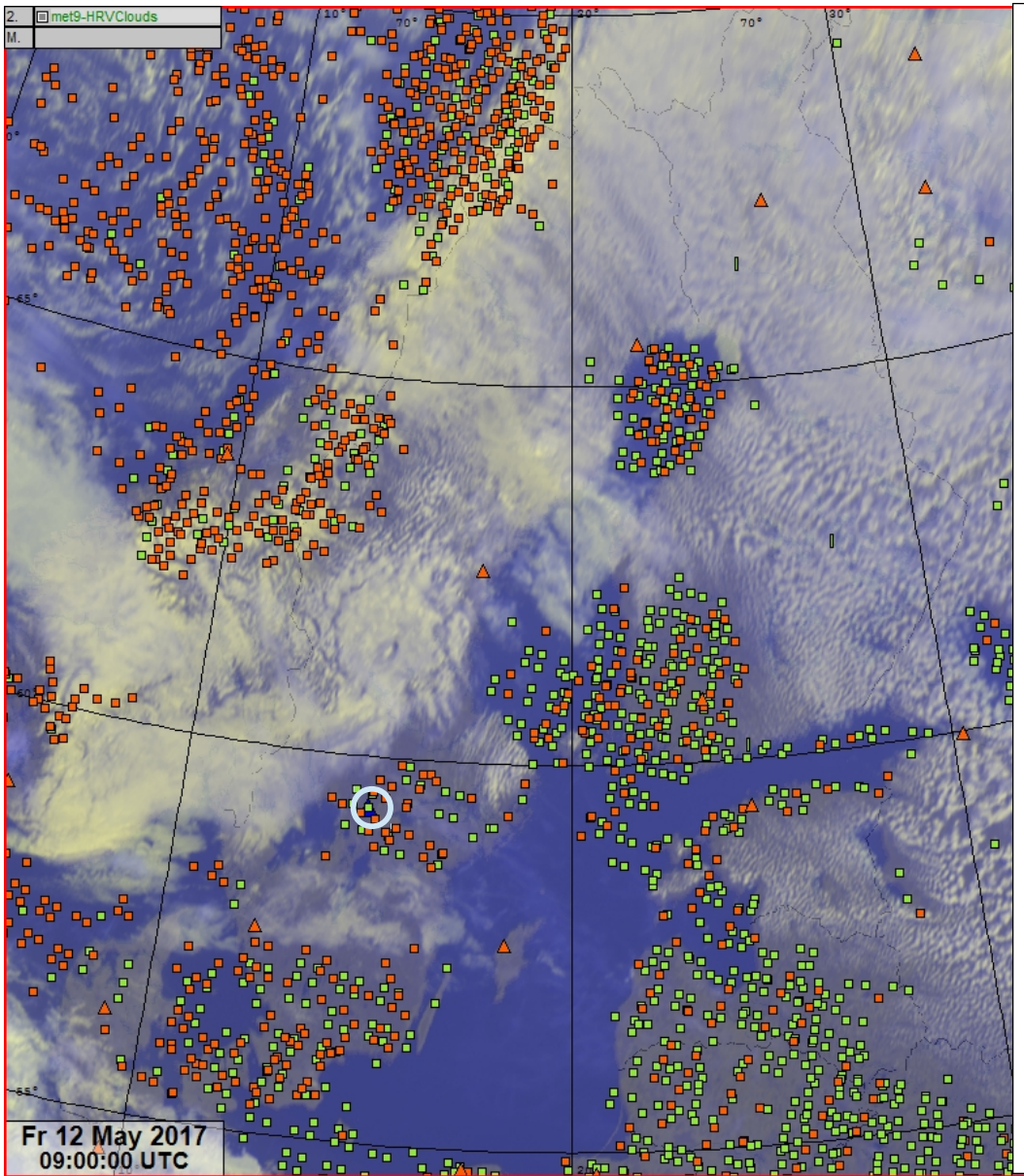


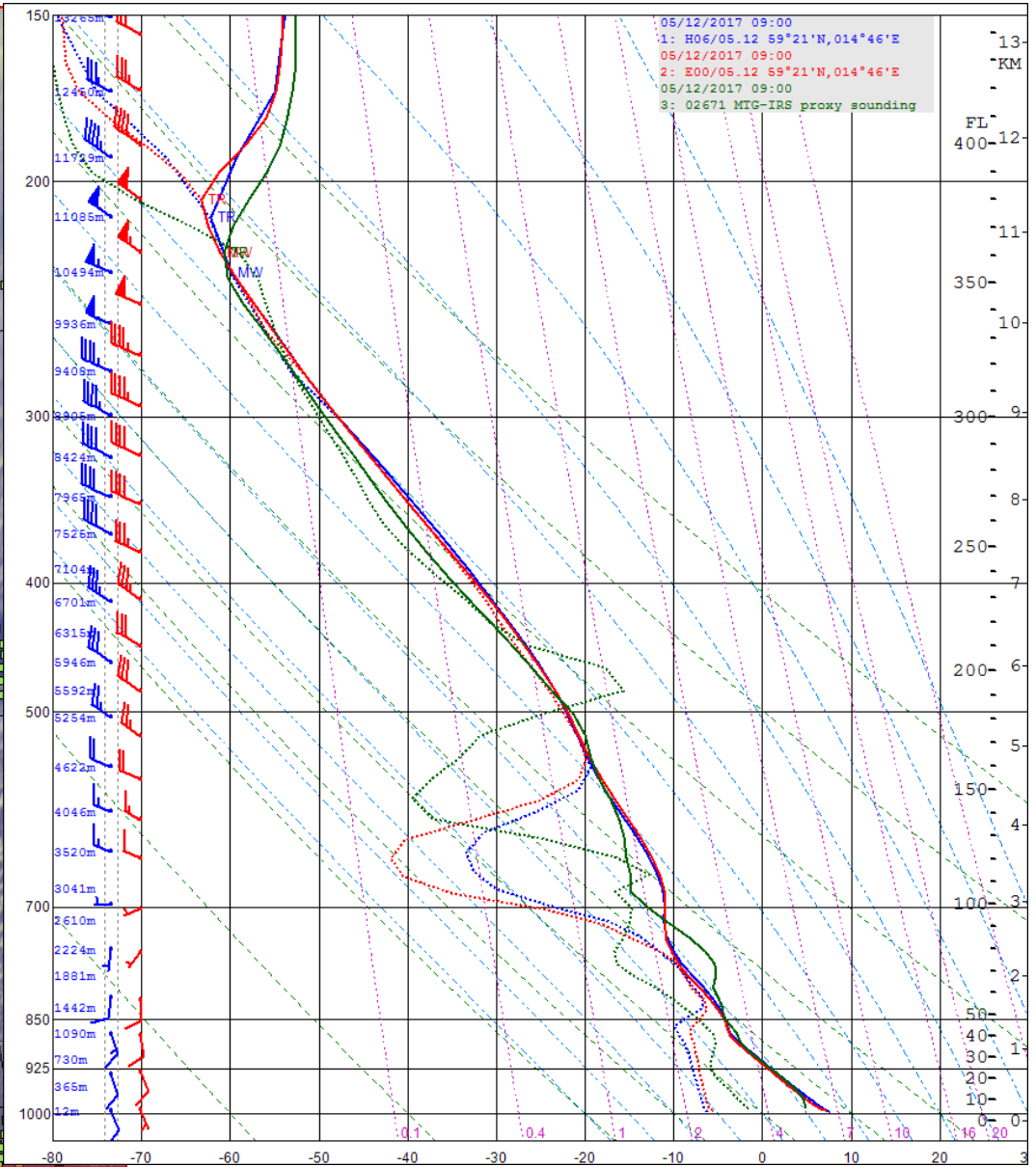


ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

MTGIRS – NRT project: Proxy-IRS retrievals at FMI, SMARTMET visualization

Figure: Example of visualization in FMI-SMARTMET workstation (MetopA-IASI)

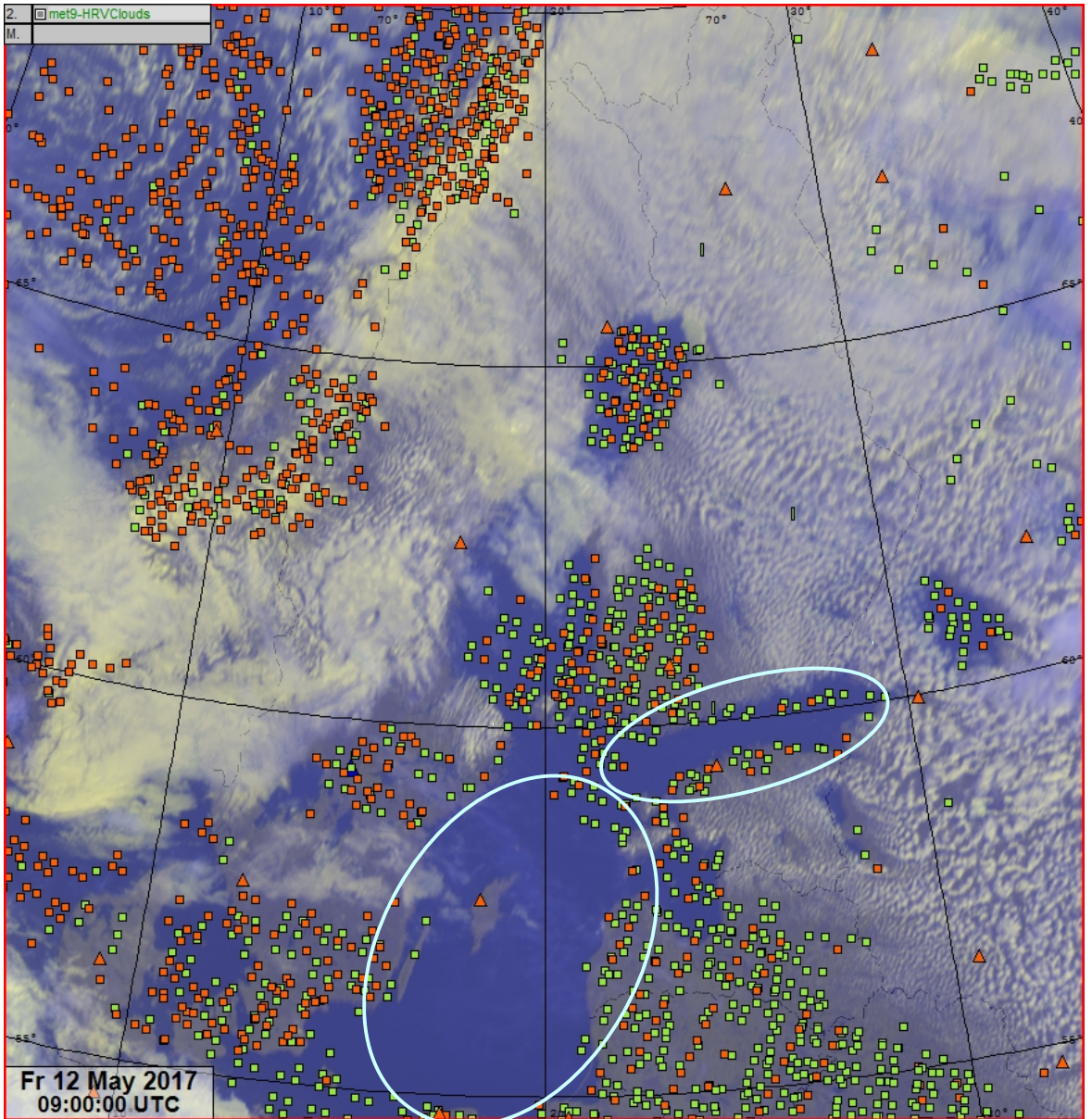




ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

MTGIRS – NRT project: Proxy-IRS retrievals at FMI, SMARTMET visualization

Figure: Example of visualization in FMI-SMARTMET workstation (MetopA-IASI)

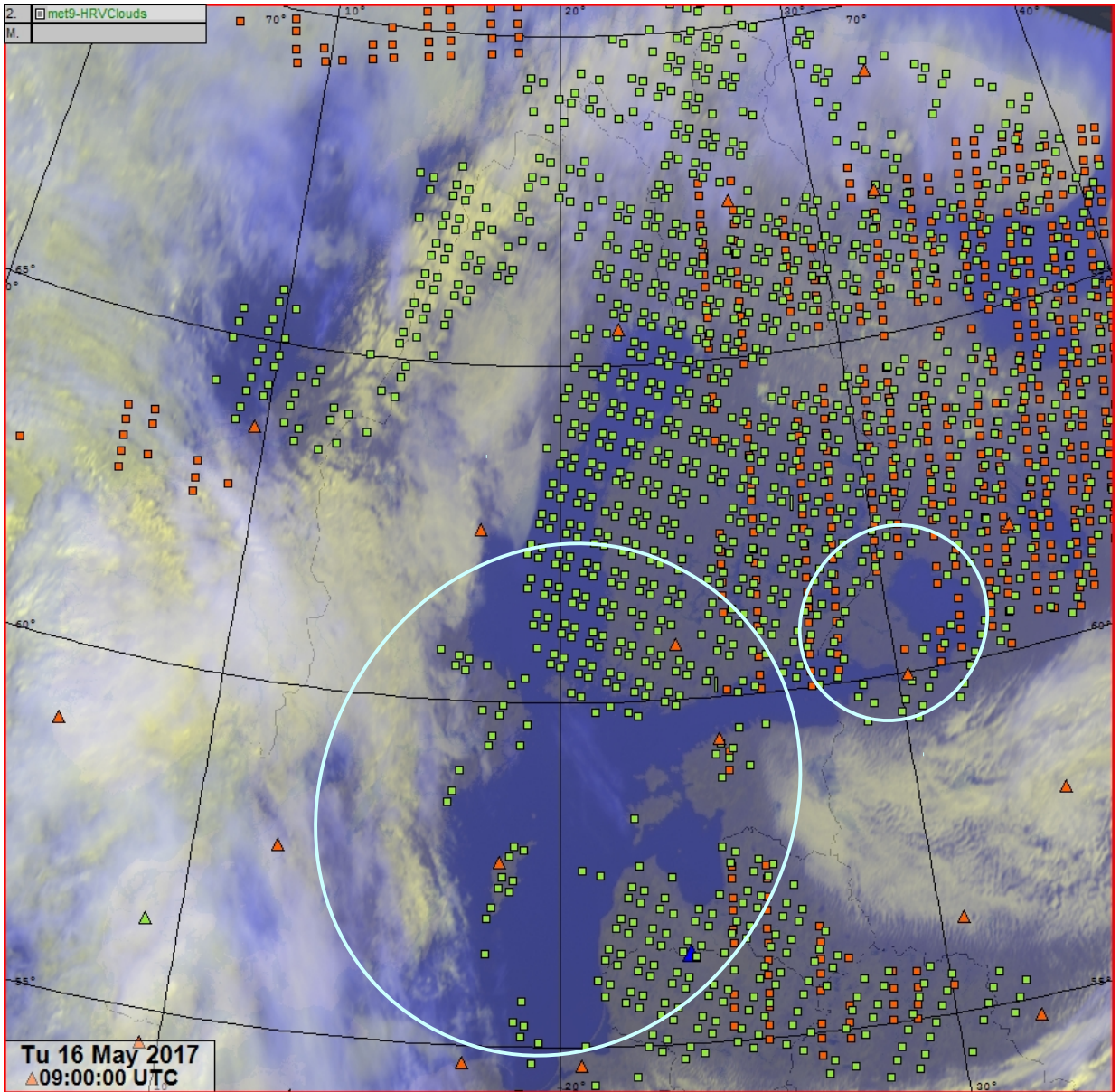


Missing retrievals?

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

MTGIRS – NRT project: Proxy-IRS retrievals at FMI, SMARTMET visualization

Figure: Example of visualization in FMI-SMARTMET workstation (MetopB-IASI)



Missing retrievals?

MTGIRS – NRT Demo: Verification of Proxy-IRS with European sounding stations

Verification of Proxy-IRS against European-wide sounding stations

- Also Apriori (i.e. ECMWF) data is verified

Here the Proxy-IRS retrievals are bound to match:

- Time-window ± 1 hours around sounding nominal time
- Maximum distance from sounding station = 50 km

Quality check profiles before included into verification

- Profiles with super-saturation is not included
- This quality check reduce the number of verification cases with ~80% !!

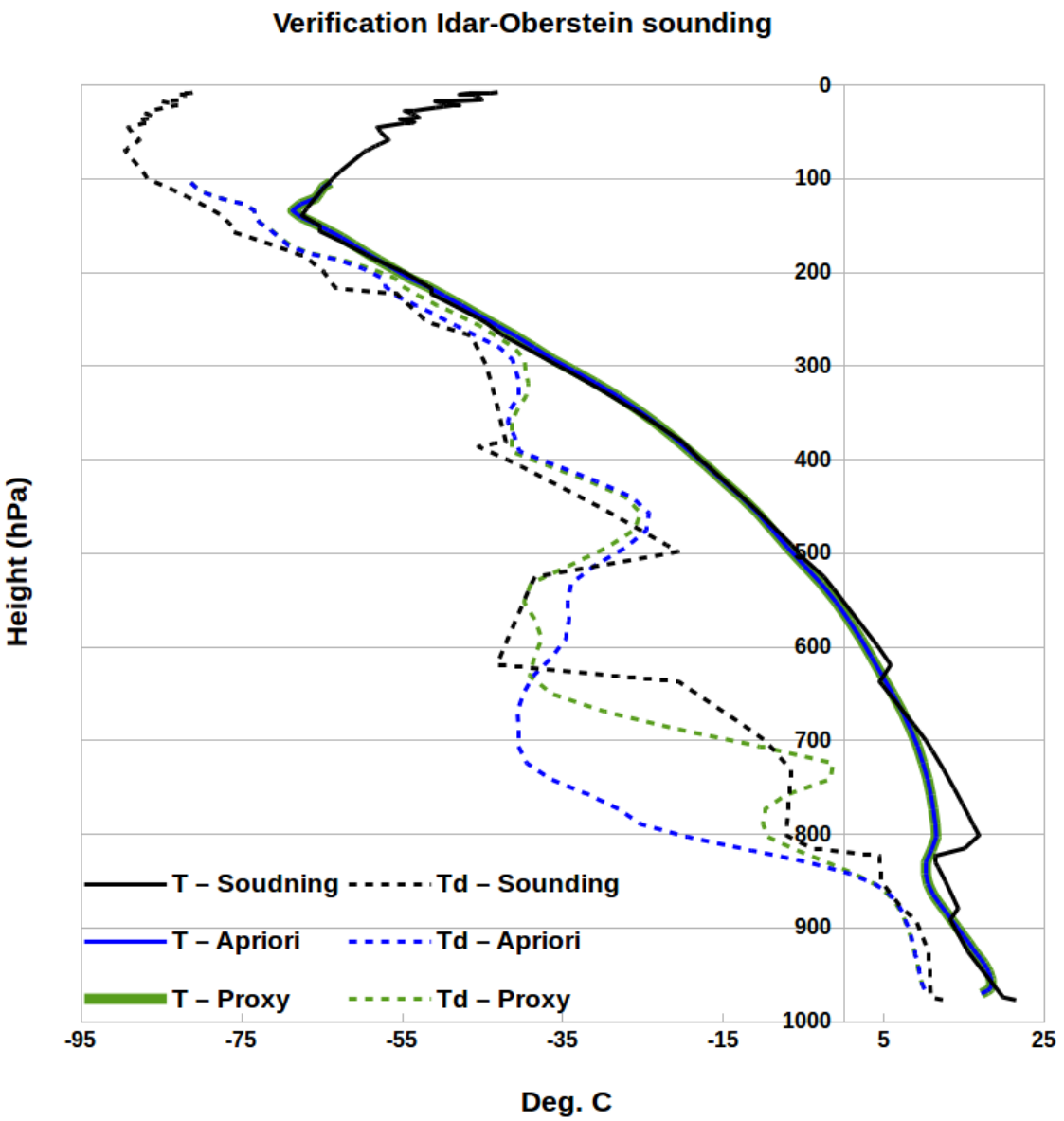
Note: Here both Metop 1 & 2 (IASI) and Suomi-NPP (CrIS) retrievals are used

MTGIRS – NRT Demo: Verification of Proxy-IRS with European sounding stations

Example sounding station: Idar-Oberstein

- Temperature profiles from Proxy-IRS and apriori (ECMWF) are on top of each other

- Proxy-IRS Dew-point temperature better than apriori, closer to sounding

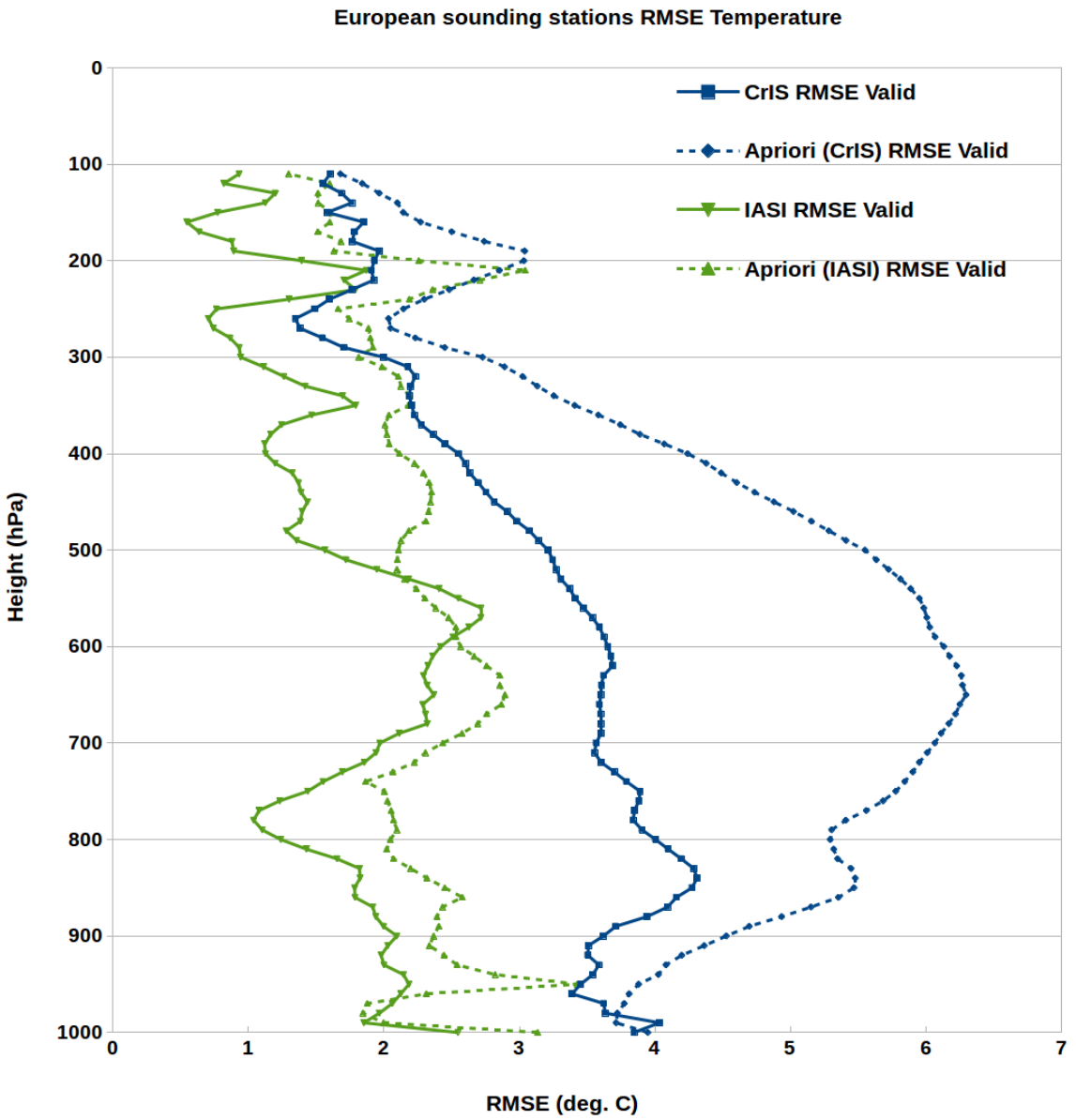


ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

MTGIRS – NRT Demo: Verification of Proxy-IRS with European sounding stations

Skill scores (RMSE) for temperature:

- Period: June-September 2016
- All sounding stations included
- Proxy-IRS is better than apriori
- Proxy-IRS deriveid from IASI input is better than with CrIS
- CrIS-apriori have very large RMSE values



Note:

CrIS proxy-IRS: 142 (out of 849)
CrIS apriori: 677 (out of 849)

IASI proxy-IRS: 8 (out of 42)
IASI apriori: 23 (out of 42)

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

MTGIRS – NRT Demo: Assimilation of Proxy-IRS in LAPS analysis system

The Local Analysis and Prediction System (LAPS):

- Full 3D analysis of atmosphere
- Assimilate observations ontop of forecast model background field (here HIRLAM)
- Horizontal resolution 3 km (coverage Finland)
- Assimilation of Proxy-IRS data

Main conclusions:

Verification against soundings: Sodankylä, Jokioinen and Tallin (marked with red dots in map)

Using Proxy-IRS as input for the LAPS analysis (i.e. LAPS-Proxy) does not improve the results

- Reference analysis (i.e. BG fields from Hirlam) provide better output

Indication that the Proxy-IRS give worse results for Sodankylä station, compared with Jokioinen:

- Surface emissivity characterization is better in Jokioinen (within proxy-IRS process)? At Sodankylä there are more bogs/marshs/swamps that might be dry or wet, so emissivity change quite significantly.

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

MTGIRS – NRT Demo: Assimilation of Proxy-IRS in LAPS analysis system

LAPS - Validation of analyzed stability indeces:

The Total Totals (TT) index is used, formula:

$$TT = T\,(850\ hPa) + Td\,(850\ hPa) - 2 \cdot T\,(500\ hPa)$$

Main conclusion:

The validation is performed using lightning and rain information

Verification against 3 sounding stations: Sodankylä, Jokioinen and Tallin

Using the Proxy-IRS gives less false alarms but with some reduction in prediction skill (Yes/Yes)
(Seen from validation results and contingency tables)

	Lightning/Rain Yes	Lightning/Rain No
LAPS-Proxy Yes	21	29
LAPS-Proxy No	13	51

	Lightning/Rain Yes	Lightning/Rain No
LAPS only Yes	35	66
LAPS only No	0	13

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

MTGIRS – NRT Demo

The full report (with questionnaires and results) can be found from EUMETSAT document:

CONTRACT REF: EUM/COS/LET/16/857985

Recent progress with the IASI-L2 data at FMI

Data downloaded via Eumetcast (DVB)

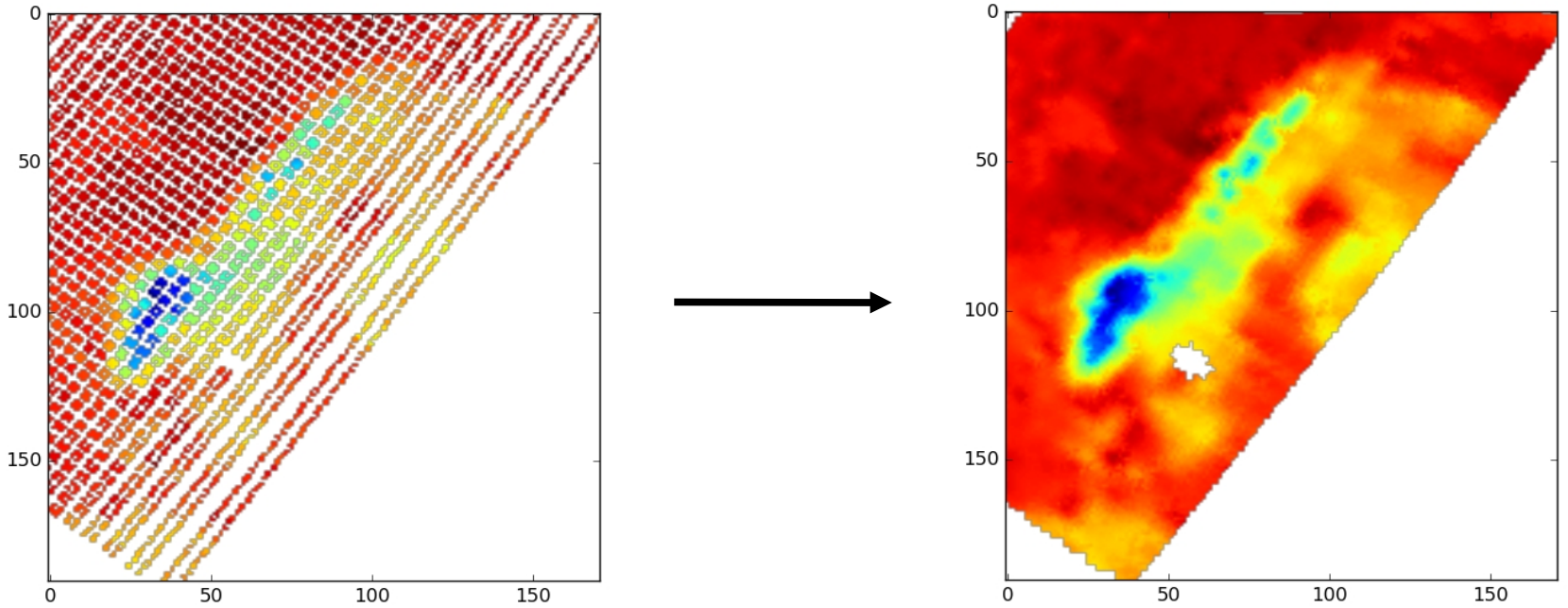
Each level in IASI-L2 data interpolated (bilinear interp. using pyresample) to a static 2D grid and saved to GRIB2 file -> 3D grid with hybrid levels:

- No look-angle geolocation correction
- No 3D interpolation

The data includes Mixing ratio, Pressure and Temperature

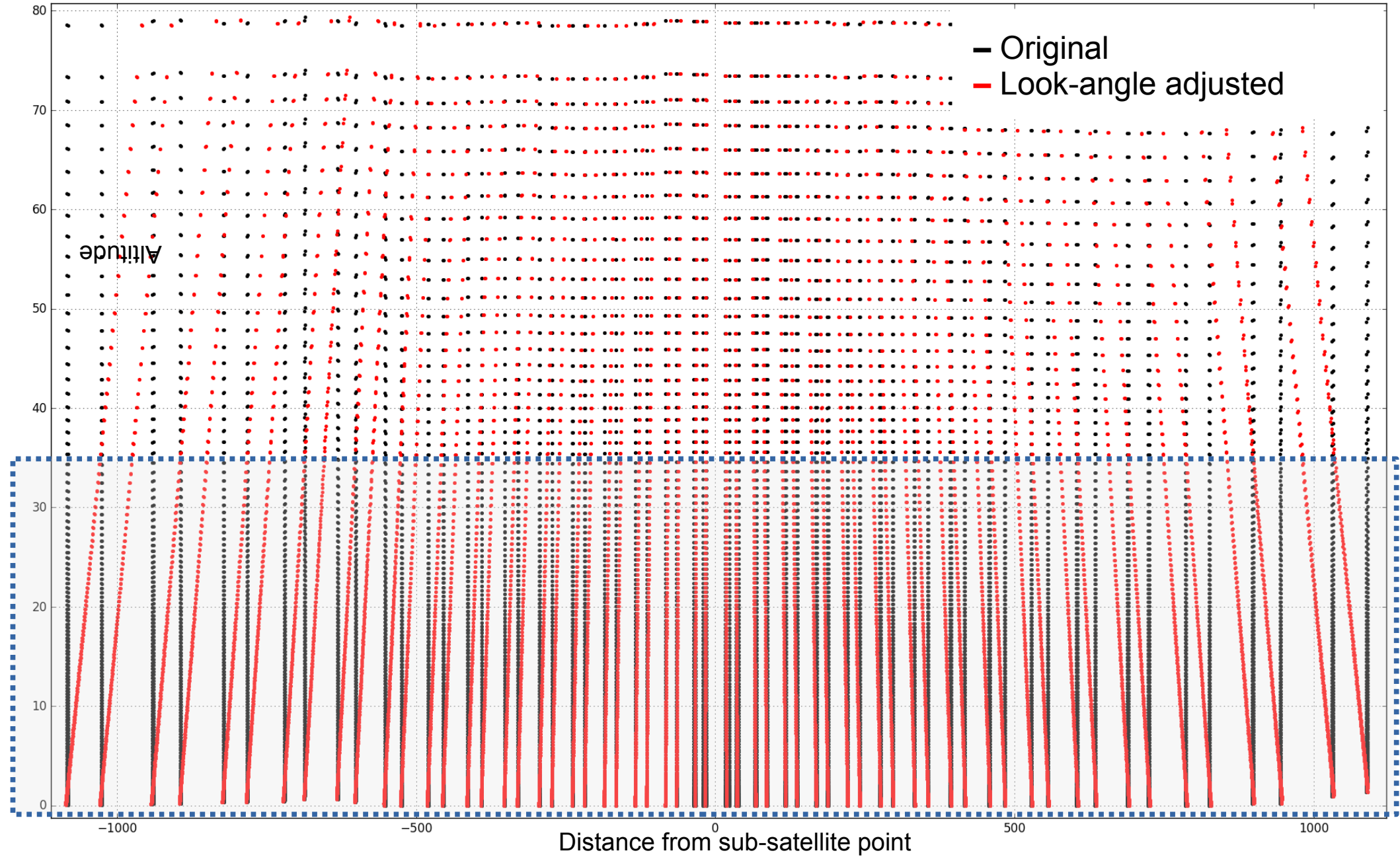
The data is not yet in operations; Software to handle incoming data, configurations and data transfers from reception are still missing

Example images (temperature) how the data are is resampled with nearest neighbour and bilinear interpolation:



ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

– – Data-area (hybrid levels 38-137 + surface) used for SMARTMET and forecasters



Possible continuation of testing MTG-IRS L2 data

Involved divisions at FMI: IT/database, Satellite, Meteorology (research + forecasters)

FMI technical facilities and setup for the Proxy-IRS data:

- Retrieval of proxy-IRS data is working, via ftp-server (in future Eumetcast?)
- Technical setup & interface for SMARTMET, FMI visualization system

FMI ~6 trained forecasters, knowledge of the Proxy-IRS data:

- Forecasters willing to involve in a continuation study, validating the Proxy-IRS data

Prepared and ready-to-use survey/questionnaire tool:

- Tool (Webropol) available, ready to use, for both FMI and others

FMI is interested to continue the testing and validation of IRS-data

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

MTGIRS - NRT Demo project meeting

FMI – Summary

Darmstadt 18-19 October 2017