ALARO-1 Experience in Turkey

ALARO-1 WD 11-13 March 2019, Bratislava

Turkish State Meteorological Service
Duygu Aktaş

Contests

- ALARO-1 in TSMS
- ALARO-1 DA in TSMS
- Verification Results - I (DA vs Non-DA)
- Verification Results – II
  (ALARO-1 DA coupled to IFS vs. coupled to ARPEGE)
- Case Study (Istanbul Hail Storm)

HPC Systems at TSMS

SGI ICE XA (Water cooled) System	
CPU	Intel Xeon E5 2690-v4
Number of processer & Processor speed	4032 core, 2.6 GHz
Peak Performance	~ 167 Tflops
Core Memory	27 TB
Operating System	LINUX (SLES 12)
Compilers	INTEL, GNU
Common File System	Lustre
Internal Connection Technology	Omnipath (100 Gbps)
Operation Technology	PBS Professional

Operational Use of ALARO-1 at TSMS

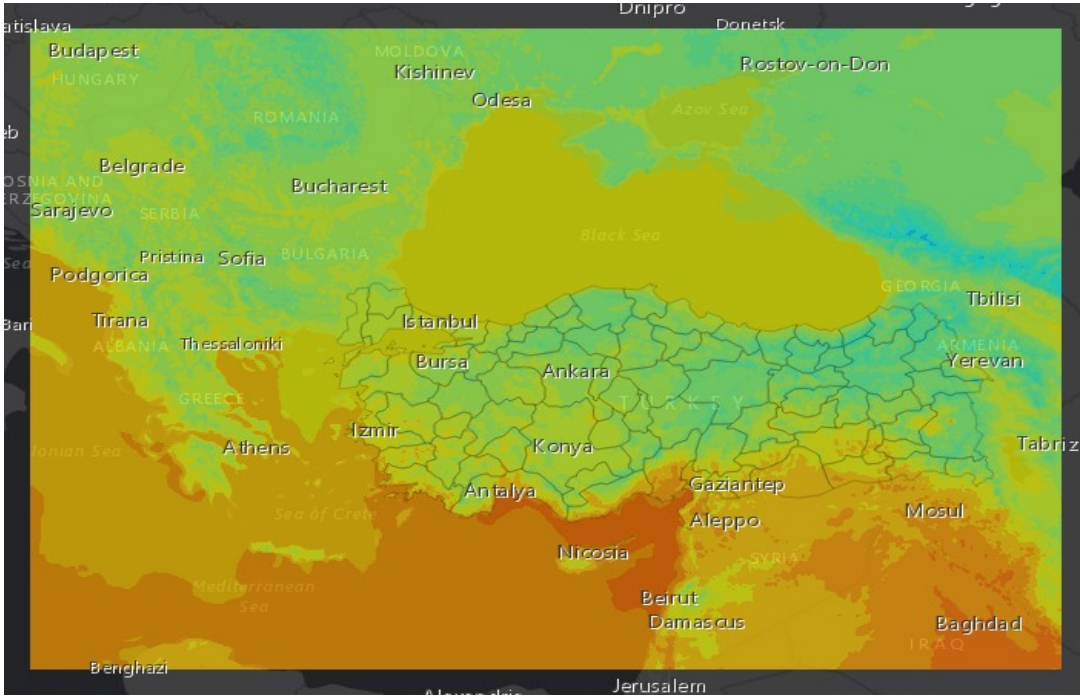
Operational Model (cy40t1bf7)

Model geometry:

- 4.5 km horizontal resolution
- 450 X 720 grid points
- 60 vertical model levels
- Linear spectral truncation
- Lambert projection

Forecast settings:

- Digital filter initialization
- 180 sec time-step
- Hourly post-processing
- 4 runs per day at 00, 06, 12 UTC (up to t+72) and 18 UTC (up to t+60).
- Coupling with ARPEGE LBC files at every 3 hours

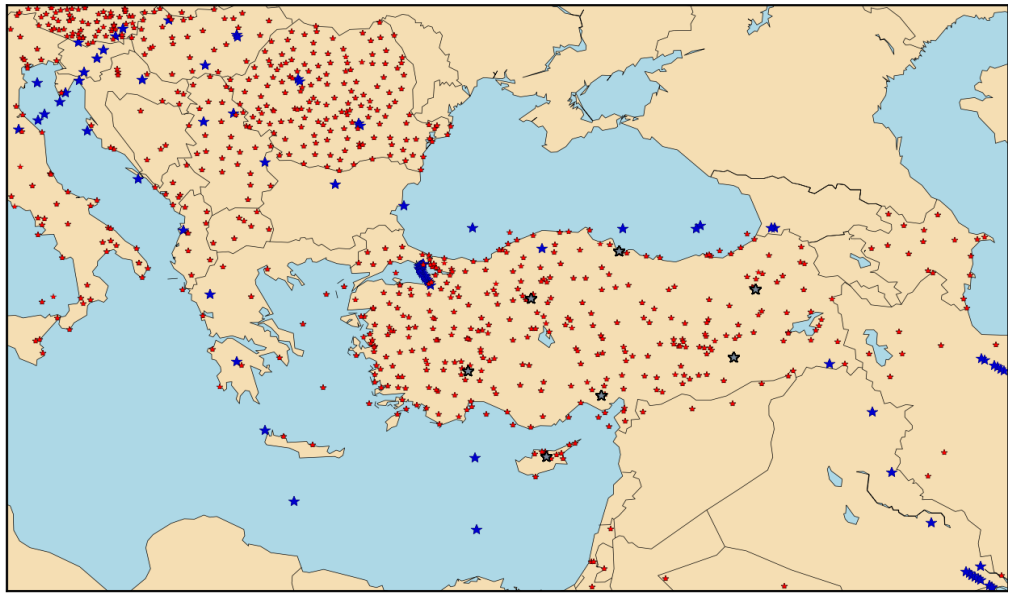


Current Data Assimilation Status at TSMS

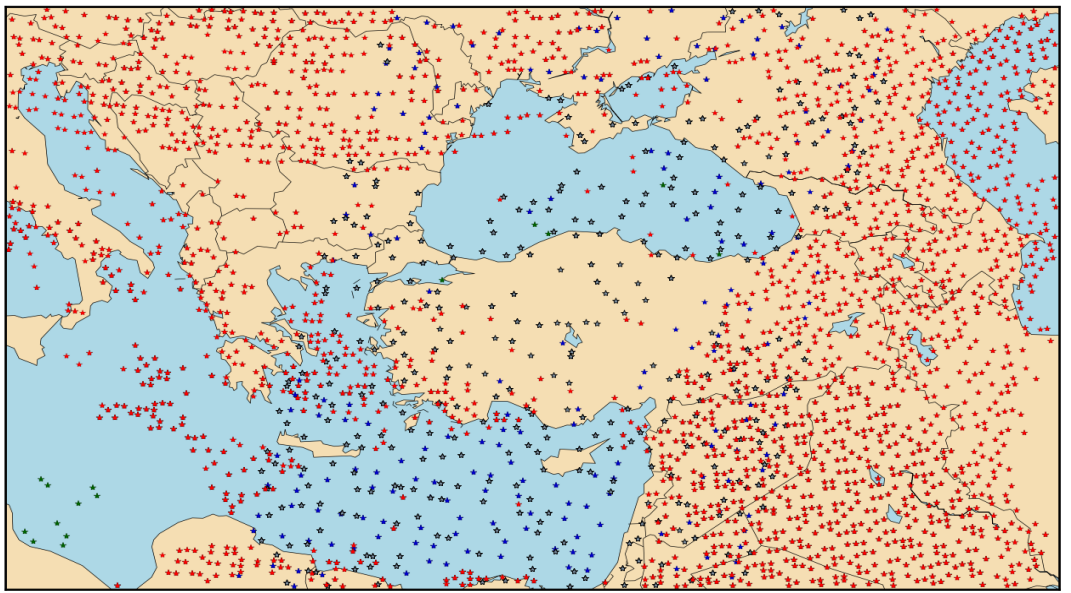
ALARO CY40T1	4.5km, 60 levels, 450x720, lbc files from ARPEGE
Conventional Observations	SYNOP GTS&Local, TEMP Local, AMDAR GTS
Non-Conventional Observations	AMSUA, AMSUB-MHS -- NOAA18-19 & METOP1-2 SEVIRI -- METEOSAT 11 AMV -- METEOSAT
Surface Assimilation	CANARI
Upper-air Assimilation	3DVAR
Operational Cycling	6hr cycling 00 06 12 18 network times, Surface analysis then upper air analysis, 48 hr forecasts 24hr VarBC cycling
B-Matrix	Ensemble B matrix calculated from AEARP both for summer and winter period Cy43t2
Latest Activities	Obsmon was installed and tested with provided observations. Surface DA exercise on beaufix has not completed.
Plans	New cycle cy43t2 will be used for assimilation in ALARO.

Distribution of the Observations in DA

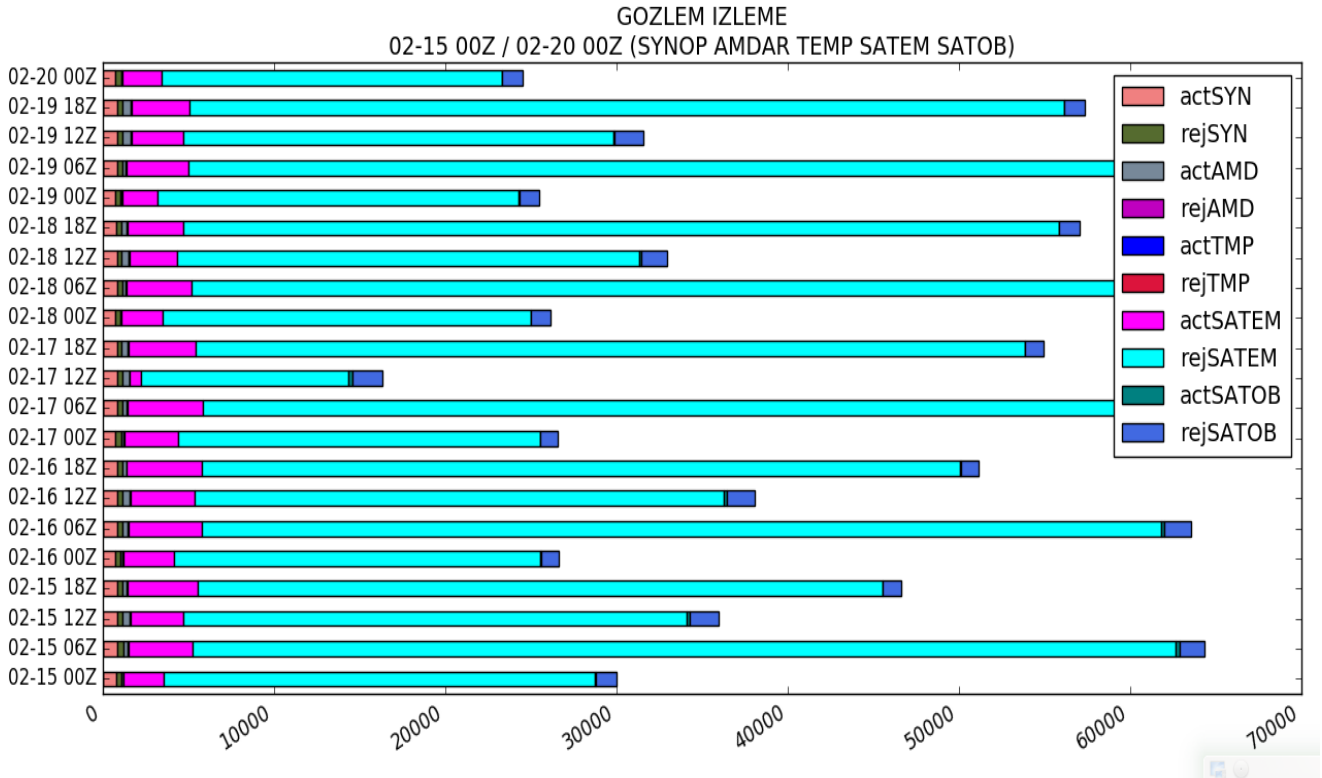
amdar: 13 synop: 769 temp: 7



amsua: 525 amsub/mhs: 995 seviri: 6485 geowind: 30



Observation Monitoring



Verification Results-I

ALARO-1 with DA vs. Non-DA

Verification Results-I

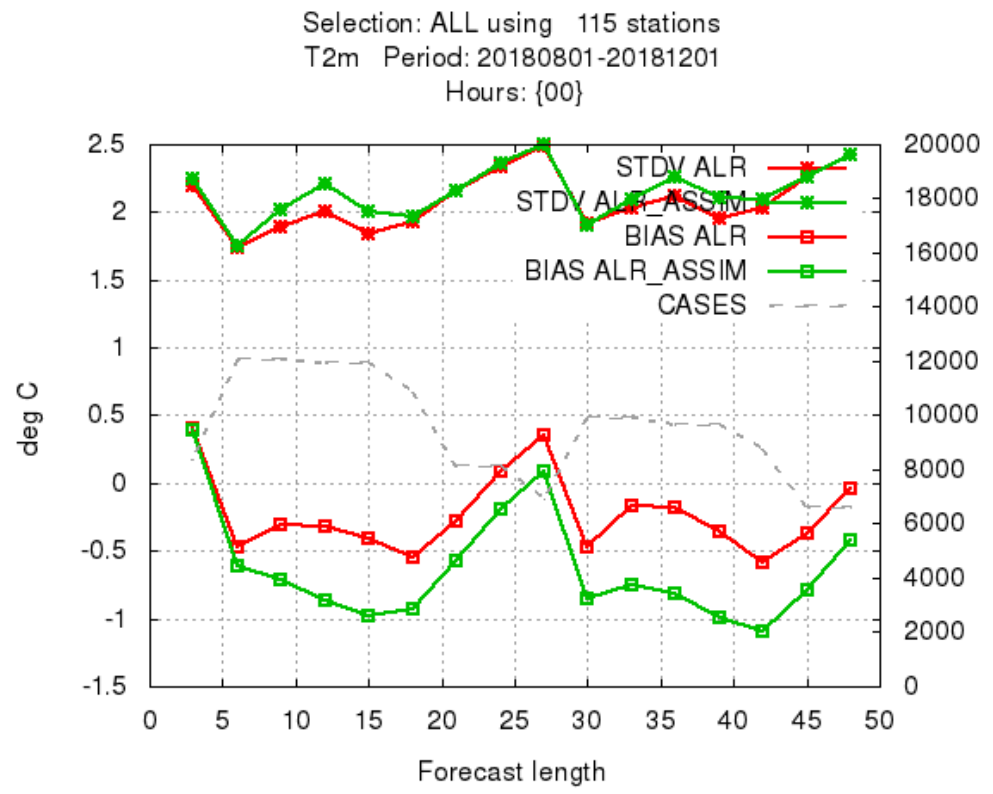
- Operational ALARO-1
- ALARO-1 3DVar

- Test period :: 2018/08/01 - 2018/12/01

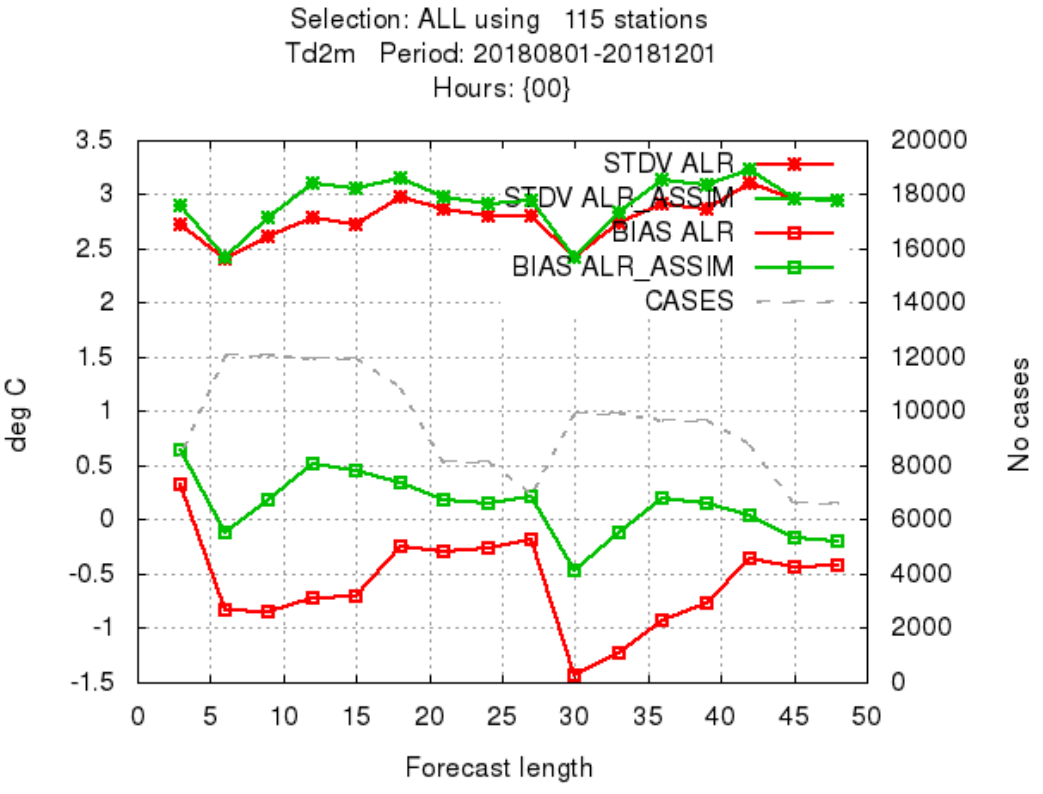
- Surface :
  - 2 m. Temperature,
  - 2 m. Dewpoint Temperature
- Upper Level:
  - Temperature,
  - Dewpoint Temperature
  - Relative Humidity

Standard Deviation & BIAS

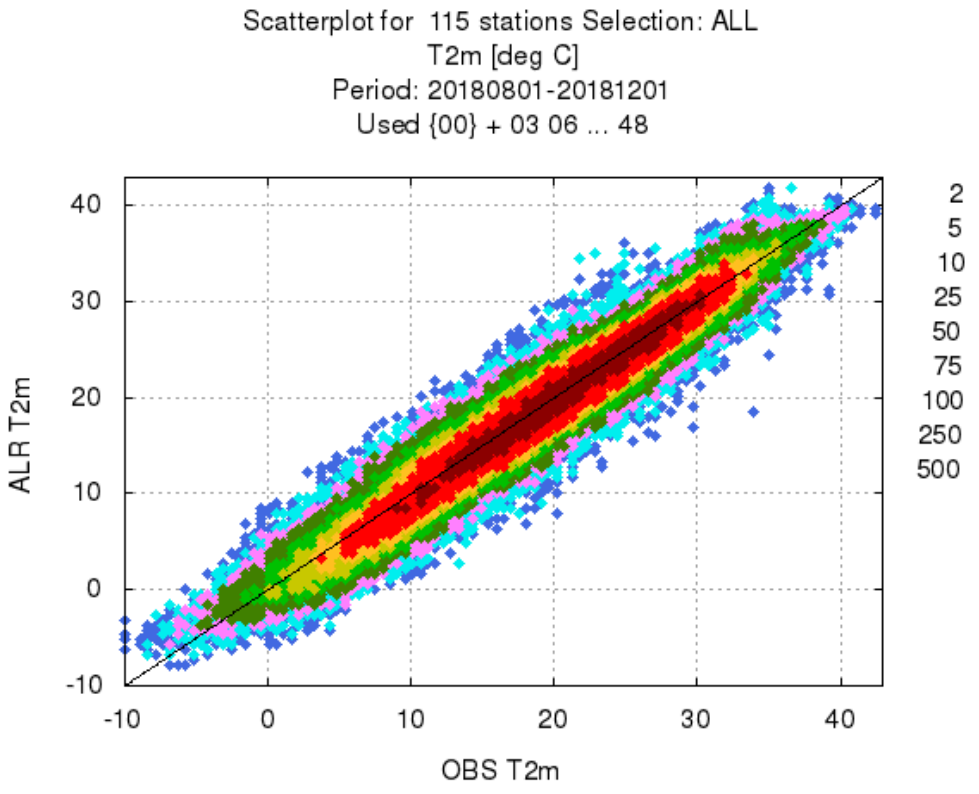
2 m. Temperature



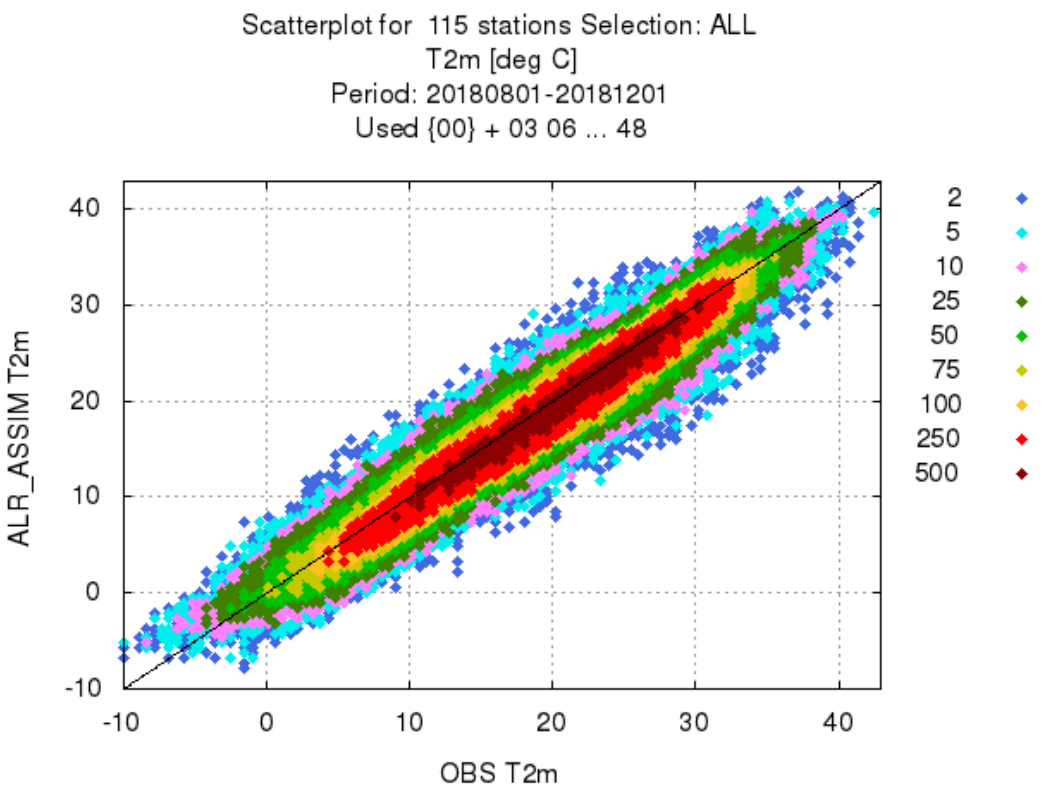
2 m. Dewpoint Temperature



2m Temperature Scatterplot

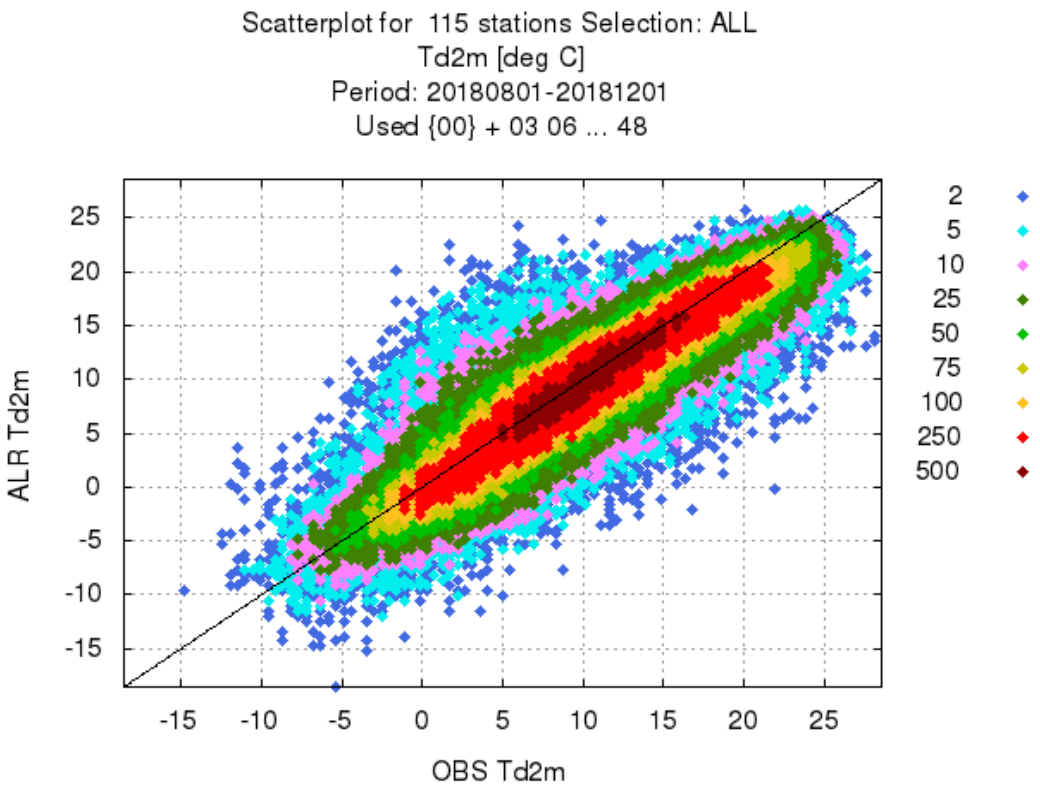


OPER

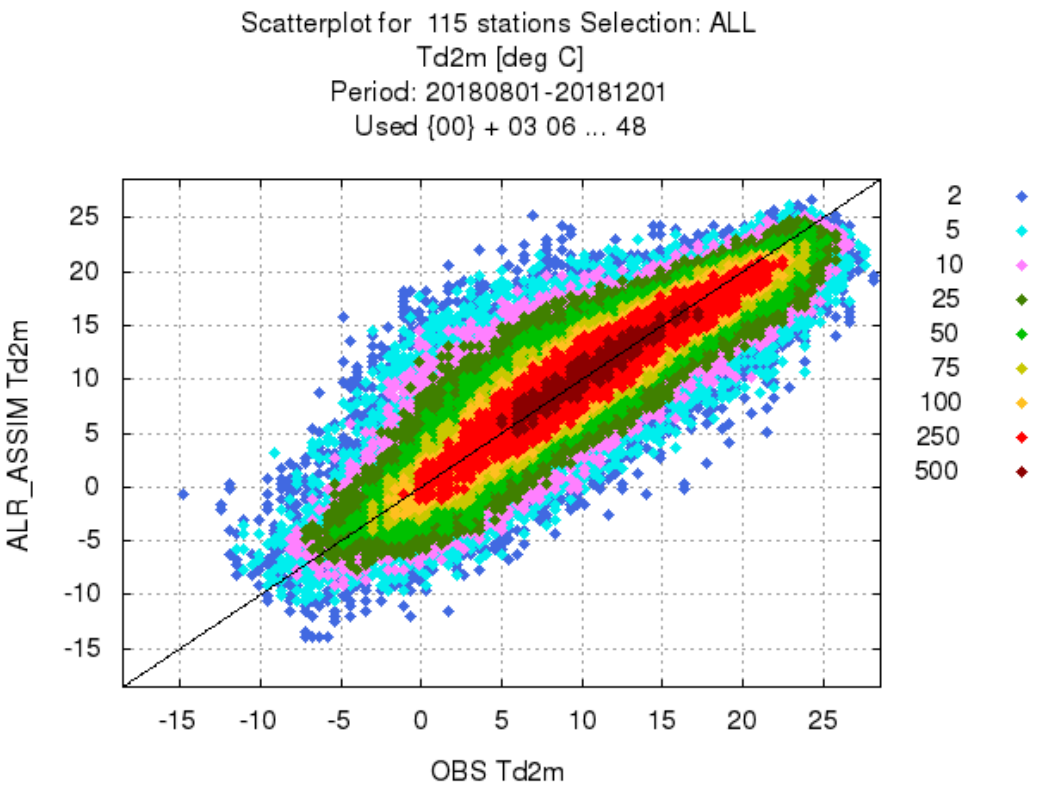


3DVar

2m Dewpoint Temperature Scatterplot



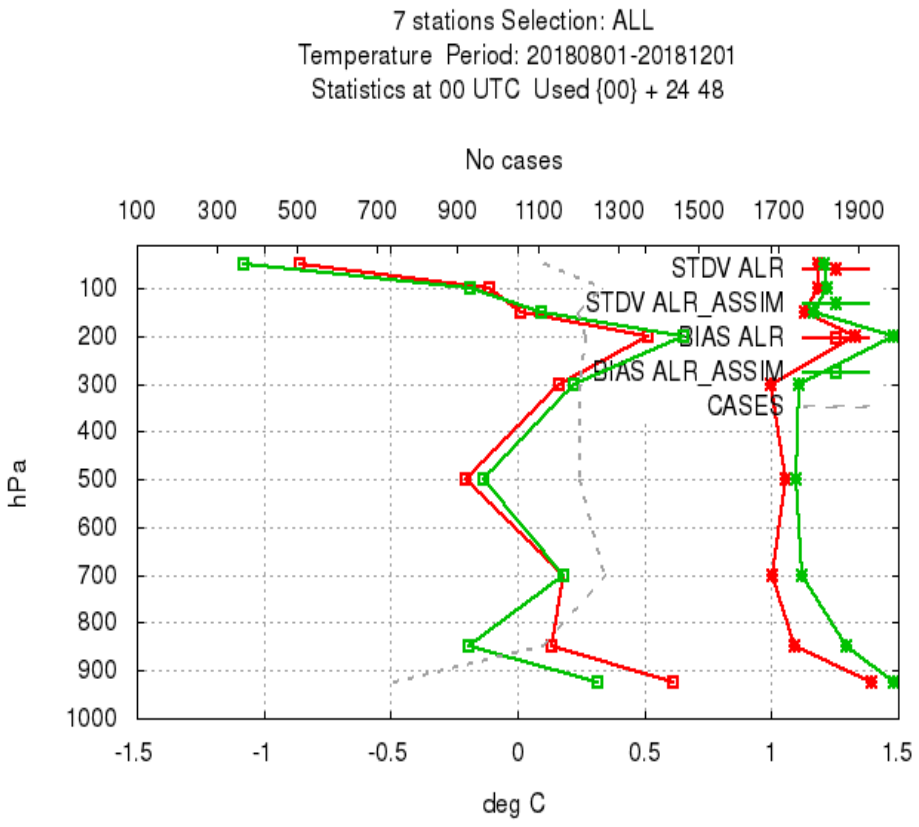
OPER



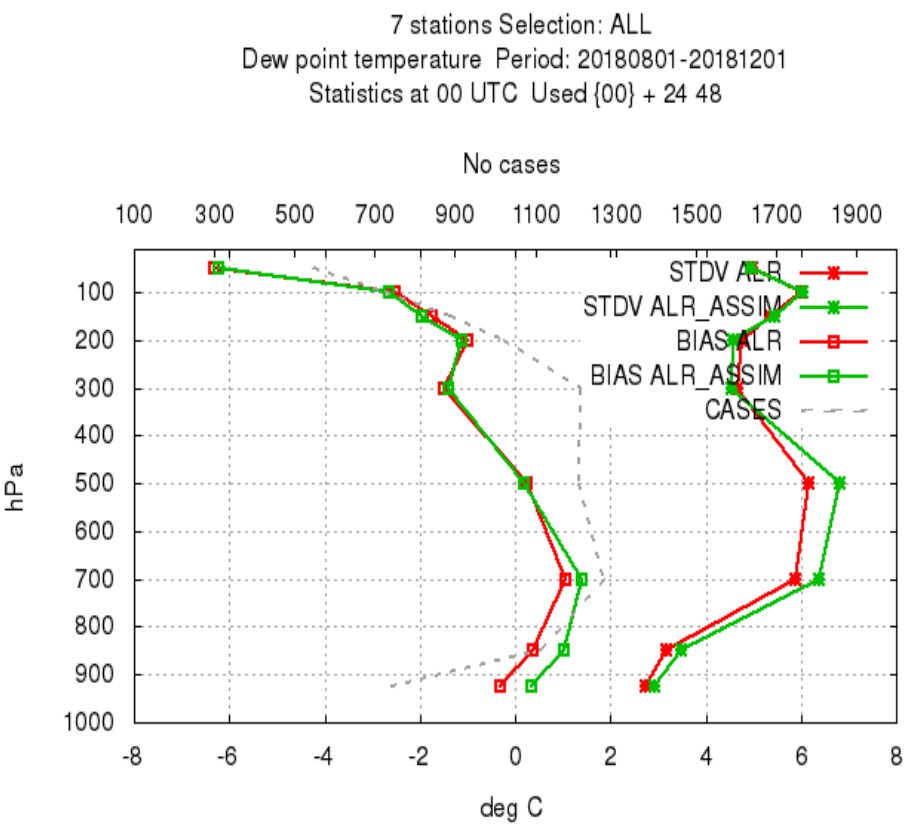
3DVar

Upper Air: Standard Deviation & BIAS

Temperature

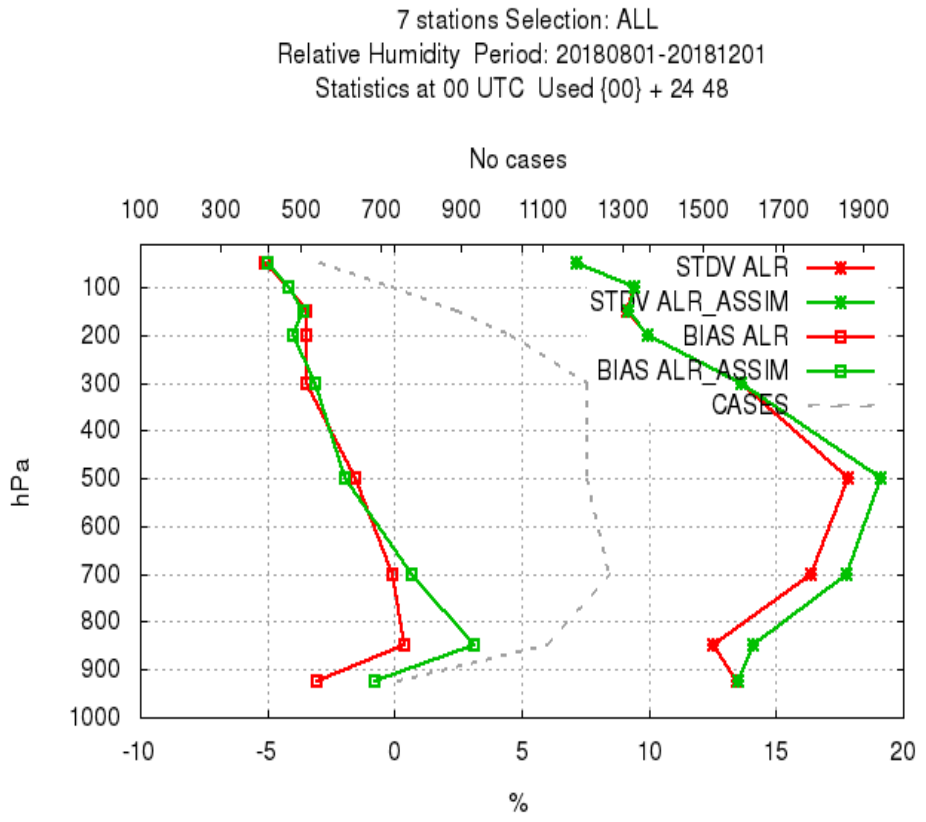


Dewpoint Temperature



Upper Air: Standard Deviation & BIAS

Relative Humidity



Verification Results-II

ALARO-1 coupled to IFS vs. ARPEGE

Verification Results-II

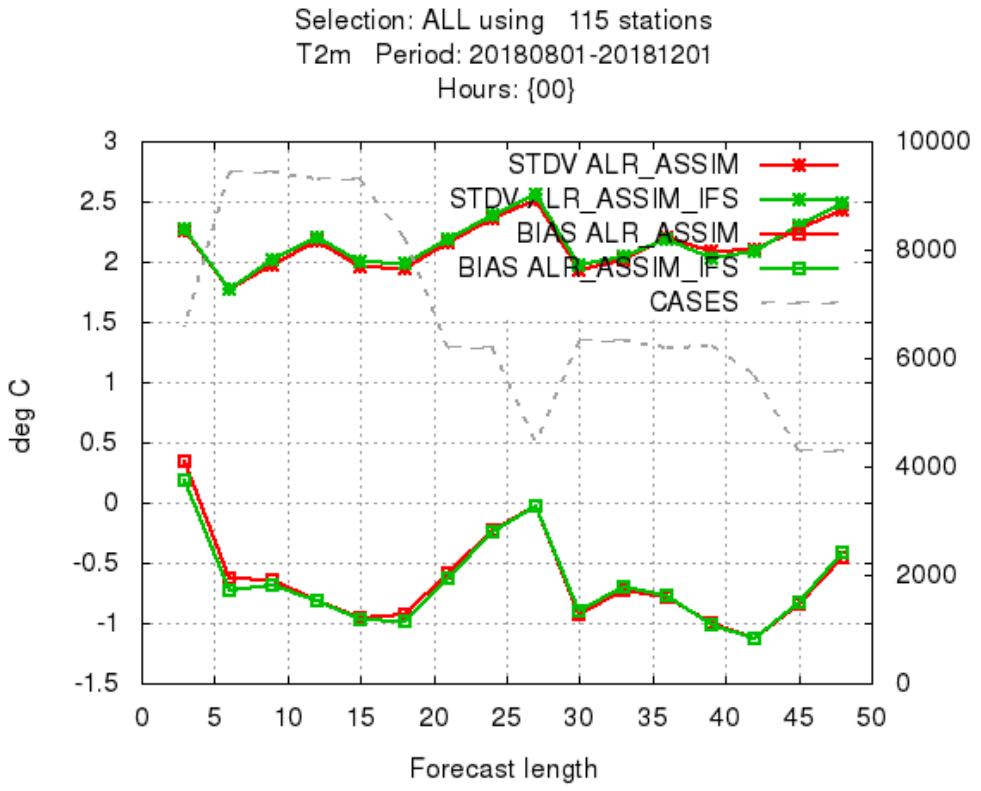
- ALARO-1 3DVar with ARPEGE
- ALARO-1 3DVar with IFS

- Test period :: 2018/08/01 - 2018/12/01

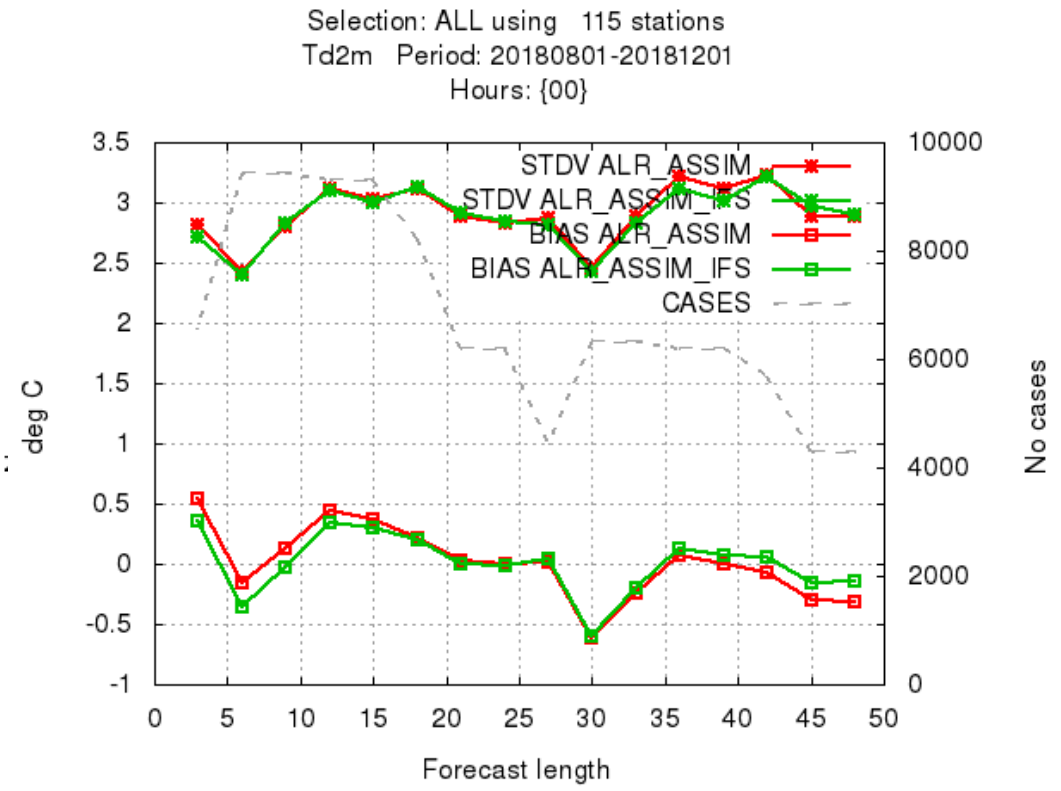
- Surface :
  - 2 m. Temperature,
  - 2 m. Dewpoint Temperature
- Upper Level:
  - Temperature,
  - Dewpoint Temperature
  - Relative Humidity

Standard Deviation & BIAS

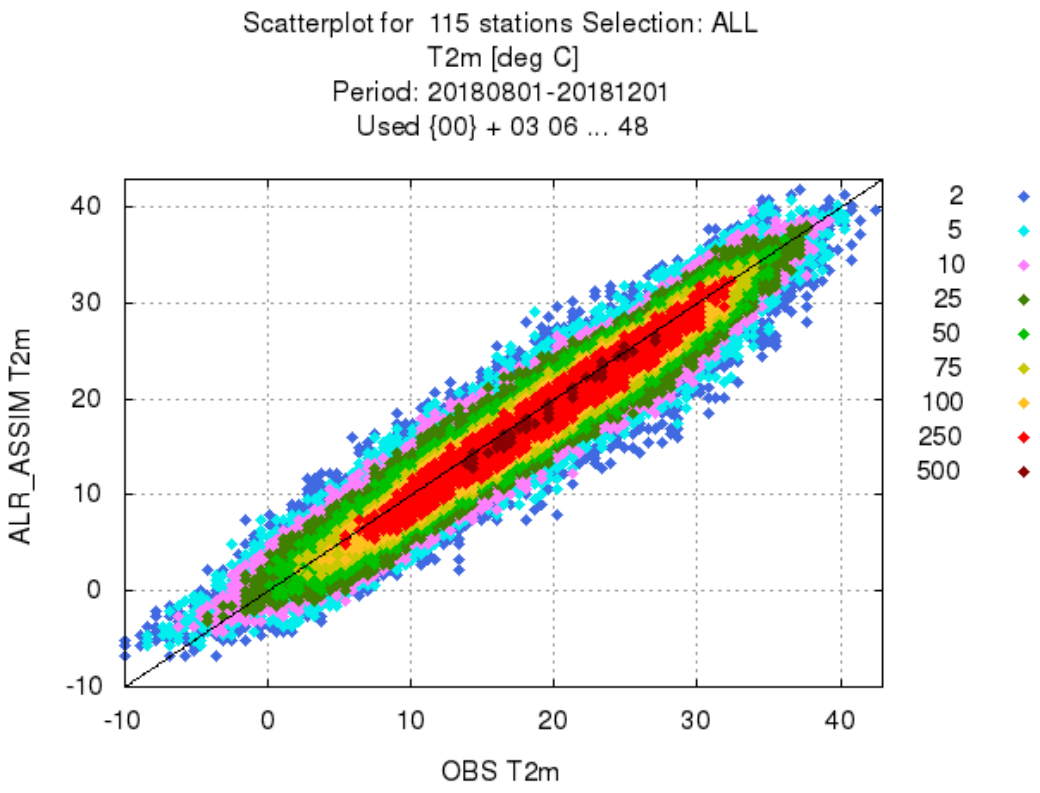
2 m. Temperature



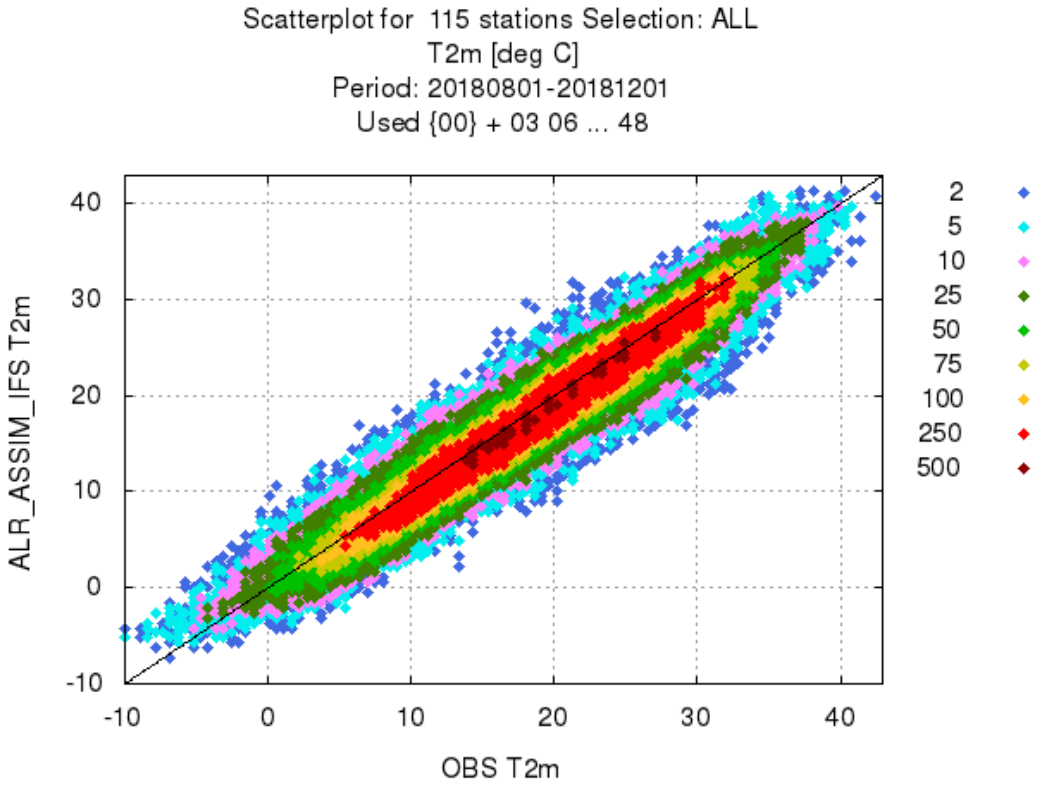
2 m. Dewpoint Temperature



2m Temperature Scatterplot

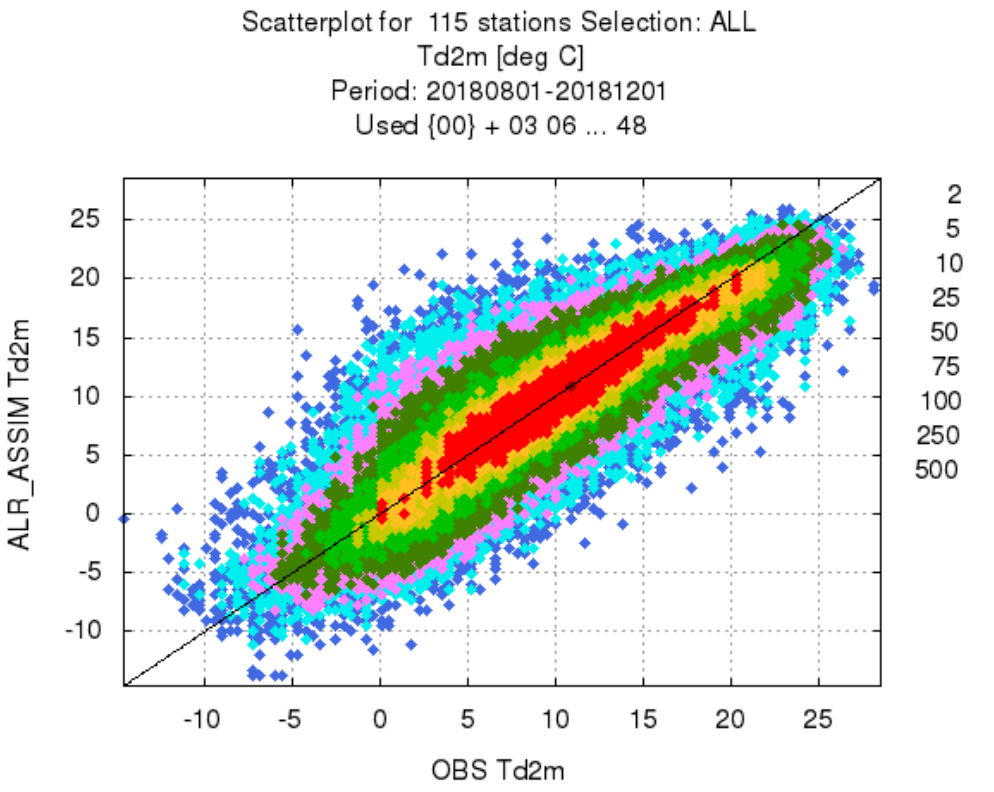


ARPEGE

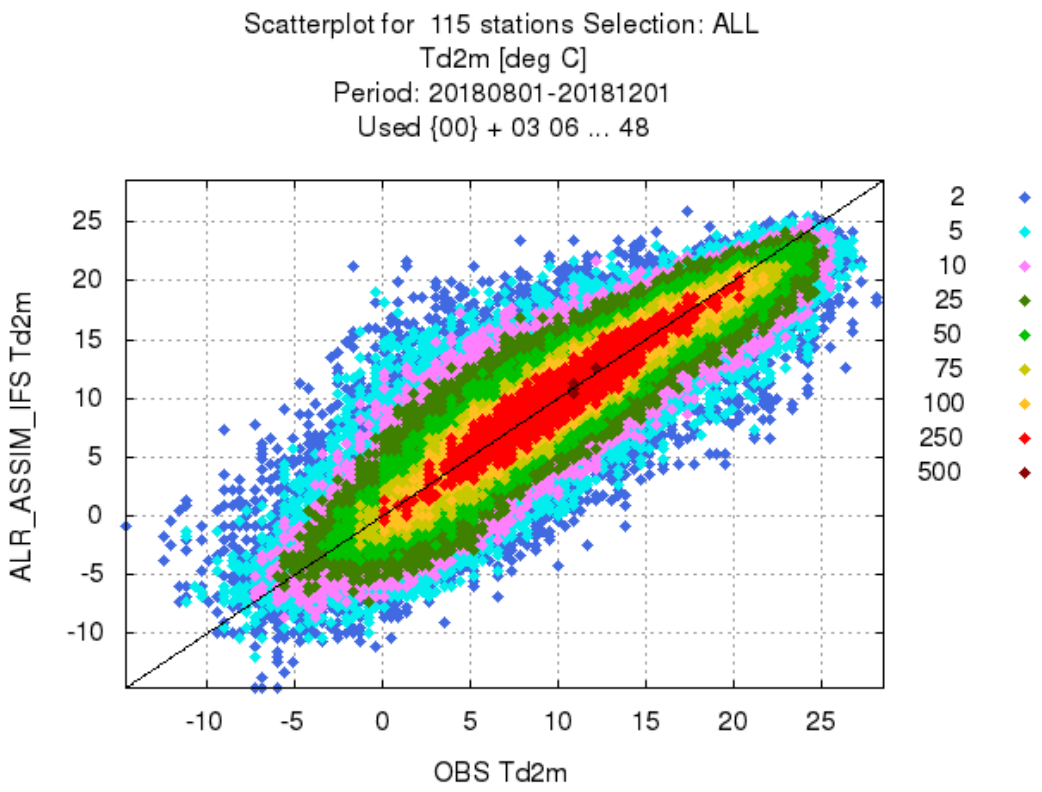


IFS

2m Dewpoint Temperature Scatterplot



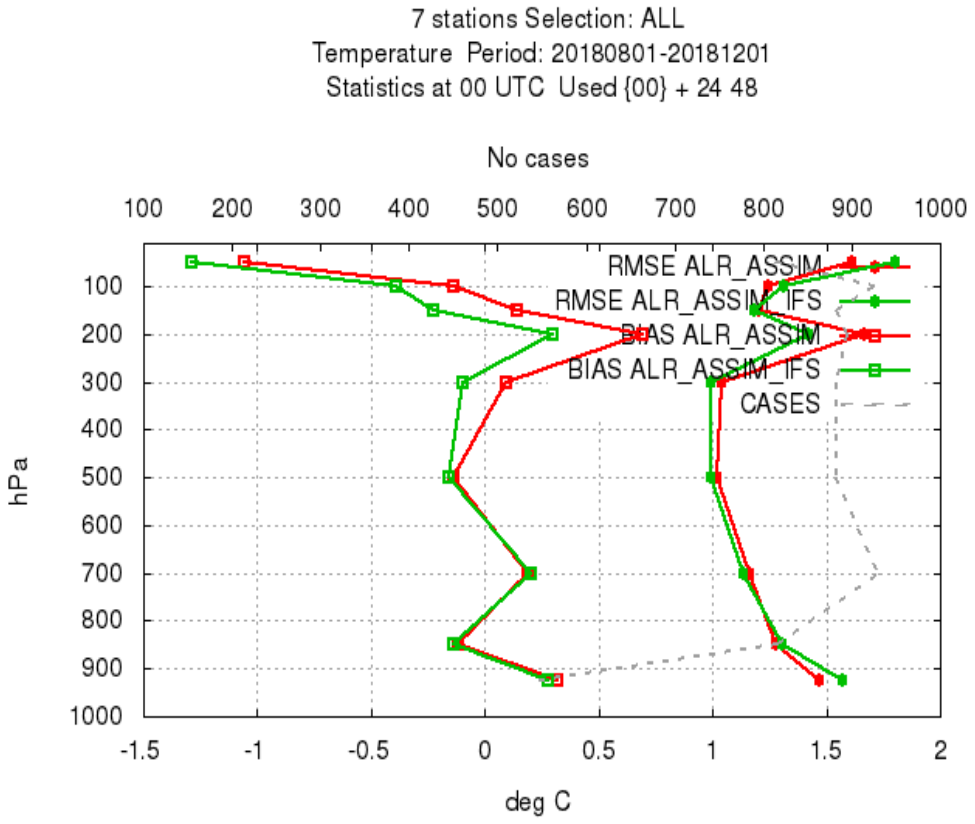
ARPEGE



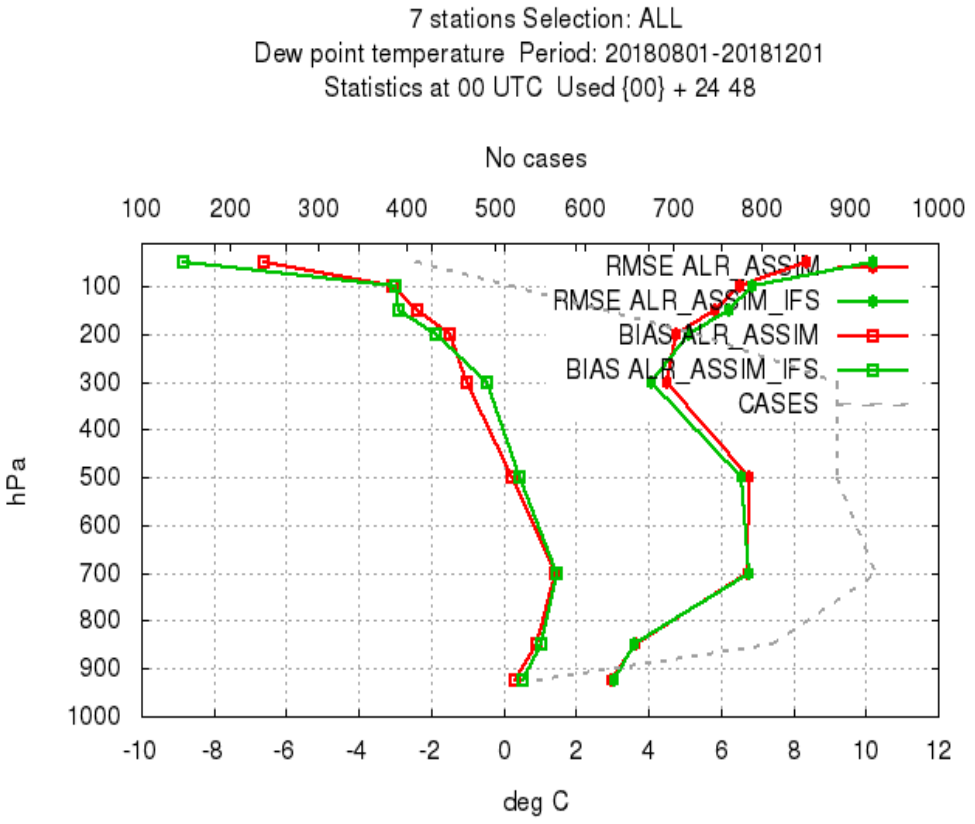
IFS

Upper Air: Standard Deviation & BIAS

Temperature

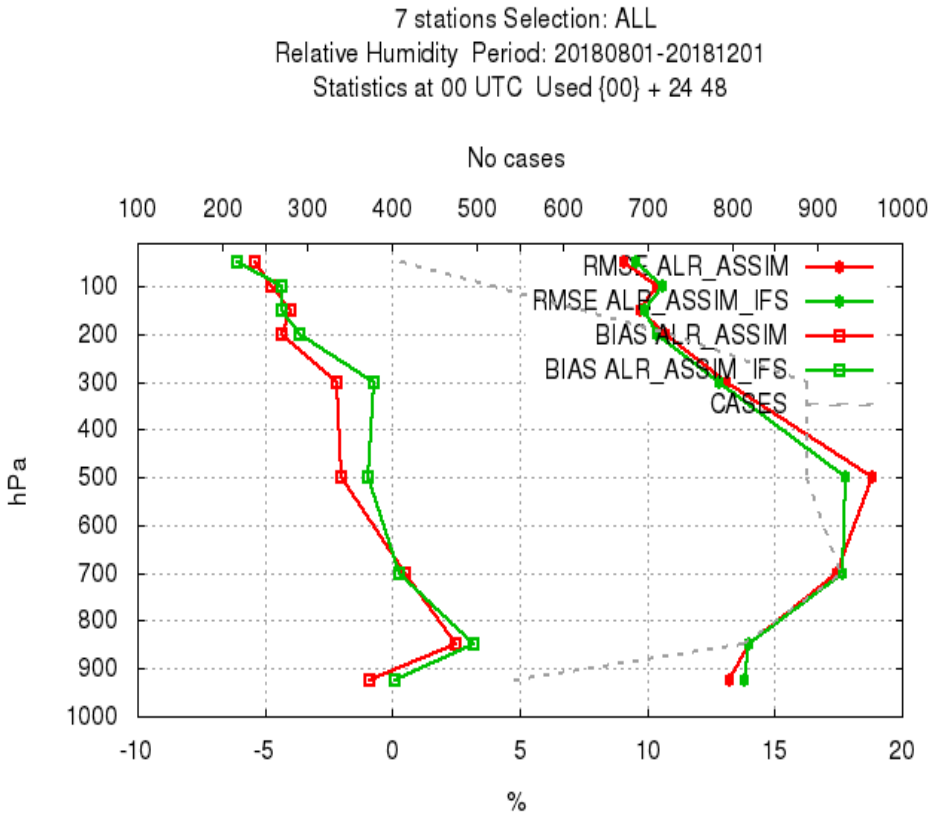


Dewpoint Temperature



Upper Air: Standard Deviation & BIAS

Relative Humidity



3DVar Roadmap

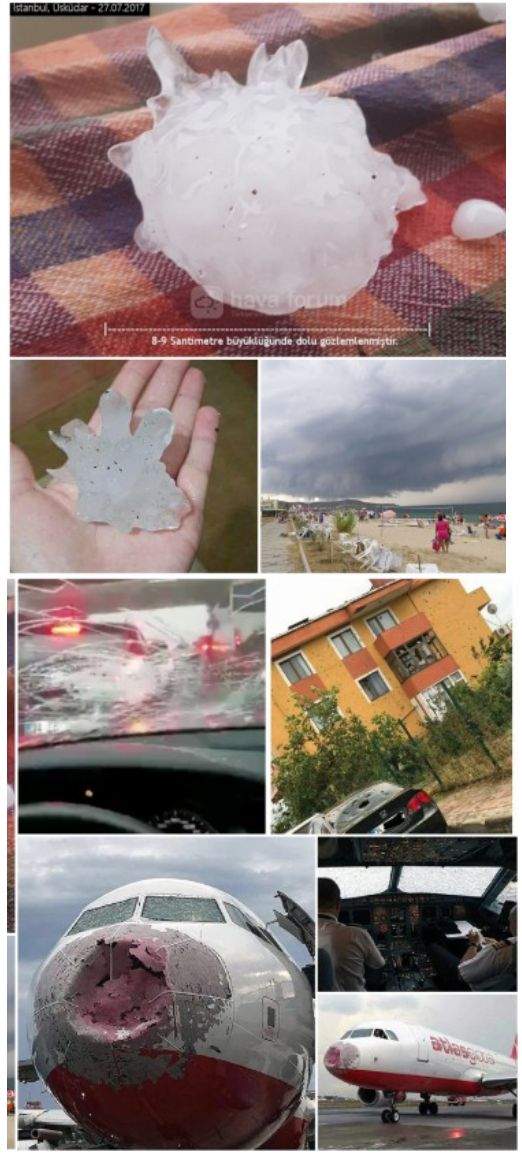
- Selection of conventional observation parameters.
- Monitoring each observation’s contribution on assimilation system.
- Satellite data thinning factor
- 3DVar system tuning

Case Study

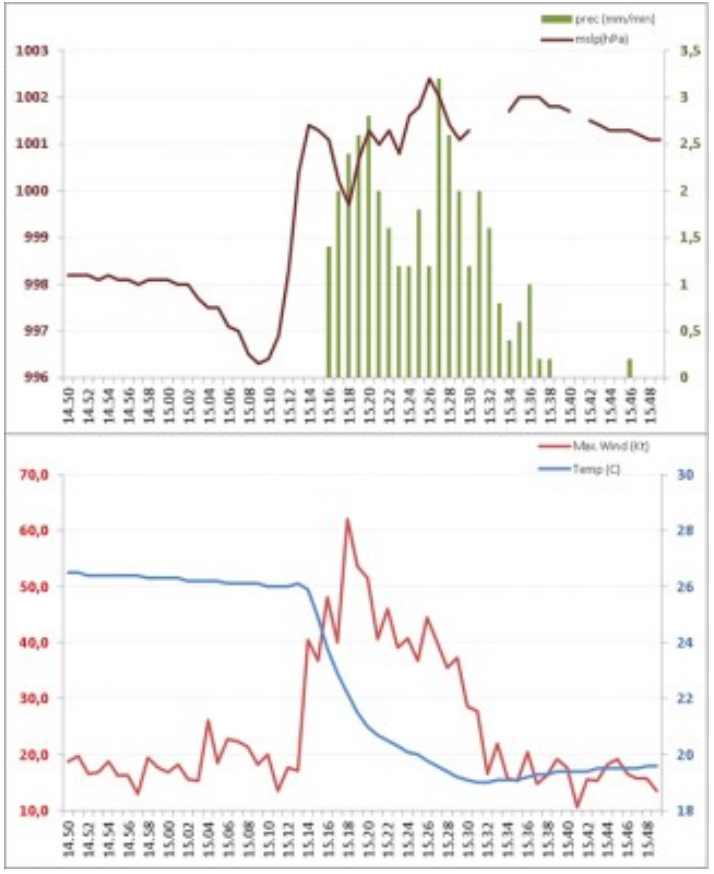
Istanbul Hail Storm

Istanbul Hail Storm

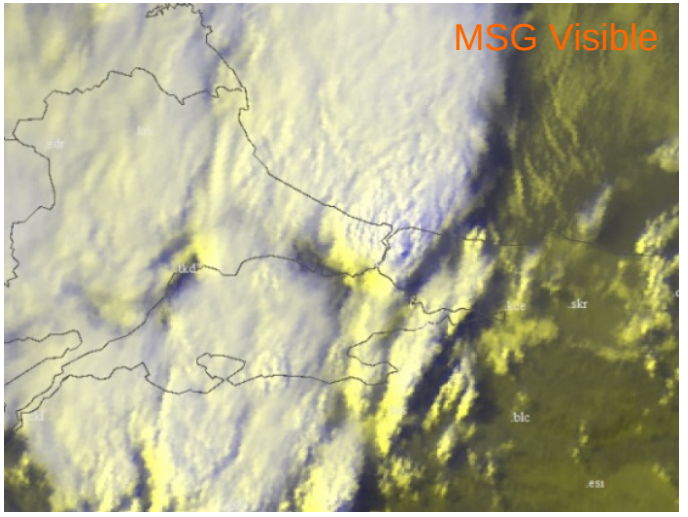
- On July 27th 2017, between 15.15-15.45 GMT , Istanbul
- Summer storm with heavy rain, strong winds and golf ball size hail.
- Caused widespread damage on vehicles and injured at least 10 people. Also several airplanes landing at Istanbul Atatürk Airport were damaged by the hailstorm.



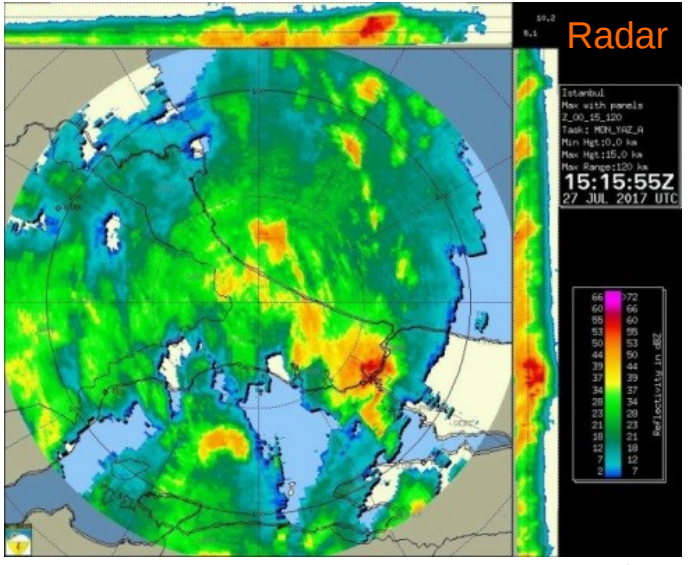
Observation



Kadıköy Rıhtım Obs.



27.7.2017 15:20 GMT

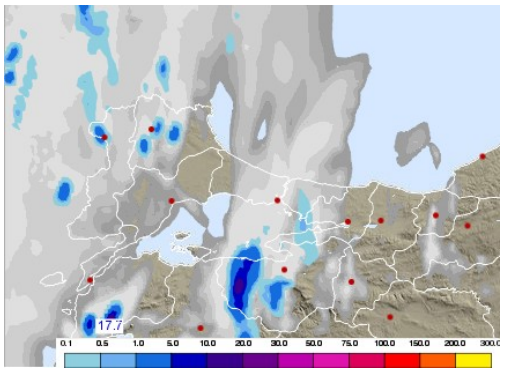


27.7.2017 15:15 GMT Radar

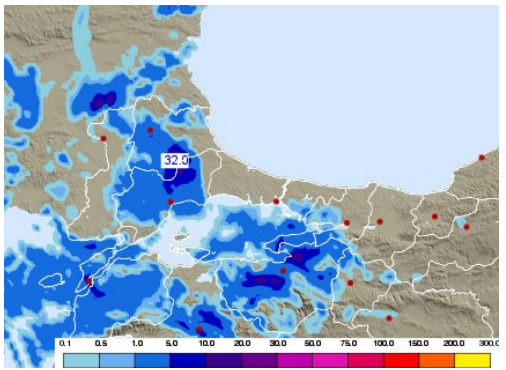
Total Precipitation

12GMT T+3-4

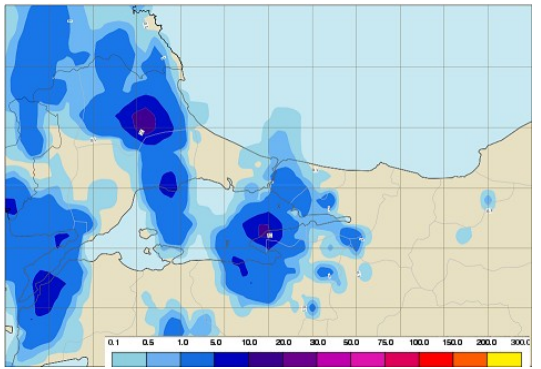
ALARO



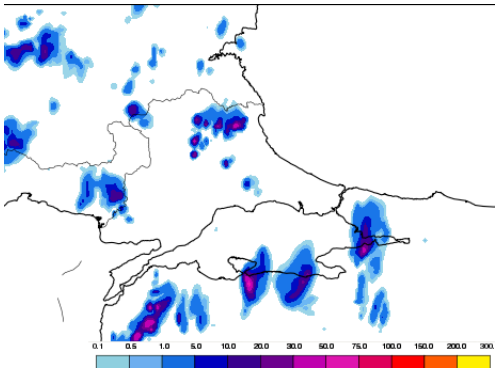
WRF



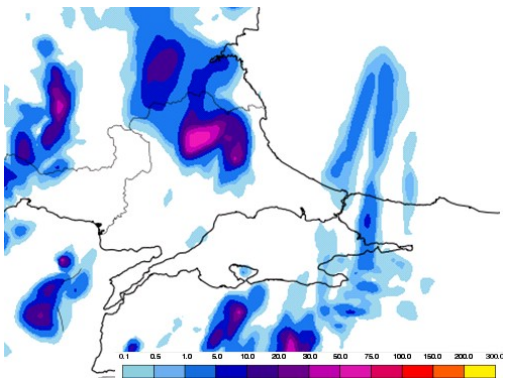
HRES



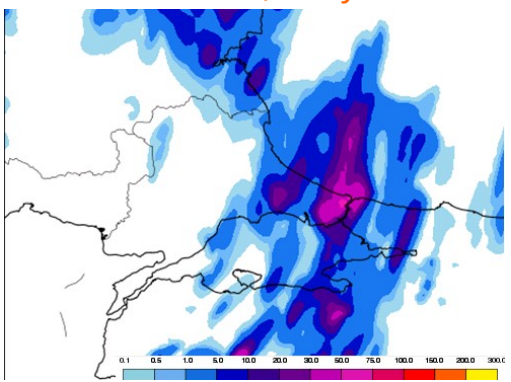
AROME



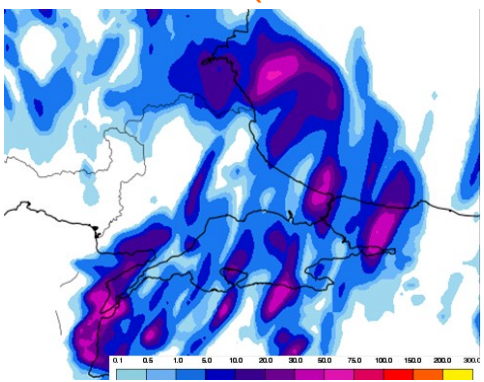
ALARO



ALR 3DVar, Only Conv.



ALR + 3DVAR (Conv. + 35 km Seviri)



12GMT T+3-5

Results

- It was observed that both operational models (Alaro-1,Wrf, Arome, ECMWF Hres) expected rain after 16.00GMT over Istanbul.

- Alaro-1 with 3D-Var DA in test mode with different inputs such as only conv. obs., -and conv+Seviri 35km thinning. ALR+3DVar model outputs produced more realistic precipitation amounts and areal coverage for this case.

- Although Arome forecasts significant rain after 16.00 GMT, it didn’t forecast hail over Istanbul.

3DVar Roadmap

- Selection of conventional observation parameters
- Monitoring each observation’s contribution on assimilation system
- Satellite data thinning factor
- 3DVar system tuning