ACCORD

A Consortium for COnvection-scale modelling
Research and Development

Use of new observations in ACCORD

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ACCORD DA teams

Contents

- **Advances in (operational) use of observations in ACCORD**

  - Radar products (reflectivity and winds from OPERA)

  - Mode-S observations

  - Clear and all-sky radiances

  - Scatterometers

  - GNSS-based observations (radio occultation and new methods)

  - Rain attenuation in microlinks

- **Conclusions**

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Doppler wind assimilation

Towards enhanced use of OPERA Doppler winds

- „Radar revolution" in MEPS of MetCoOp: increased density of winds, smaller obs. errors, less thinning
- OPERA OIFS vs. ODE studies
- Wind assimilation studies over Spanish domains
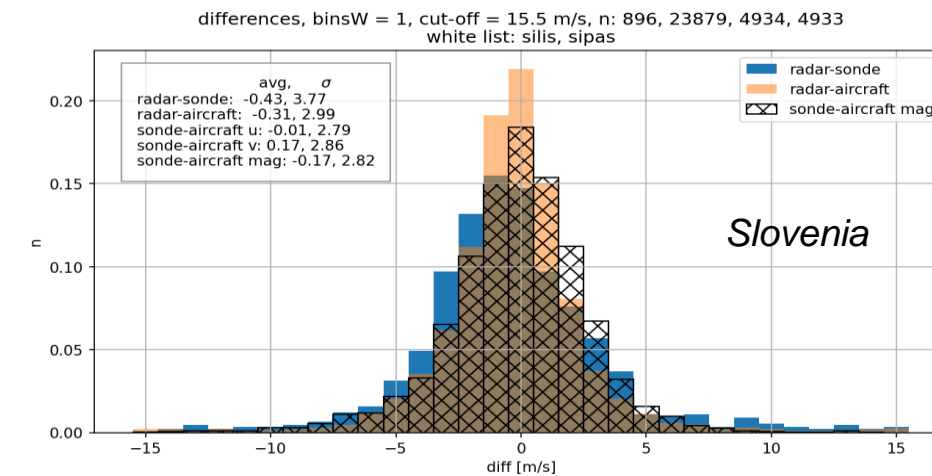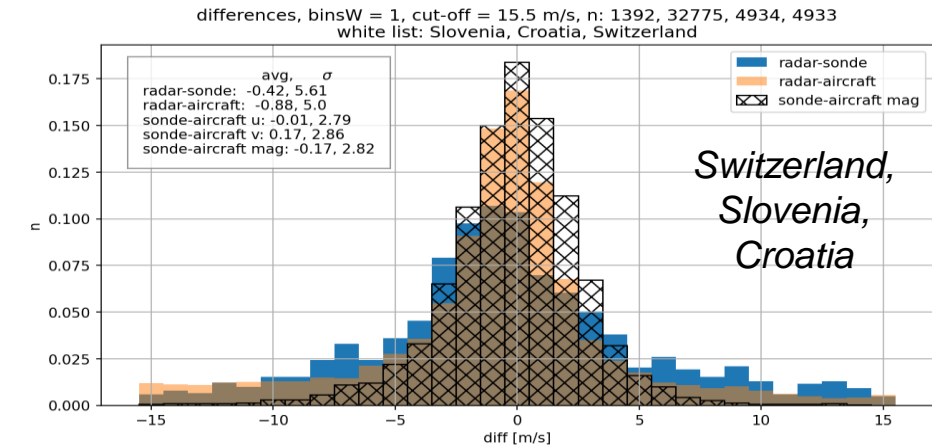- Validation of dealiased Doppler winds

Radial winds FG departures

France
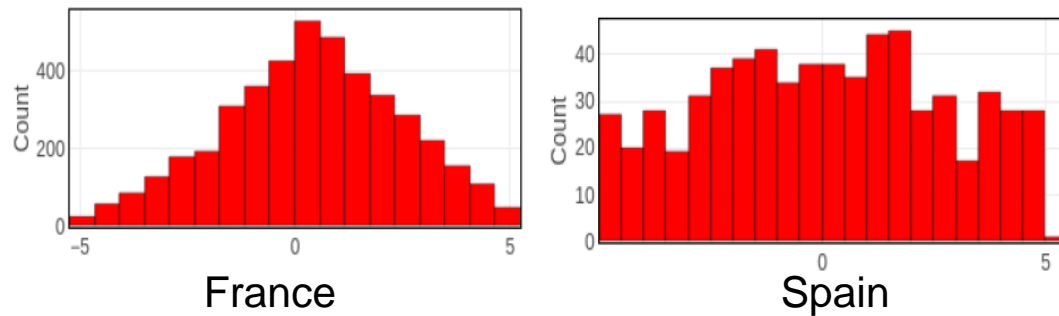
Spain

=> *Higher-quality provision expected over Spain, reflectivity-optimized wind scans potentially useful.*

Work of J. Sanchez, M. Ridal, M.Dahlbom

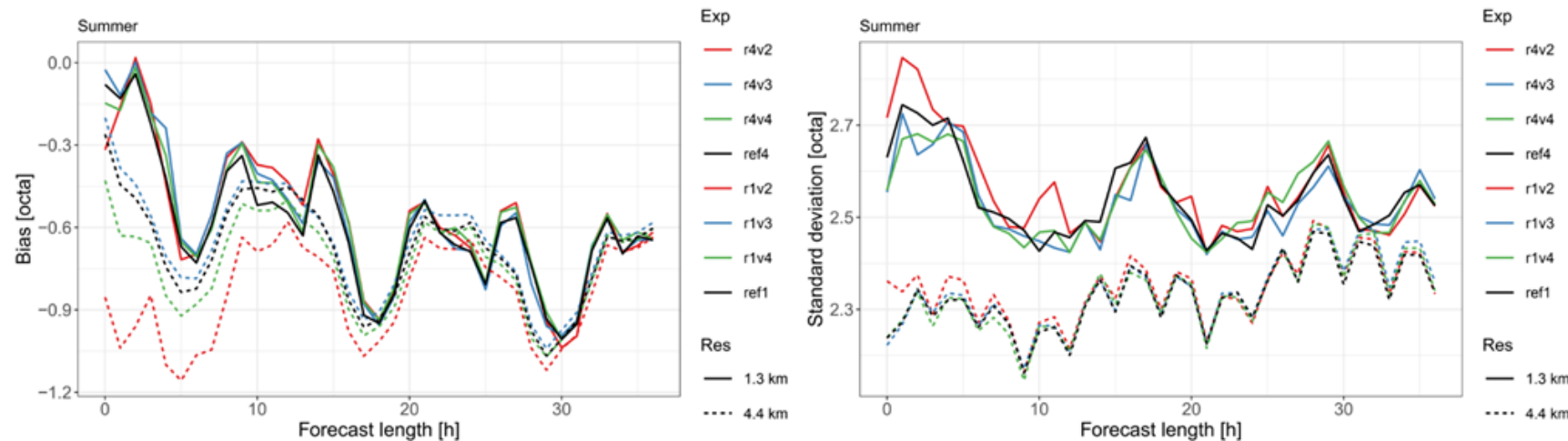*Differences between dealiased radar, radiosonde and aircraft winds scans with low NI in 2021*

differences, binsW = 1, cut-off = 15.5 m/s, n: 1392, 32775, 4934, 4933
white list: Slovenia, Croatia, Switzerland

avg, σ
radar-sonde: -0.42, 5.61
radar-aircraft: -0.88, 5.0
sonde-aircraft u: -0.01, 2.79
sonde-aircraft v: 0.17, 2.86
sonde-aircraft mag: -0.17, 2.82

Switzerland, Slovenia, Croatia

differences, binsW = 1, cut-off = 15.5 m/s, n: 896, 23879, 4934, 4933
white list: silis, sipas

avg, σ
radar-sonde: -0.43, 3.77
radar-aircraft: -0.31, 2.99
sonde-aircraft u: -0.01, 2.79
sonde-aircraft v: 0.17, 2.86
sonde-aircraft mag: -0.17, 2.82

Slovenia

Work of V. Švagelj, B. Strajnar, P Smerkol

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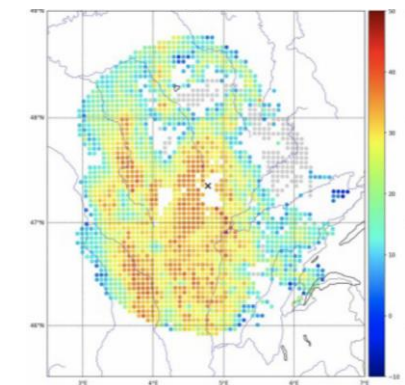# Improvements of the 1D-Bayesian scheme for radar reflectivity

Within the *ALARO-CSC*

- Reflectivity DA decreases with cloudiness (dry observations)
- Universal approach for OPERA modified for use of less observations, redefined sensitivity thresholds
- Radar DA operational in 1.3 km ALARO-RUC (Slovenia)
- AROME-FR: New settings allow more realistic retrievals with a better variability more consistent with observations
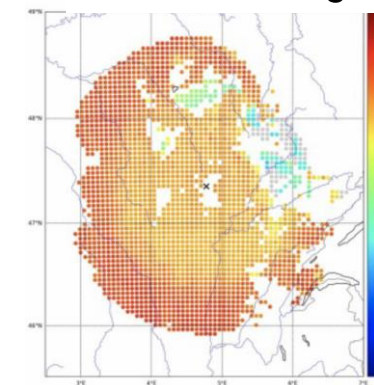
Work of A. Bučanek, B. Strajnar, S. Panežić

Within the e-suite *AROME-FR*
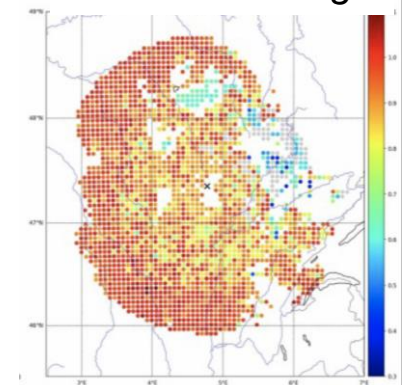
Observed reflectivities

Retrieved RH

with old settings   with new settings

Work of M. Martet

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Mode-S observations

Impact of Mode-S data on FG fits
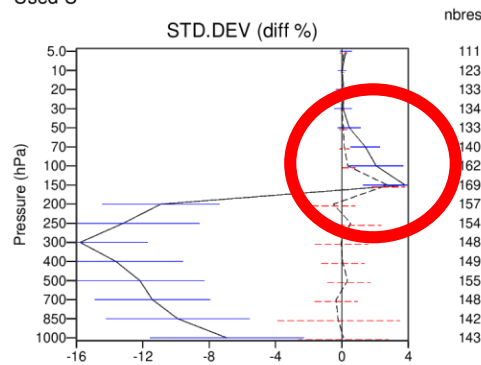

within the AROME 3D-Var

within the AROME 3D-EnVar
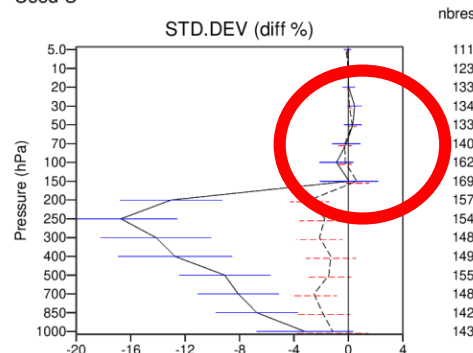
Work of Vivien Pourret

⇒ *EnVar enhances the impact of Mode-S data with a better handling of vertical correlations within the background error covariances.*

- Quality and coverage of EMADDC T improved substantially (today both Modes EHS wind and T data comparable with AMDAR)
- Impact:
    - AROME-FR: large and clear impact below 150 hPa
    - MetCoOp: neutral impact on average (lots of other data assimilated), improved individual weather situations.
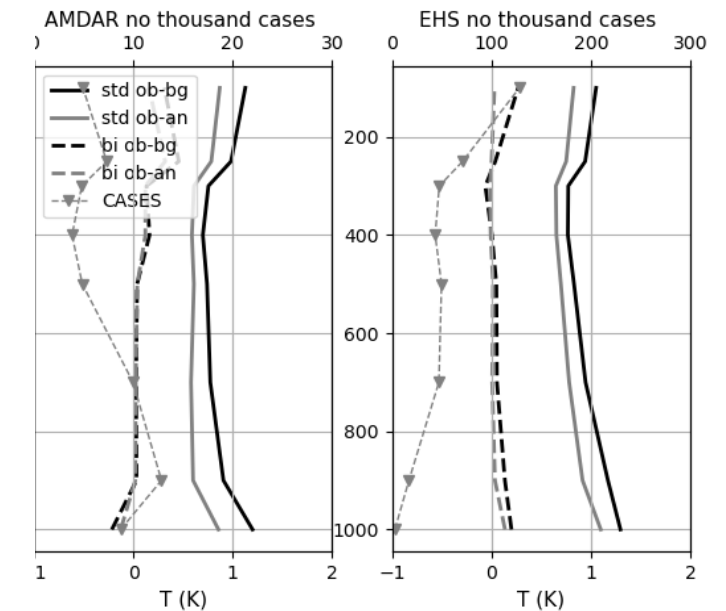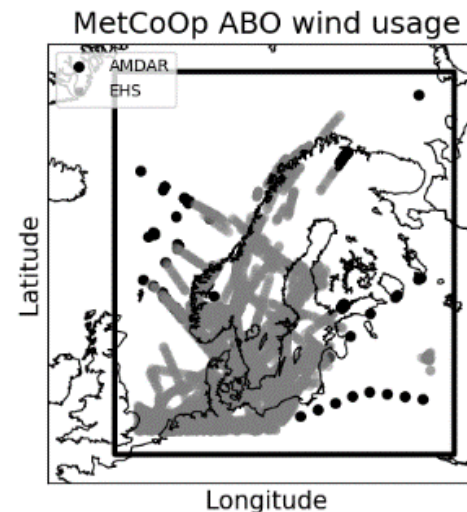
Work of Roohollah Azad, Magnus Lindskog, Siebren de Haan and Martin Ridal, Idir Dehmous

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Use of clear-sky radiances

*In **HARMONIE-AROME** systems of various HIRLAM centers*

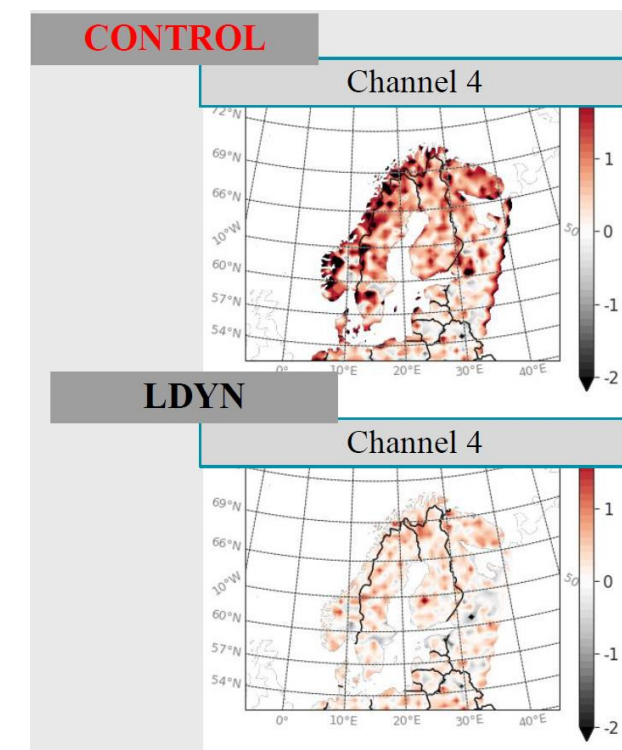M=MHS   A=AMSU-A   AT=ATMS   I=IASI   SEV=SEVIRI   C=Cris   MW2=MWHS-2

Satellite/Center	N18	N19	N20	NPP	MET-B	MET-C	FY3D	FY3E	MT-11
MetCoOp	A	M,A	AT,C	AT,C	M,A,I	M,A,I	MW2		SEV
AEMET	A	M,A			M,A,I	M,A			SEV
Met IE	A	M, A	AT	AT	M, A, I	M, A., I	MW2		
DMI	A	M,A	AT,C	AT	M,A,I	M,A,I	MW2		
AR-ARC	A	M,A	AT,C	AT,C	M,A,I	M,A,I	MW2		
NL-AR	A	M,A	AT	AT	A, M	A, M	MW2		

Oper > 3m, Oper < 3m, Preop. <3m, Preop. >3 months but not in oper. yet, in R&D

Mean FG dep. for classification-based and dynamic emissivity for Ch-4 AMSU-A

CONTROL
Channel 4

LDYN
Channel 4

- Substantial work on research, pre-operational and operational implementation
- Use of retrieved/dynamic surface emissivity AMSU-A & MHS window channels over land and sea-ice improved FG departures and more observations can be used
- Configuration to be applied for EUMETSAT/ESA mission AWS

Work of Stephanie Guedj, Magnus Lindskog, Reima Eresmaa, Roger Randriamampianina

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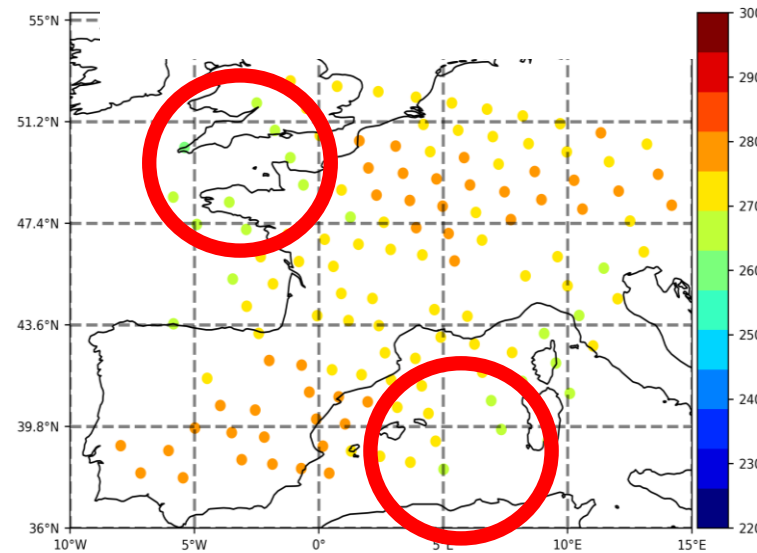A Consortium for COnvection-scale modelling Research and Development

All-sky direct assimilation of microwave sensors

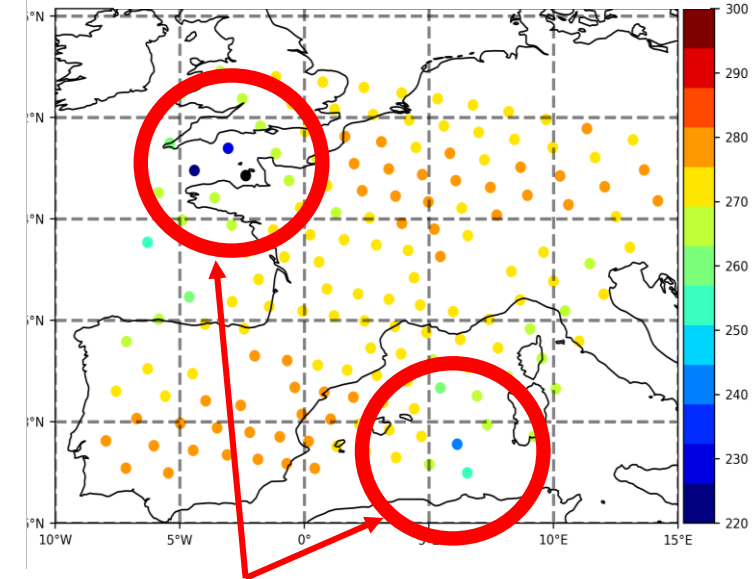*In preparation for thenext parallel e-suite **AROME-FR cy48***

- The use of the ECMWF all sky route for microwave observations is under tests and provide promising impacts on AROME gust winds and precipitation forecasts.
- Considered sensors: MHS, MWHS2, GMI, AMSR2

MHS observations – channel 5

Work of Mary Borderies and Philippe Chambon, in collaboration with Alan Geer, Roohollah Azad and Roger Randriamampianina

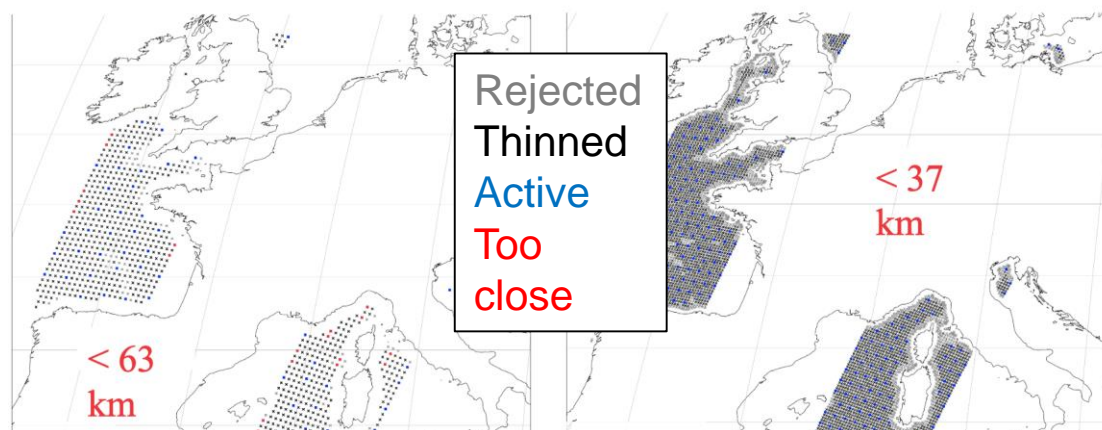**Active in the clear sky route**

Active in the all sky route

TB depressions - indicator of scattering within clouds

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High-resolution scatterometer data

Impact of HY-2B and 2C scatterometers data on first guess fits to ASCAT winds

The assimilation of high resolution scatterometer data (25km), with a 50 km thinning leads to x4 more data in the 3D-Var AROME and improved forecast of surface winds and relative humidity.

with old settings   *with new settings*

Rejected
Thinned
Active
Too
close

< 37 km

< 63 km

ASCAT Wind10m (2an)-speed Globe
Used wind data
MetOp-3(C) ASCAT

fg departure
nb=   28008 (ref=   28008) rms=   1.55   (1.61   )
mean= -0.332   (-0.341   ) std=   1.51   (1.57   )
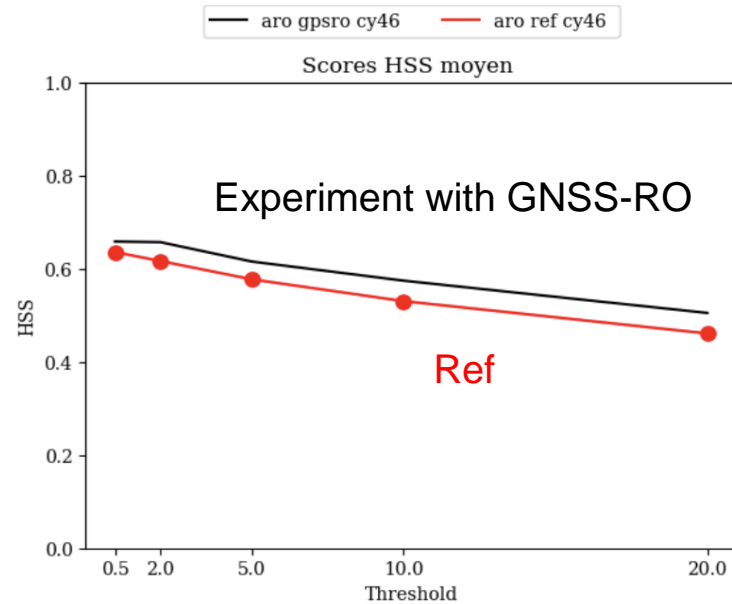min= -11.8   (-13.8   ) max=   11.9   (13.1   )
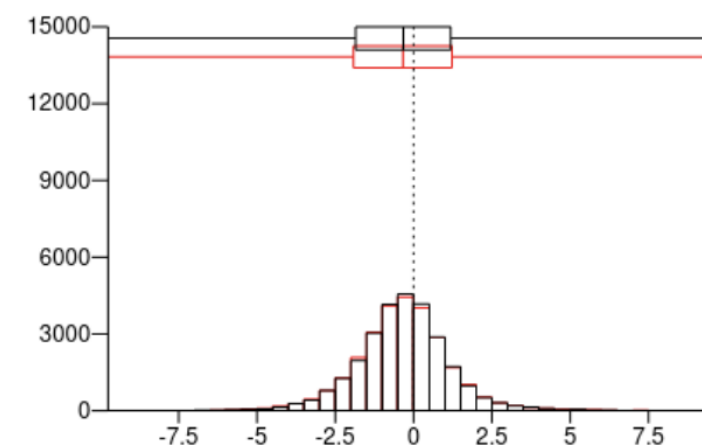
=> *The assimilation of HY-2B and 2C HR scatterometers data improves the first guess fit to ASCAT observations*

Work of Christophe Payan

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GNSS-based observations

Bending angles of GNSS-RO

Experiment with GNSS-RO

Ref

legend: aro gpsro cy46 — aro ref cy46
Scores HSS moyen

=> *The assimilation of GNSS-RO within AROME-FR improves forecasts including for precipitation*

Impact of GNSS ZTD from 3 networks around Belgium


period :20210501-20210531
ARGPS — AR13-OPER
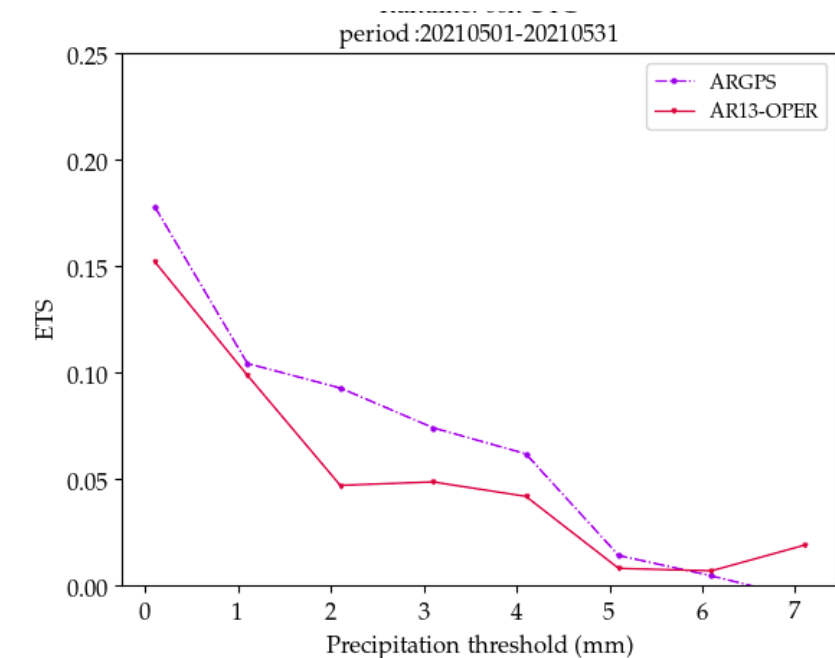
Positive impact of ZTD on precipitation for low thresholds. Shown potential to improve near-surface and upper-air temperature and humidity forecast.

Work of Dominique Raspaud

Work of Idir Dehmous

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Tropospheric delay observations under evaluation

Time series of ZTD from moving trains in Austria.

Interferometric Synthetic Aperture Radar (InSAR) tropospheric delay increment in obs. space.
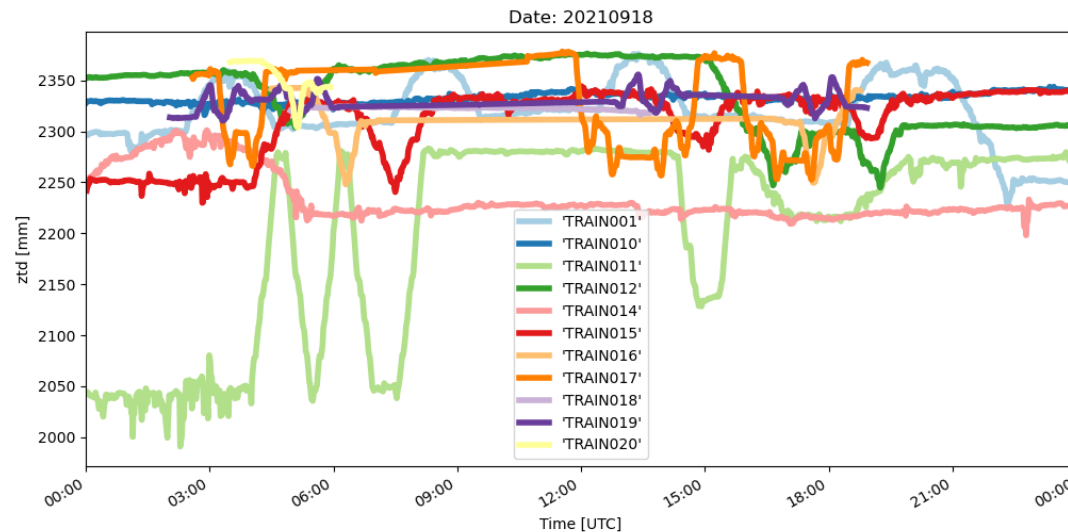
Data from 10 trains per day are now available for passive assimilation in AROME-AT.
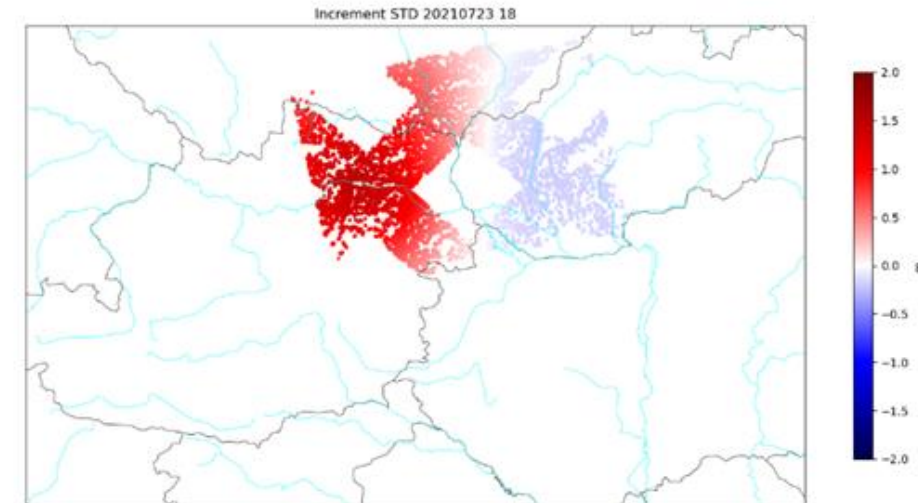
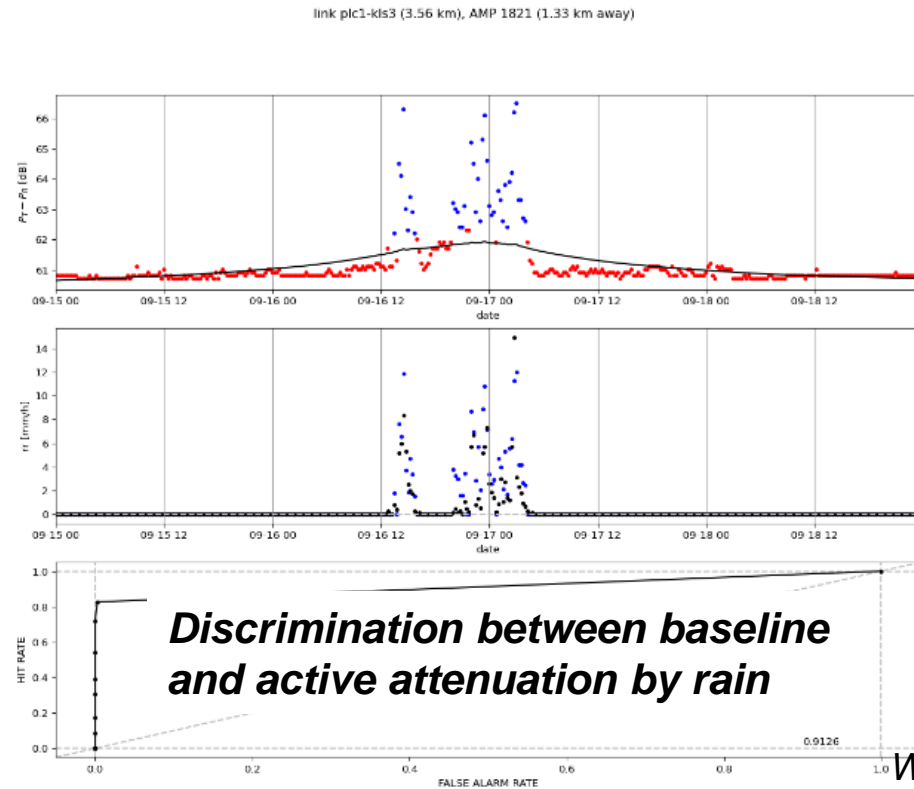Relative changes of slant tropospheric delay over a short period are converted to absolute delays by adding first guess values before assimilation.

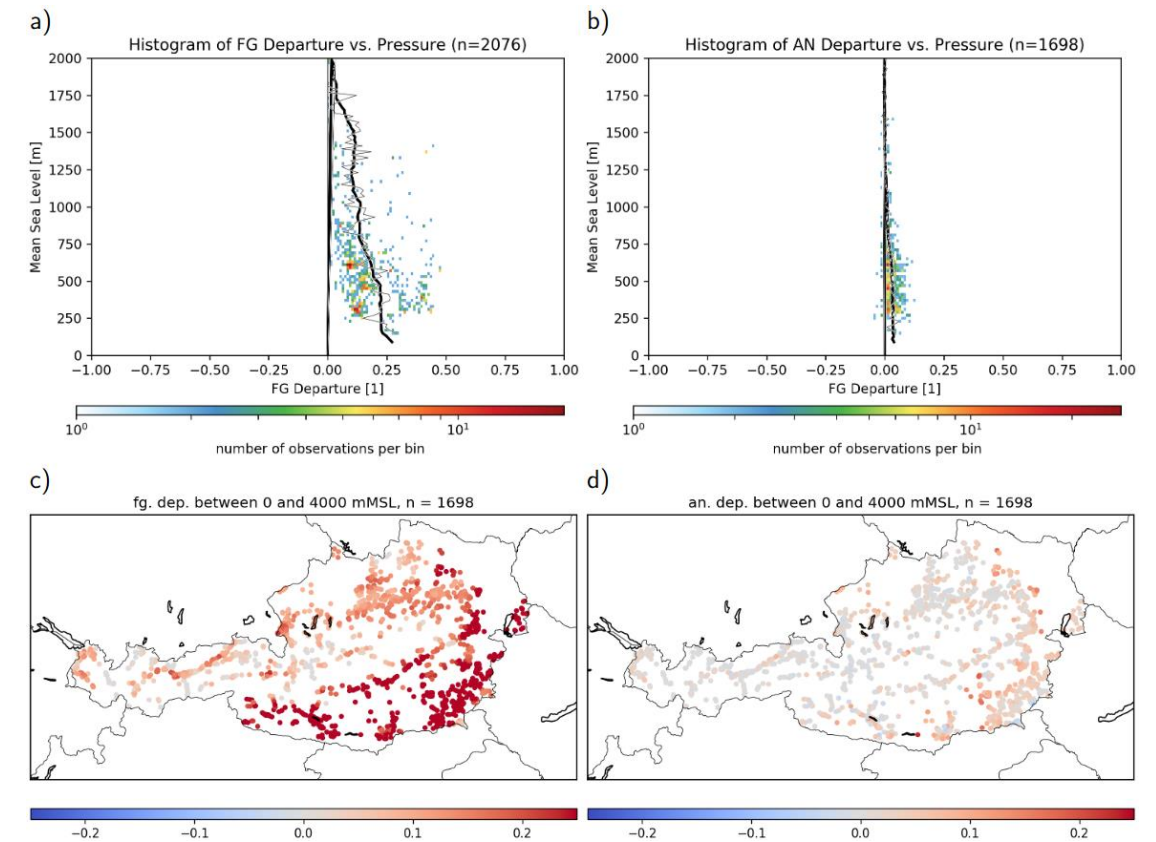=> *These novel tropospheric delay observations possess significant systematic errors, development of a robust bias correction is essential.*

Work of Florian Weidle

Work of Florian Meier

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- Attenuations in microwave links related to precipitation - high.res and rapid delivery
- Links processed by AI or a fast factor graph algorithm.
- Simple assimilation applied – to be improved with 1D+3DVar rain rate assimilation)

**FG and An departures for specific humidity
Using a simple (rain = 100% humidity) assimilation
in AROME-AT 3D-Var**

Discrimination between baseline and active attenuation by rain

Work of Peter Smerkol and Phillip Schefknecht

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Conclusions

- Refined methods to better exploit existing radar data sets, especially OPERA
- Mode-S data now massively used, impact depends on the assimilation method
- Increased use of clear-sky and now also all-sky radiances and other satellite products (winds), including advanced surface properties estimation and bias correction
- Exploitation of alternative obs. sources (e.g. PWS, SPOs, microlinks, GNNS-related data, …)

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Thank you for attention!

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