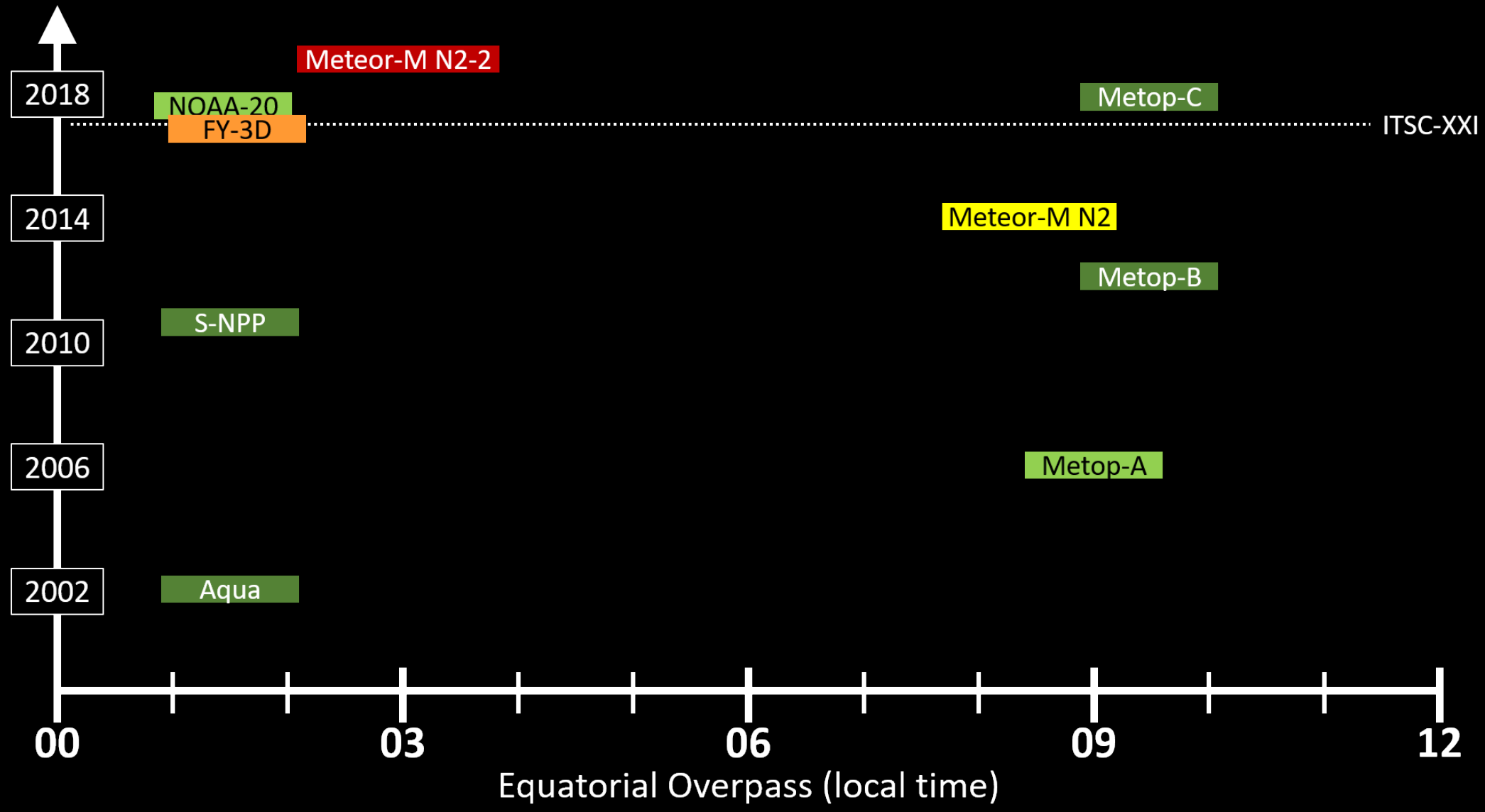
New IR sounders in the ECMWF NWP system

4/11/2019

Reima Eresmaa

ECMWF

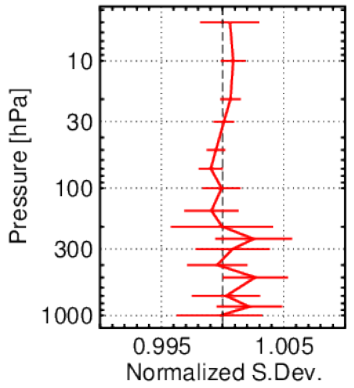
EUMETSAT NWP SAF NUMERICAL WEATHER PREDICTION


2018
2014
2010
2006
2002
Meteor-M N2-2
NOAA-20
FY-3D
Metop-C
ITSC-XXI
Meteor-M N2
Metop-B
S-NPP
Metop-A
Aqua
00
03
06
09
12
Equatorial Overpass (local time)

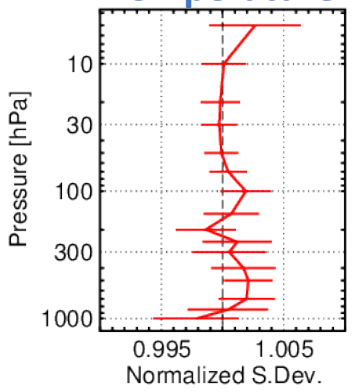
4. Metop-C IASI

Background fit to other observations

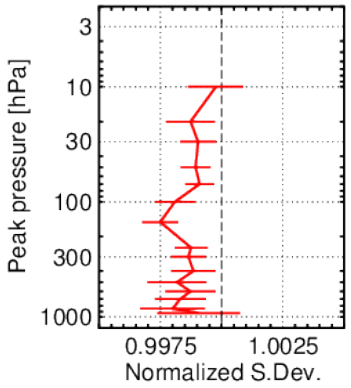
Conventional wind



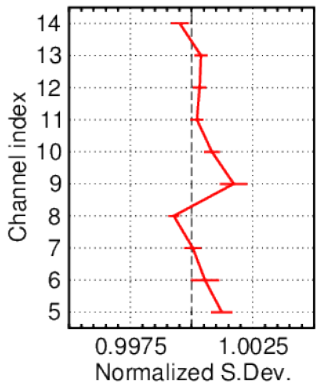
Conventional Temperature



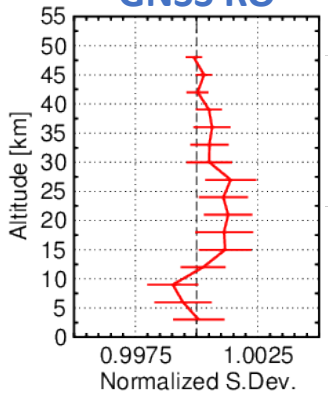
Long-Wave CrIS channels

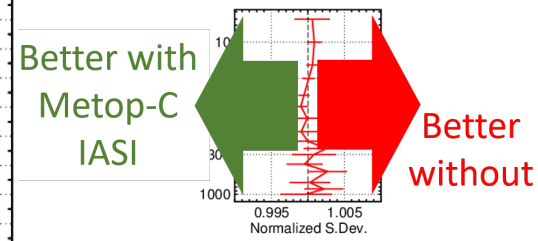


AMSU-A

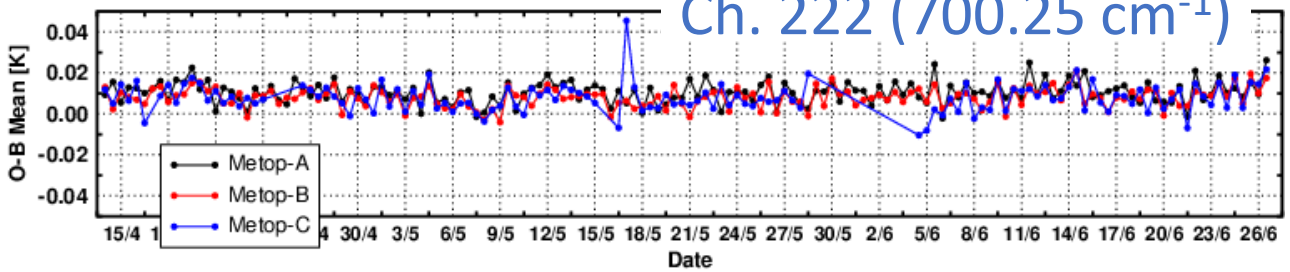


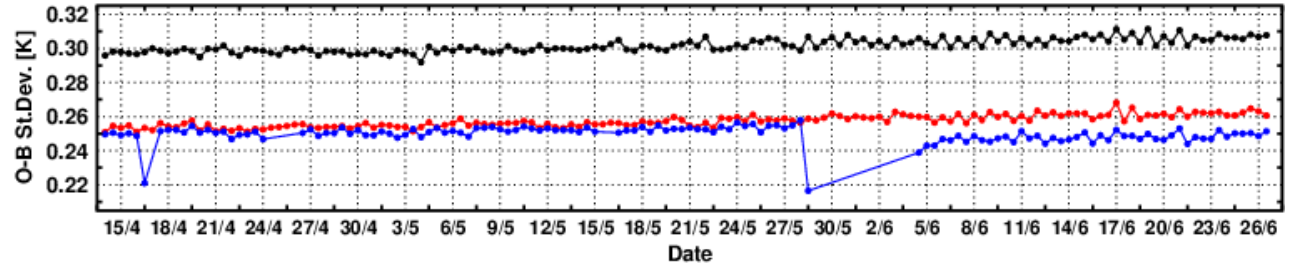
GNSS RO





Ch. 222 (700.25 cm^{-1})





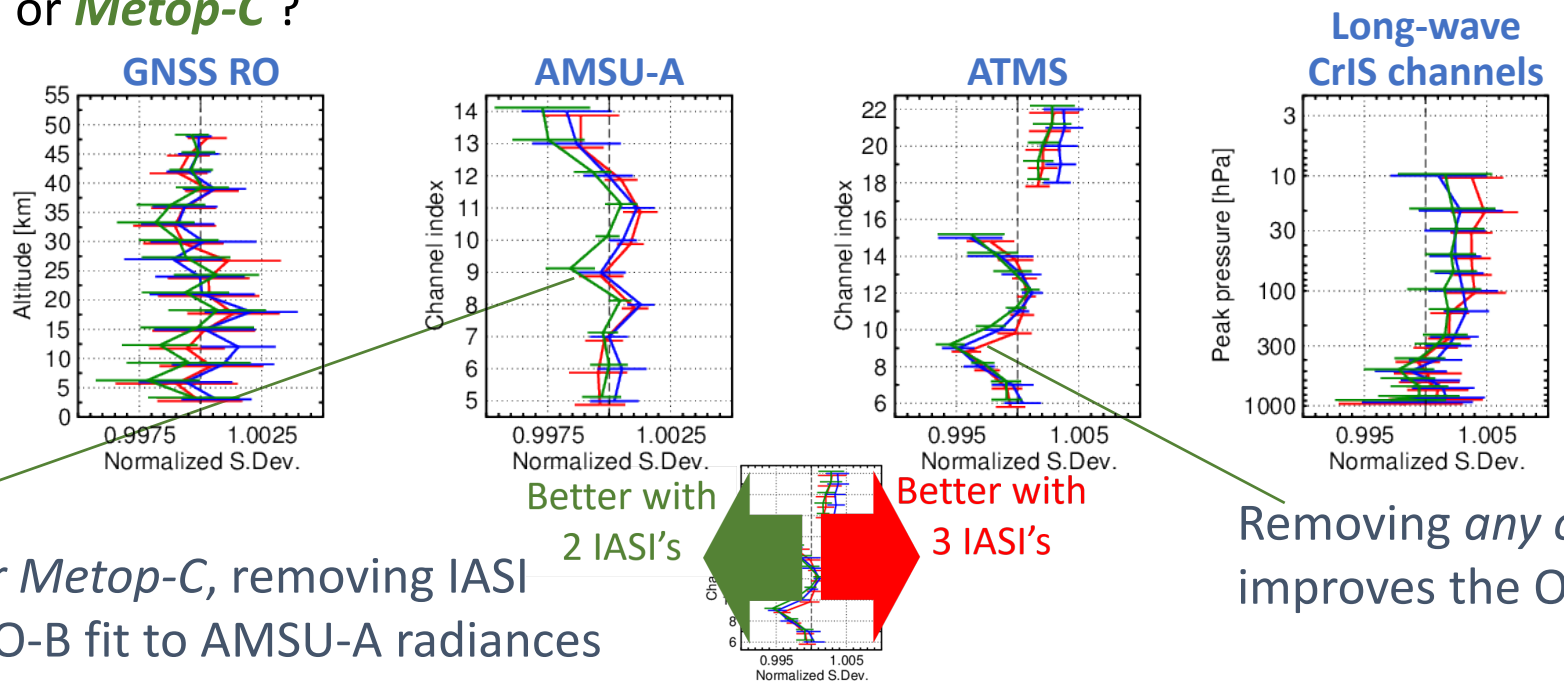
- Launch **7th November 2018 –** activated @ECMWF **25th September 2019**
- Noise less than in Metop-B IASI
- Metop-A and Metop-B IASI's are *known to* produce a positive impact in the ECMWF 4D-Var
- The initial assimilation system setup for Metop-C is similar to that of Metop-A and Metop-B …

… BUT Metop-C fails to produce a good impact !

Something's not quite right:

- specifically in the *use of Metop-C IASI*?
- in the *use of IR radiances in general*?

- **Including all three IASI's in the control**, what's the impact of removing either ***Metop-A***, ***Metop-B***, or ***Metop-C*** ?



Specifically for Metop-C, removing IASI improves the O-B fit to AMSU-A radiances

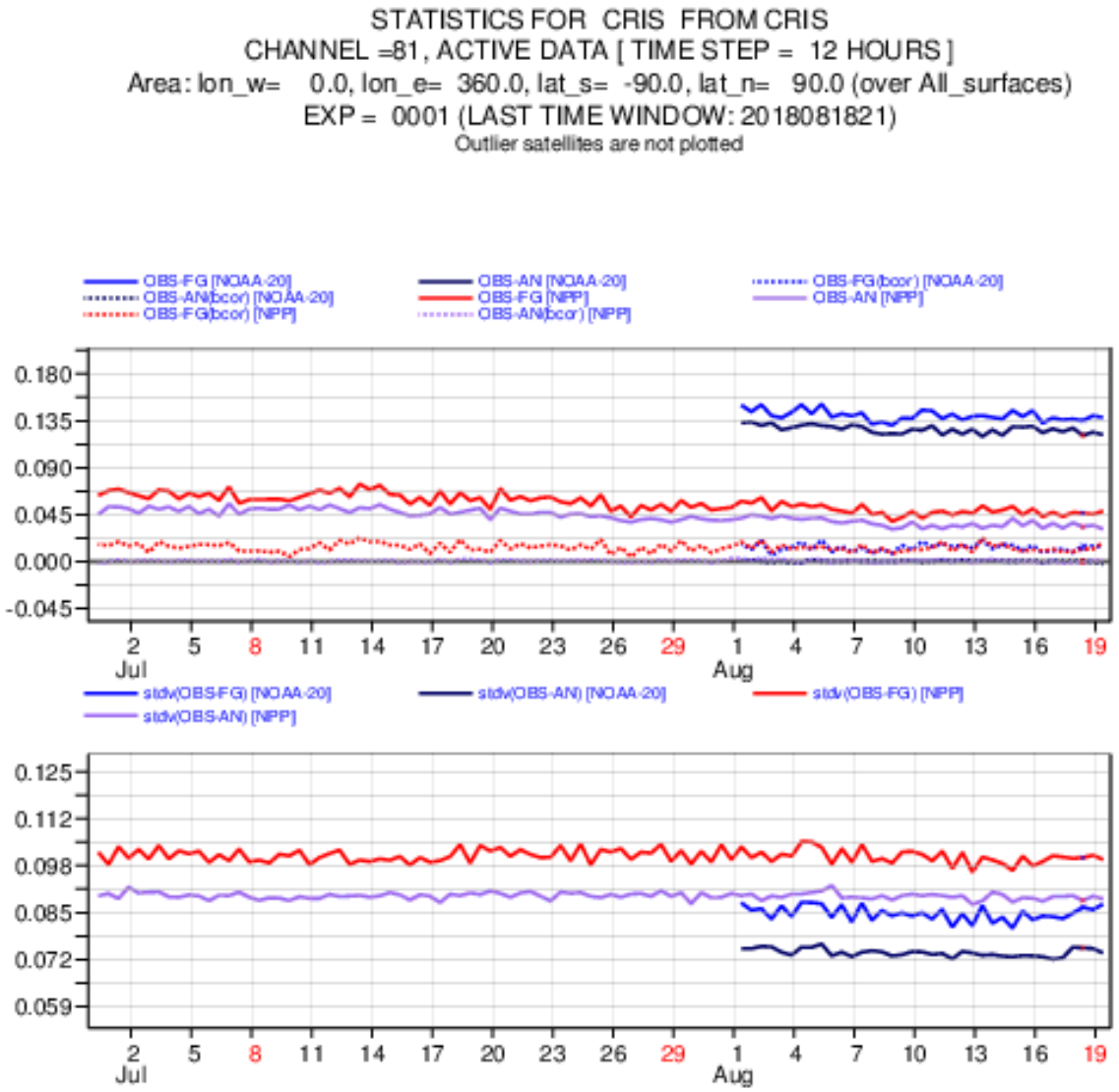
Removing *any one of the three IASIs* improves the O-B fit to ATMS

→ *Prefer to swap from Metop-A to Metop-C, rather than try to optimize the system for three IASI's (for now)*

3. NOAA-20 CrIS

- Launch **18th November 2017 –** activated @ECMWF **11th September 2018**
- Noise less than in S-NPP CrIS
- The initial assimilation system setup is similar to that for S-NPP CrIS, except for
  - Aerosol detection is switched off
  - WV channels (MWIR band) are not used

  → **Active use limited to 111 channels**



S-NPP
NOAA-20

Trending @ECMWF

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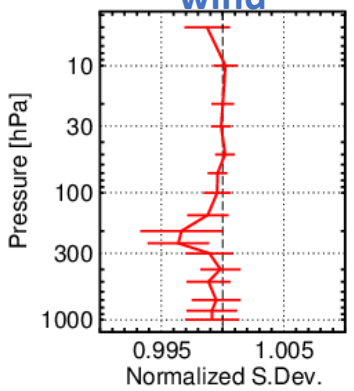
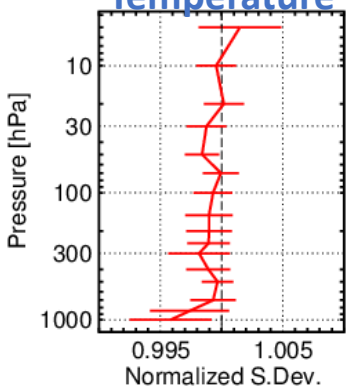
Background fit to other observations

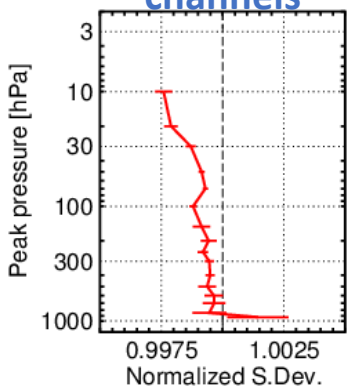
Conventional wind

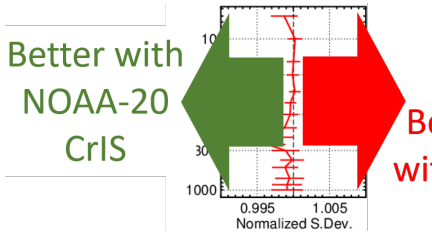


Conventional Temperature

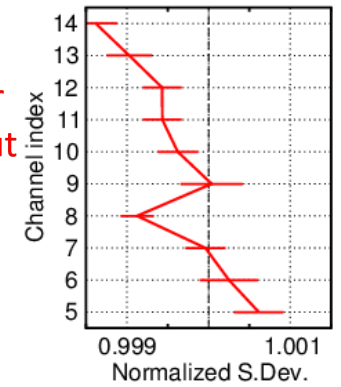


Long-Wave IASI channels

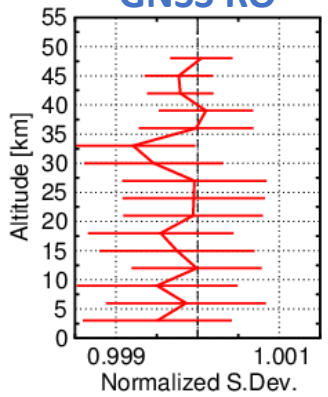




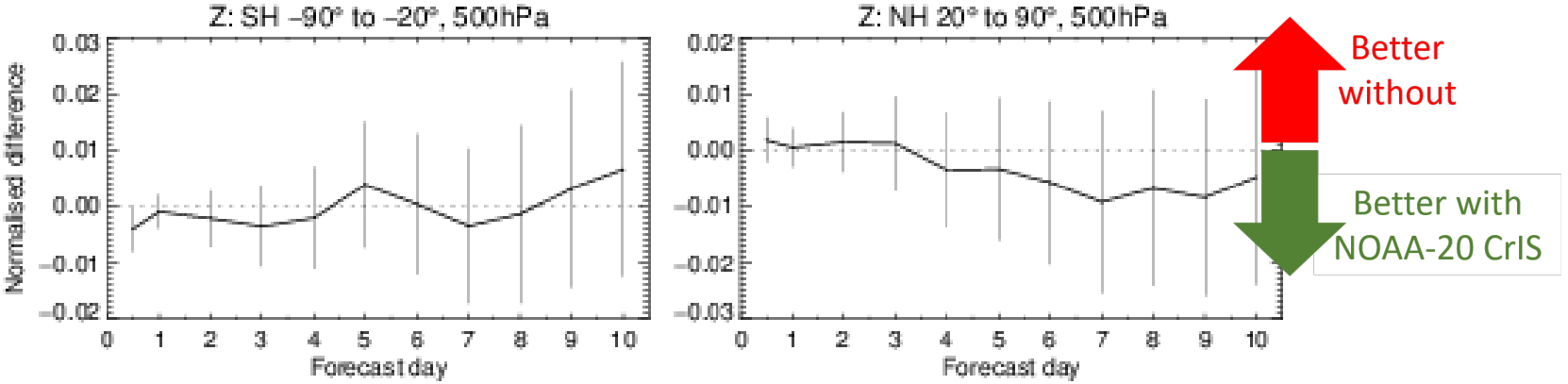
AMSU-A



GNSS RO

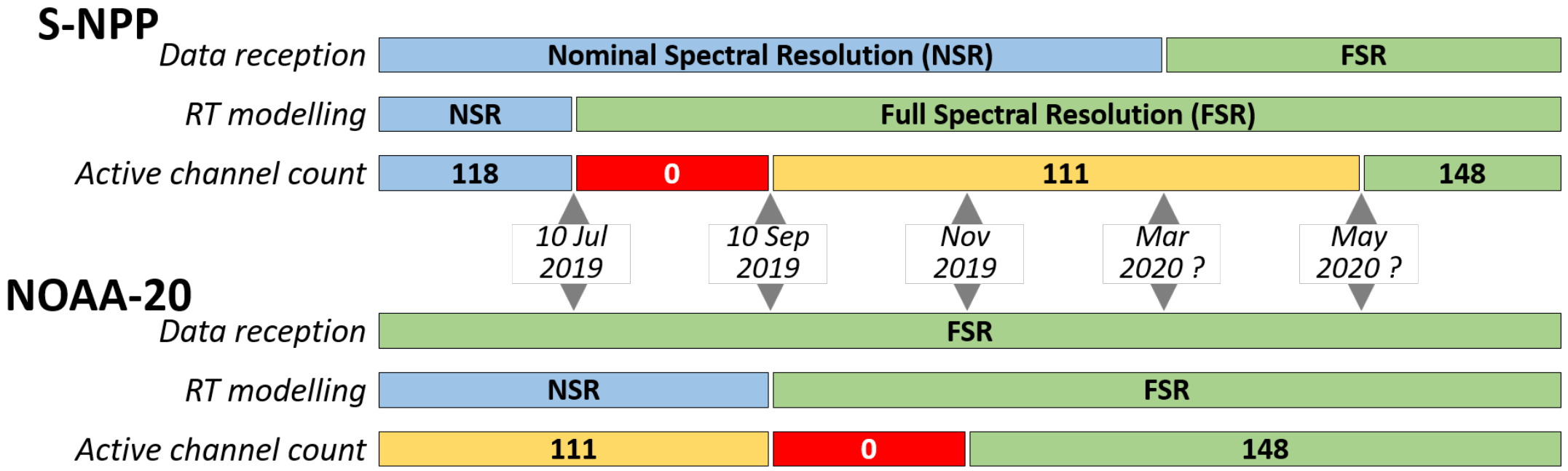


Forecast RMSE



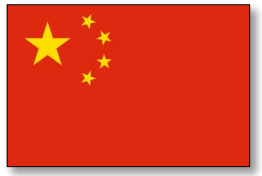
NSR to FSR transition

Expecting a significant performance gain from the activation of 37 water vapour channels in FSR

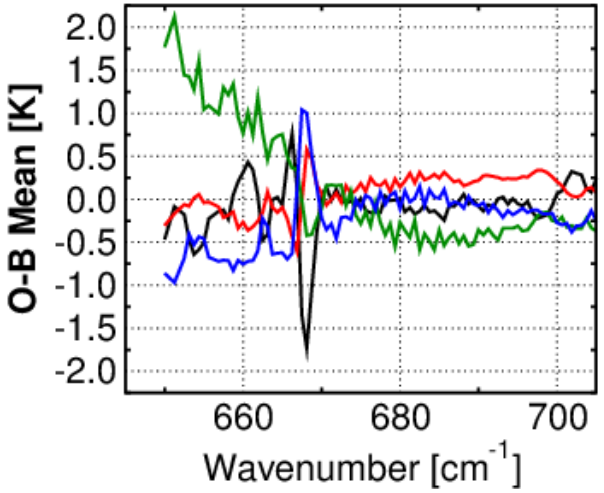


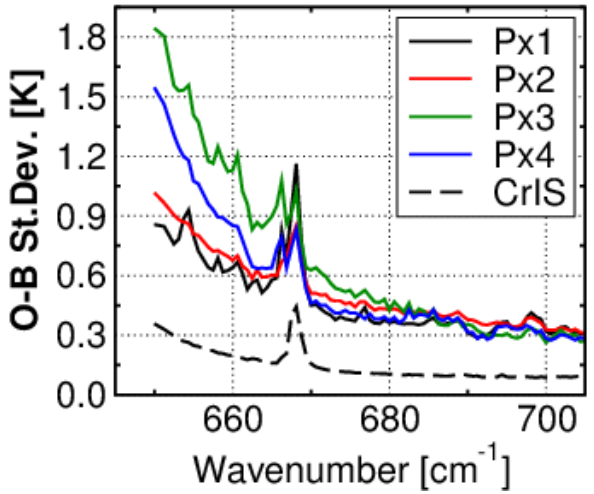
Trending @ECMWF

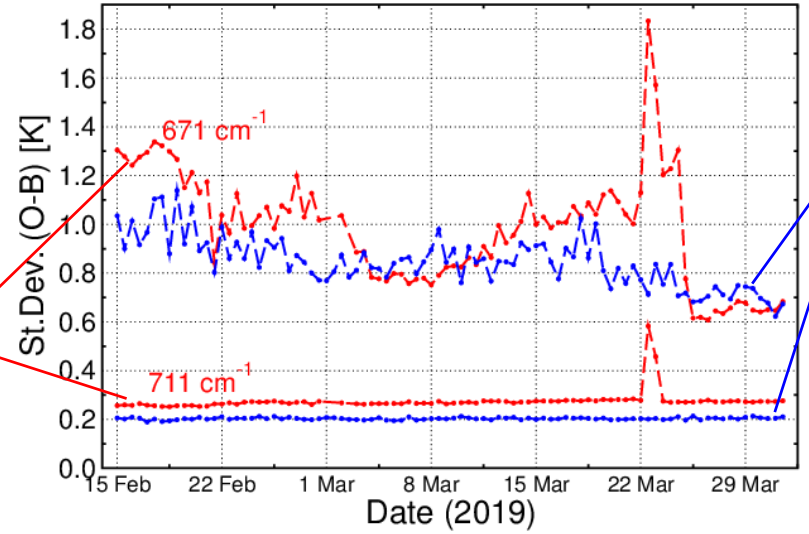
2. FY-3D HIRAS



- O-B statistics show considerable inter-pixel variations
  - Pixel 3 up to 2K warmer than others
  - Pixels 3 and 4 noisier than pixels 1 and 3
- Stable performance over the 2-month sample (Feb-Mar 2019) – however noise is 2-3 times higher than in CrIS







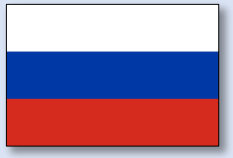
FY-3D HIRAS

NOAA-20 CrIS x 2

Trending @ECMWF

1. Meteor-M N2 IKFS-2

METEOR-M N2 **IKFS-2**



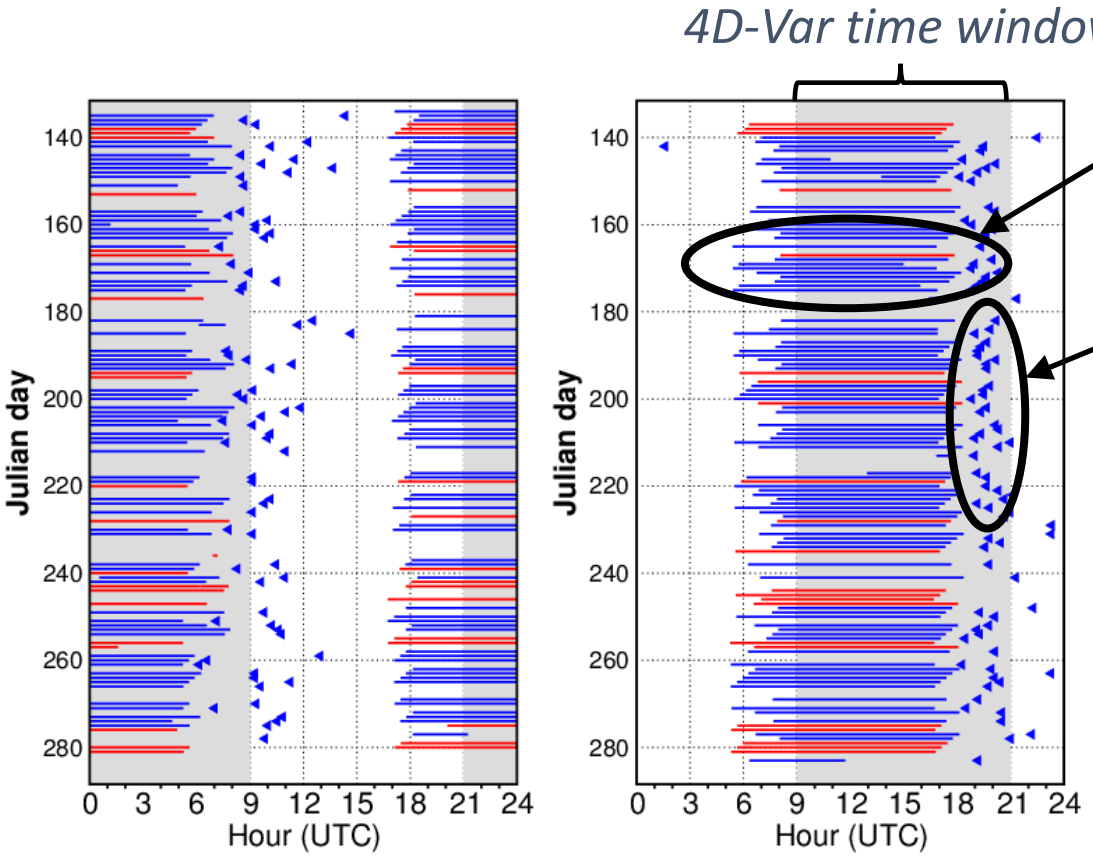
- Launch date **8th July 2014**
- **20:25** local time for ascending-node equatorial overpasses
- 2701 channels in two bands
  - 660—1209.5 cm^{-1}, **0.35 cm^{-1}** channel spacing
  - 1210.2—2000.5 cm^{-1}, **0.7 cm^{-1}** channel spacing
- **30 km** nadir field-of-view size

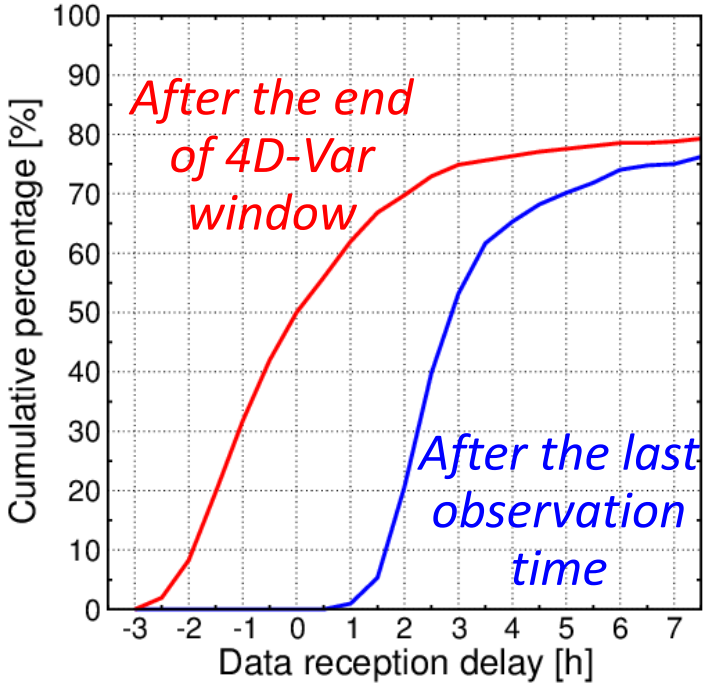
FY-3D **HIRAS**

- Launch date **14th November 2017**
- **13:30** local time for ascending-node equatorial overpasses
- 2211 channels in three bands
  - 650—1135 cm^{-1}, **0.625 cm^{-1}** channel spacing
  - 1210—1750 cm^{-1}, **0.625 cm^{-1}** channel spacing
  - 2155—2550 cm^{-1}, **0.625 cm^{-1}** channel spacing
- **16 km** nadir field-of-view size

Trending @ECMWF

1. Meteor-M N2 IKFS-2



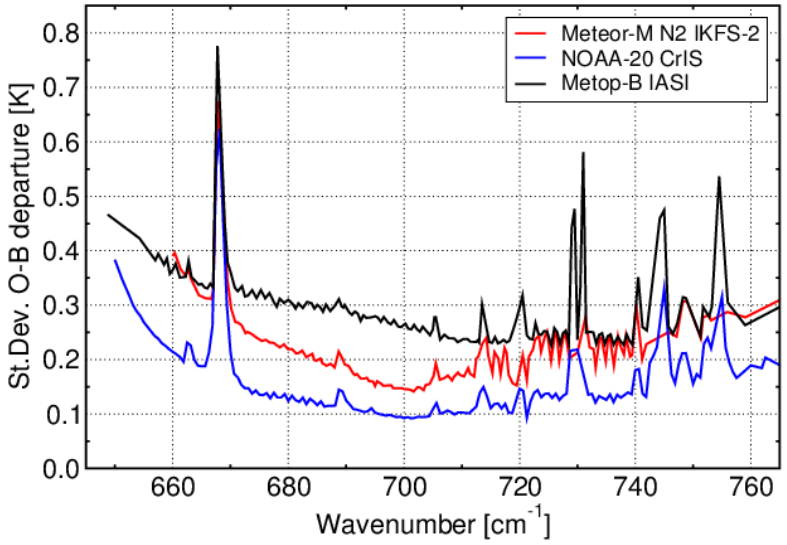


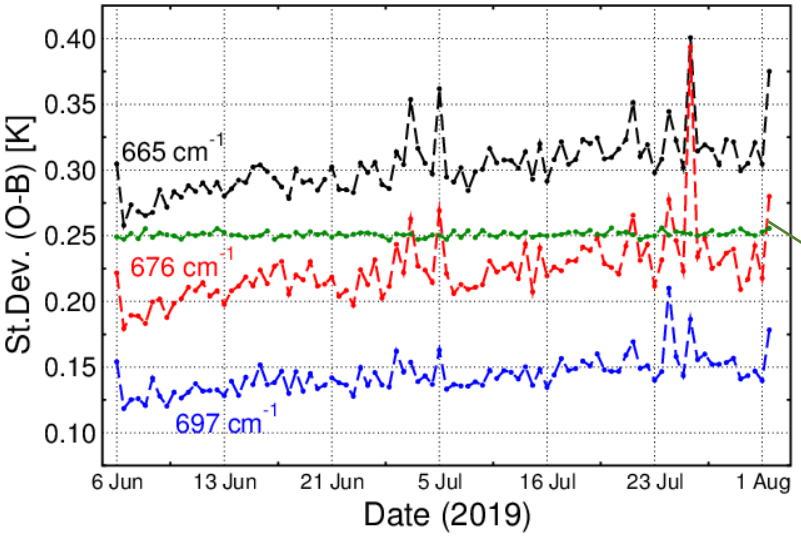
- In 150 days since mid-May 2019, we have received 95 days worth of data
- Approx. 50% of data arrived by the 4D-Var closing time, and 75% within three hours from that

→ **We could currently achieve 33–50% near-real-time data coverage**

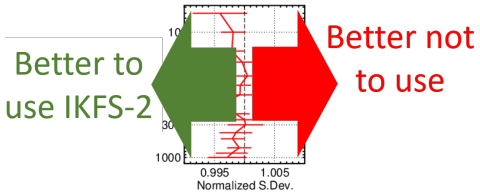
Trending @ECMWF

1. Meteor-M N2 IKFS-2



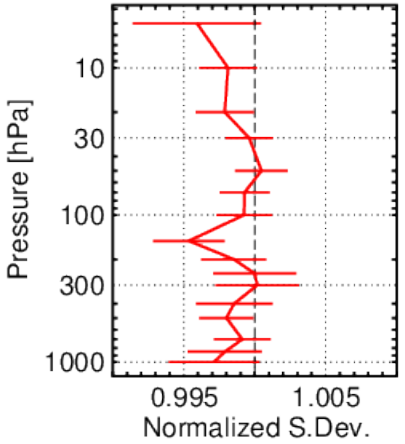


Metop-B IASI @703 cm^{-1}



Background fit to other observations

TEMP T



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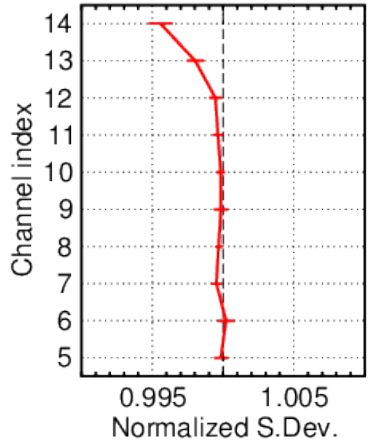
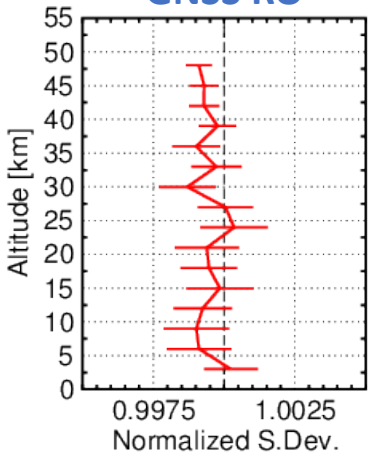


GNSS RO



- Activating 174 channels in the long-wave IR sounding band
- 74-day test period (Jun—Aug 2019)

→ *Encouraging scores in short-range forecast verification*

Trending @ECMWF

1. Meteor-M N2 IKFS-2
2. FY-3D HIRAS
3. NOAA-20 CrIS
4. Metop-C IASI

Summary

1. NOAA-20 CrIS and Metop-C IASI have been activated
   - The use of water vapour channels of NOAA-20 CrIS will start very soon
   - Metop-C IASI has replaced Metop-A
2. Considerable inter-pixel variation in FY-3D HIRAS
   - Stable performance over the two-month sample
   - Near-real-time data access would be appreciated
3. Good performance against ECMWF background in Meteor-M N2 IKFS-2
   - Consistent real-time data reception is lacking
   - We’re looking forward to the arrival of IKFS-2 on Meteor-M N2-2