# Operational Assimilation of Aeolus HLOS Winds in the Météo France Global NWP Model

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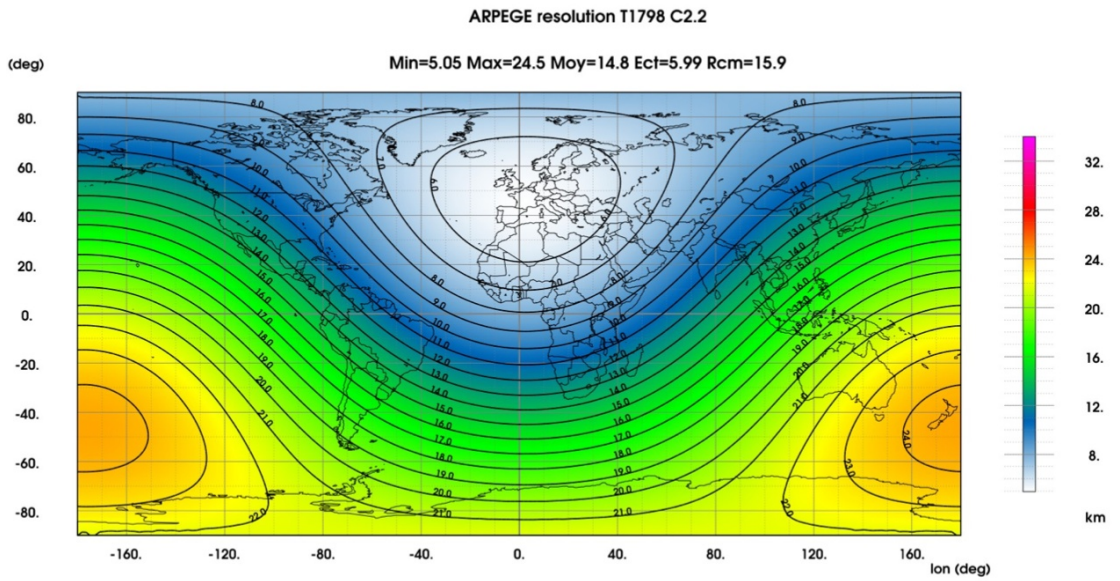
# Outline

- Current global NWP system and observation usage
- Milestones towards operational assimilation of Aeolus HLOS winds
- Future activities

# Global model ARPEGE (high resolution)




**Spectral model with variable resolution:**
$T_L$1798c2.2L105

**#** $\Delta x$ from **5** to 25 km
# 105 vertical levels
from 10 m to 0.1 hPa

**Incremental 4D-Var assimilation (6-h window and 30 min time-slots)** :

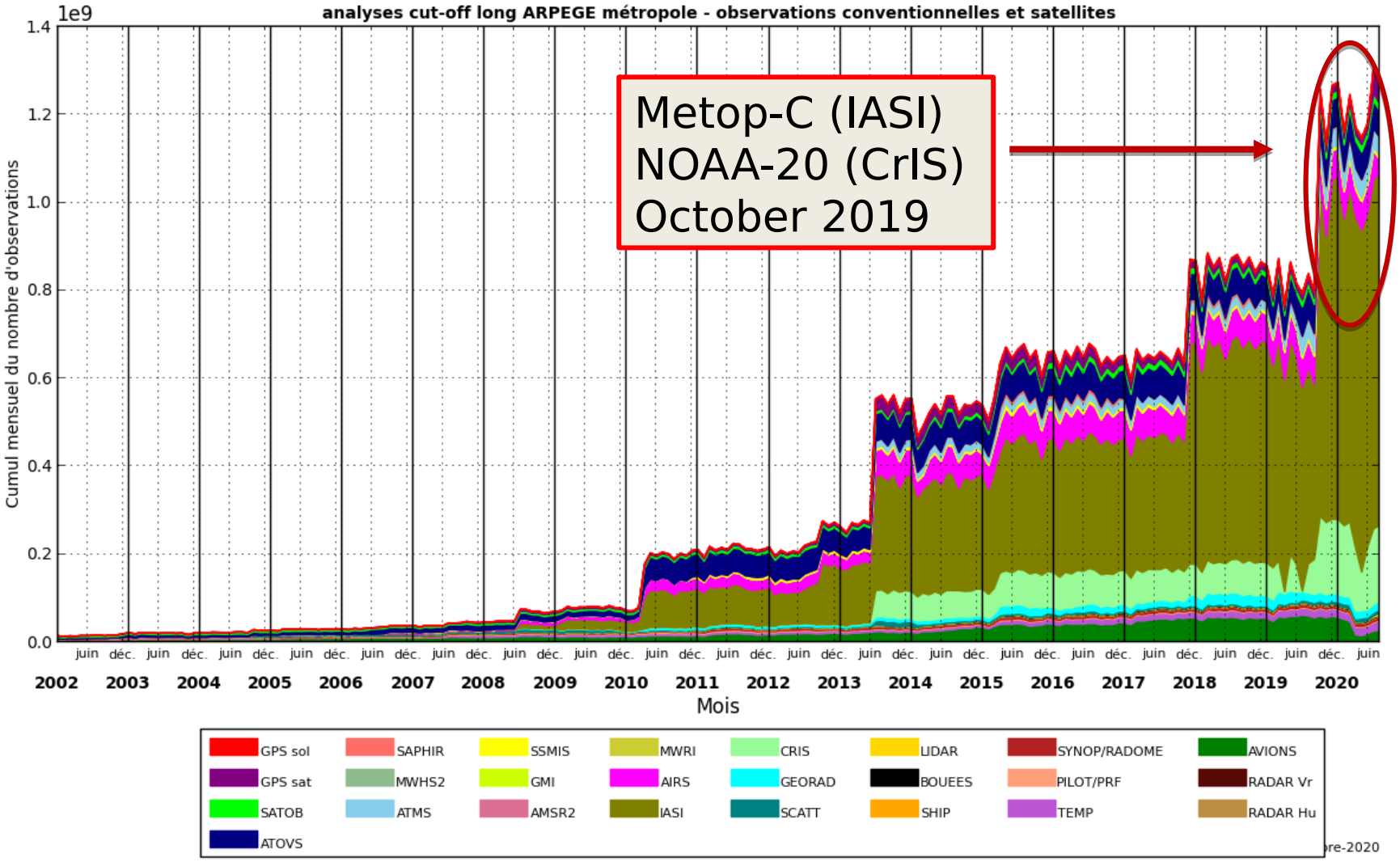
- 2 loops of minimization: $T_L$224c1L105 (40 iterations) + $T_L$499c1L105 (40 iterations)
- Background error variances and correlation lengths from an EDA system (4D-Var at lower resolution: $T_L$499/$T_L$224) with 50 members (**AEARP**)

**Forecasts (cut-off and ranges):**
00 UTC (1h10/54h), 00 UTC (2h15/102h),
06 UTC (3h/72h), 12 UTC (1h50/114h), 18 UTC (3h/60h)

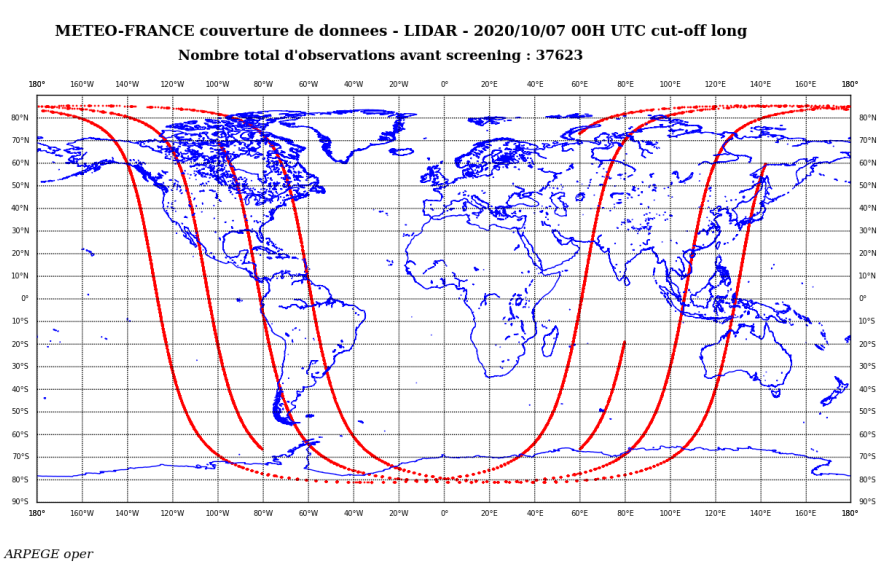
**Since 07/2019**

# Observation evolution in ARPEGE

**Evolution des cumuls mensuels de nombre d'observations utilisées par type d'observation**



# Aeolus work plan summary




- Aeolus launched in August 2018
- Observation : HLOS Wind
- Lidar Doppler 2 channels : molecular (Rayleigh), aerosol (Mie)
- Level 2B Cal/Val dataset provided by ECMWF with Eumetcast
- Data provided in Bufr Format
- First laser operated till beginning of June 2019
- Second laser data available in July 2019
- Several impact experiments conducted with data from first and second laser
- Unbiasing work with L2B processor
- HLOS winds bias corrected from M1 temperature gradient. Operational broadcast (04/2020)
- All these activities resulted in the operational use of Aeolus winds in Météo France operational model ARPEGE :

  **Monitoring in January 2020**

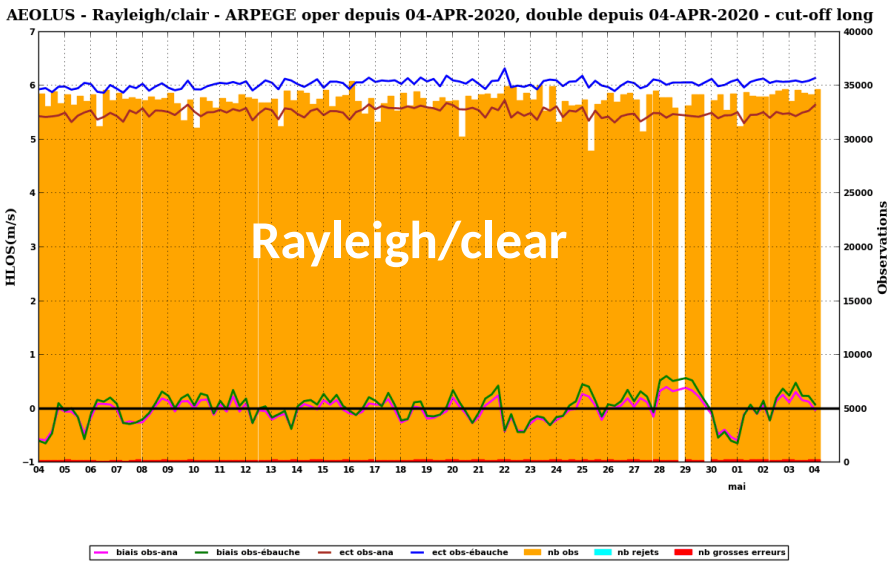
  **Assimilation in June 2020**

# Pre oper XP
# HLOS winds M1 bias corrected

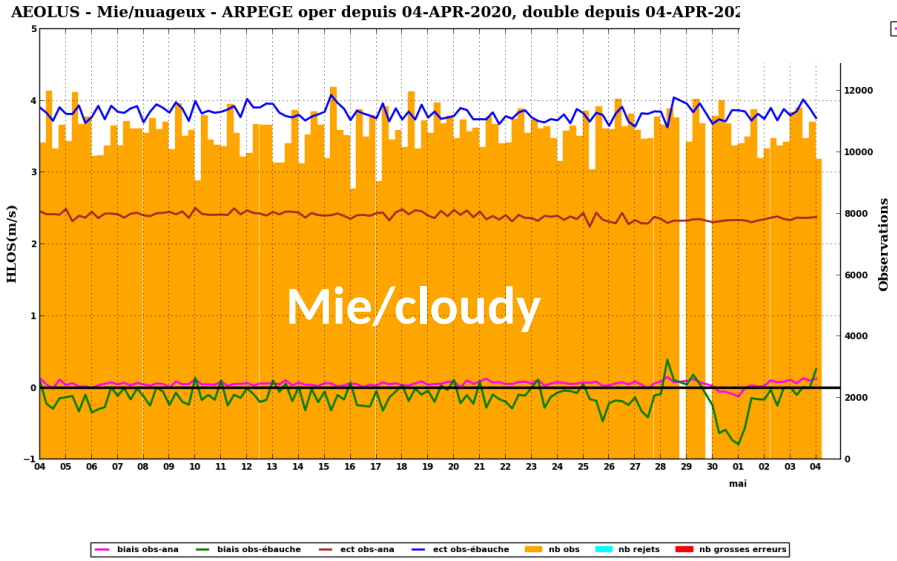
April 4 -May 24 2020

**Std(OmB)**
**Mean (OmB)**
**Std(OmA)**
**Mean (OmA)**

*Statistiques intégrées sur la verticale*




*Statistiques intégrées sur la verticale*




L2Bp $\sigma_0$ scaled

**Quality controls (adapted from ECMWF guidelines):**

HLOS winds restricted to Rayleigh/clear and Mie/cloudy

Mie integration length > 5 km

Rayleigh/clear above 850 hPa

Rayleigh winds kept when 2 m/s < $\sigma_0$ < 8 m/s

Mie winds kept when 0.5 m/s < $\sigma_0$ < 3 m/s

Background check to reject winds too far from model (5$\sigma$)

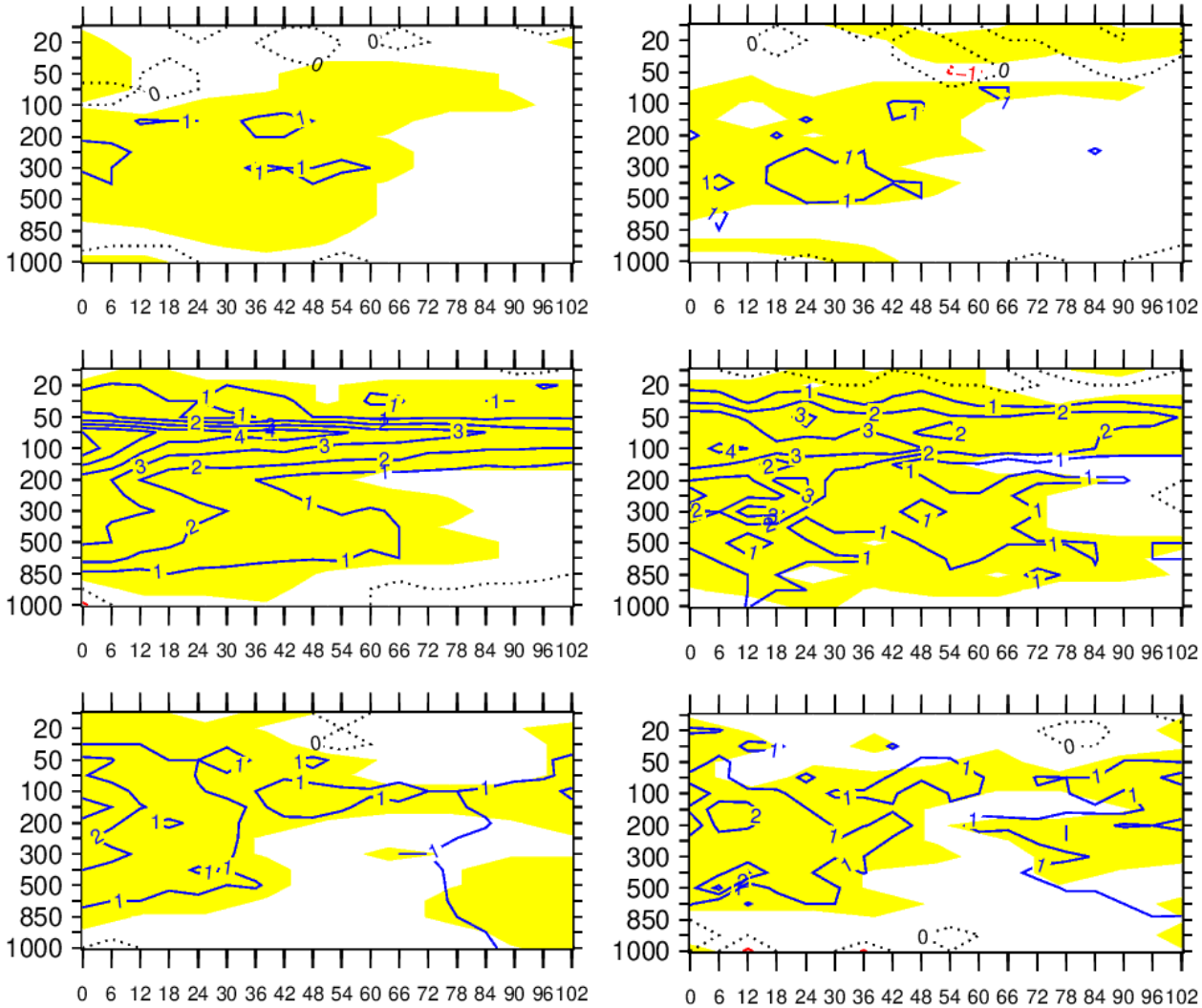
# Forecast scores – Pre oper XP

## HLOS winds M1 bias corrected

NH

Tropics

SH




**Wind** **Temperature**

April 4 -May 24 2020

Normalized RMS(O-F)
Differences REF – EXP
REF : ARPEGE oper
O : ECMWF analyses

☺

☹

**significant**

# DFS and FSOi – Pre oper XP

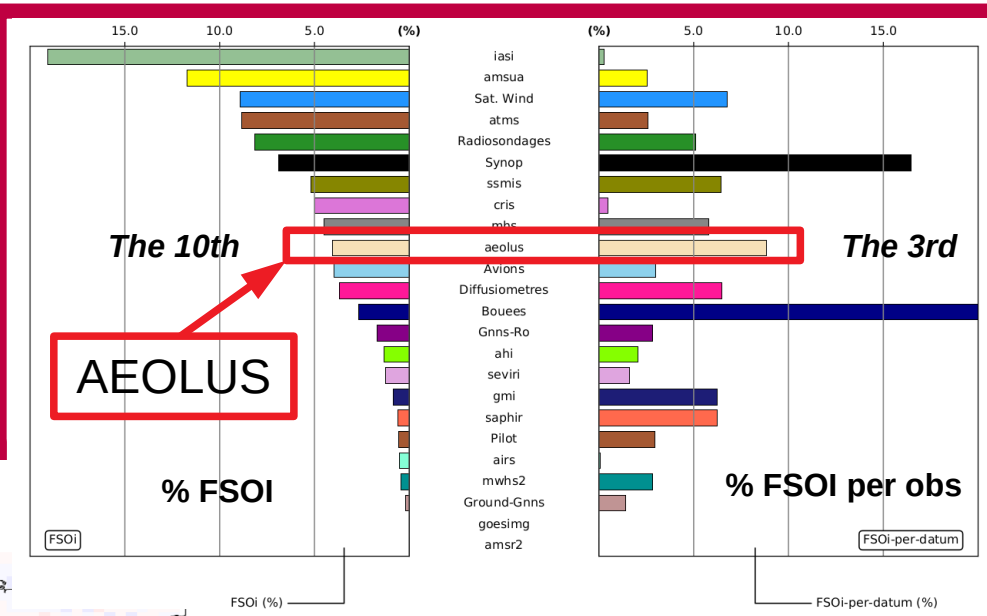
## HLOS winds M1 bias corrected

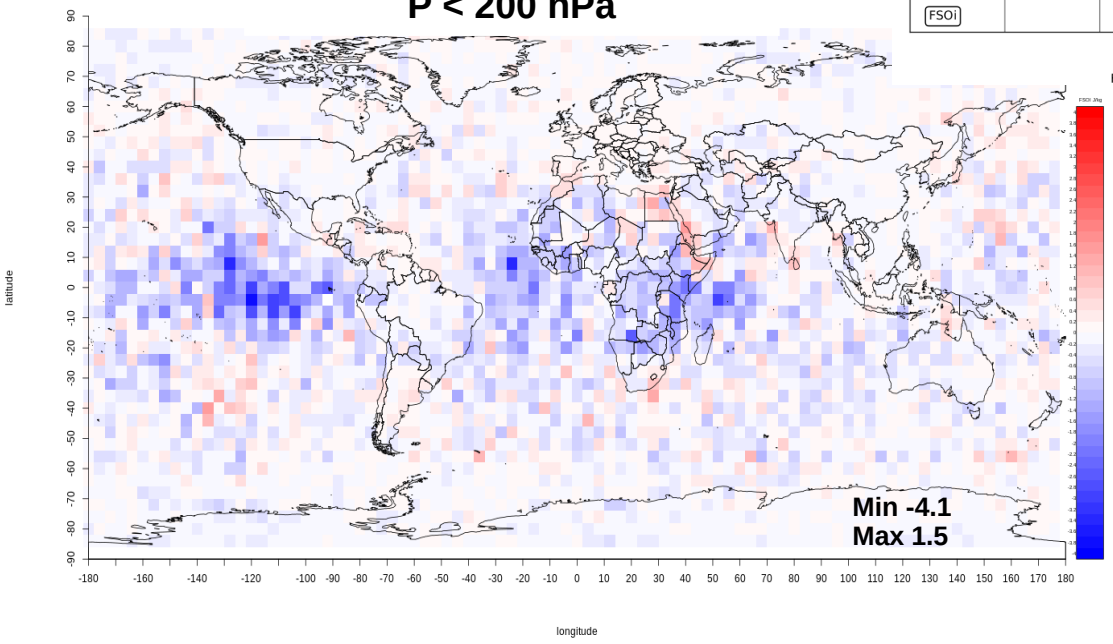
April 4 -May 24 2020

Information content of observations

| Obs type | Aeolus | GNSS-RO | RAOBs | IASI |
|---|---|---|---|---|
| % observation | 0.42 | 2.90 | 1.49 | 62 |
| % DFS | 2.3 (x5,5) | 13.5 (x4,7) | 6.00 (x4) | 33 (x0.52) |

**DFS**




Rayleigh/clear positive impact in 24h forecasts in tropical high levels especially for observations in data void areas (East Pacific, Atlantic, Africa)

**FSOI**

# Conclusions and future activities

- Assimilation experiments with FM-B laser (from July 2019), positive forecast scores : strong impact in the Tropics and to a lesser extent in the Southern Hemisphere, in NH with few aircraft data, large impact of Aeolus in data void regions.
- Operational monitoring in ARPEGE since January 2020
- Operational assimilation by end of June 2020 (together with data from 9 GNSS-RO receivers)
- Planned activities : improvements to the observation operator , evaluation within the convective scale model AROME, revised observation error scaling, separate impact assessment of Mie and Rayleigh channels, use of field campaigns for additional validations, examination of Aeolus impact on case studies (e.g. tropical storms).



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# Thank you for your attention !