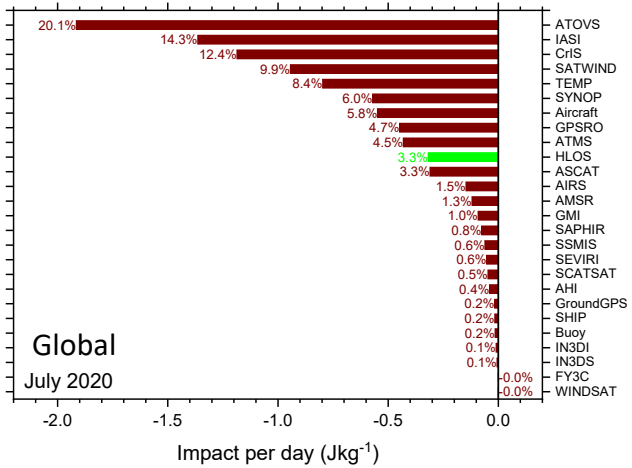
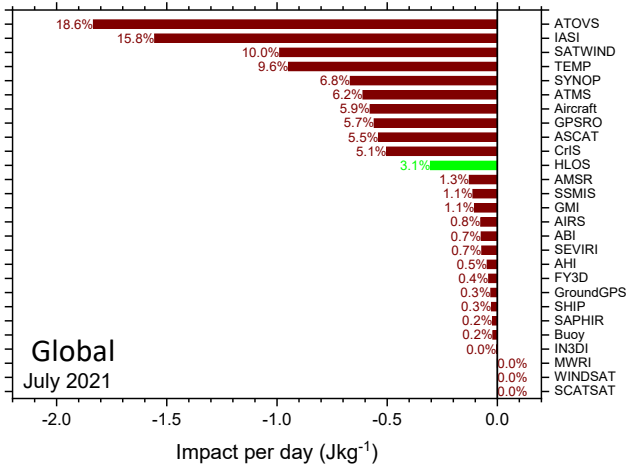
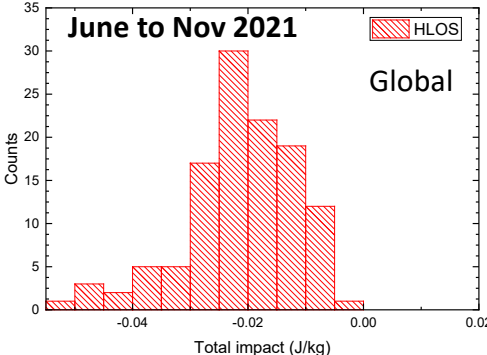
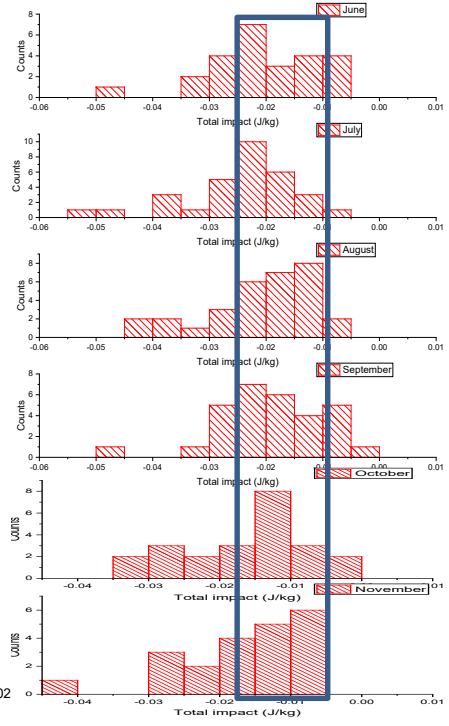
Multi-year impact of Aeolus HLOS wind in a global NWP system









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"3rd Aeolus NWP impact and L2B product quality working meeting"
1 and 3 December 2021

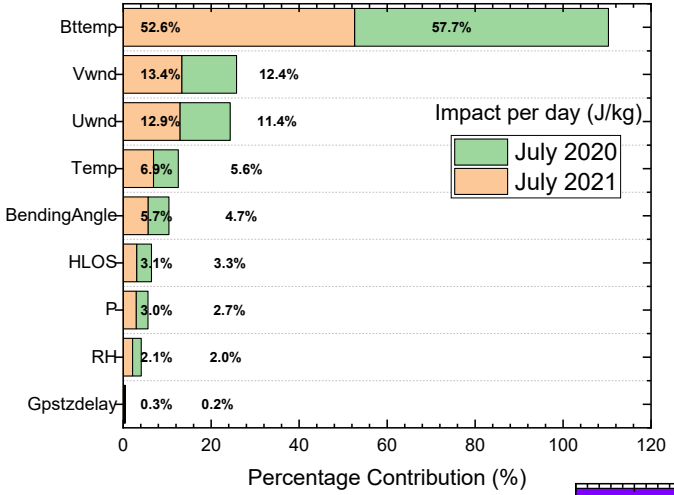
NCUM Global assimilation-forecast System (NCUM-G)

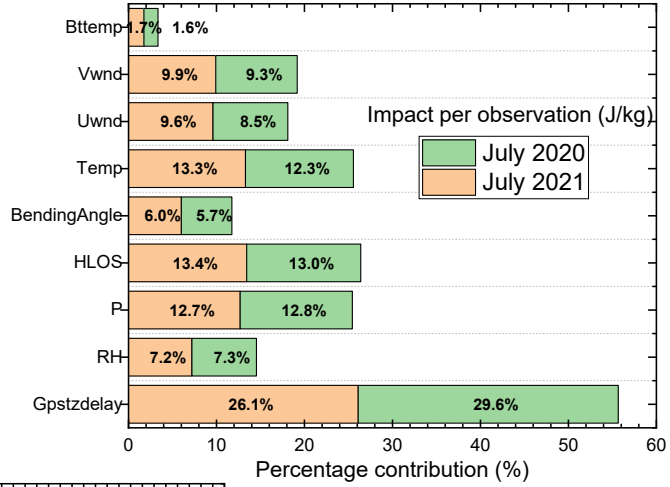
Model (NCUM-G:V7)	Atmospheric Data Assimilation	Surface analysis
Model: Unified Model; Version 11.2 **Domain: Global** **Horizontal Resolution:12 km** **Vertical levels: 70 levels (model top at 80 km)** • **Physical Parametrizations: Based on GA7.2** **Dynamical Core: ENDGame** • **Forecast length: 10 days (based on 00 UTC and 12 UTC initial conditions)**	**Method**: Hybrid incremental 4D-Var (Hybrid 4D-Var). Information on "errors of the day" is provided by NEPS (NCMRWF Ensemble Prediction System) **Data Assimilation Cycles:** 4 analyses per day at 00, 06, 12 and 18 UTC. **Observations:** •Observations received at NCMRWF from GTS (IMD) and various satellite data producers (NOAA/NESDIS, EUMETSAT, ISRO etc.) are used for assimilation. •Variational bias correction is applied to satellite radiance.	**Soil Moisture analysis:** Method: Simplified Extended Kalman Filter **Analysis time:** 00, 06, 12 and 18 UTC **Observations assimilated:** ASCAT soil wetness observations, Screen Temperature and Humidity increments **SST:** Updated at 12 UTC DA cycle (OSTIA based SST and sea-ice analysis) **Snow Analysis:** Satellite-derived snow analysis. Updated at 12 UTC DA cycle

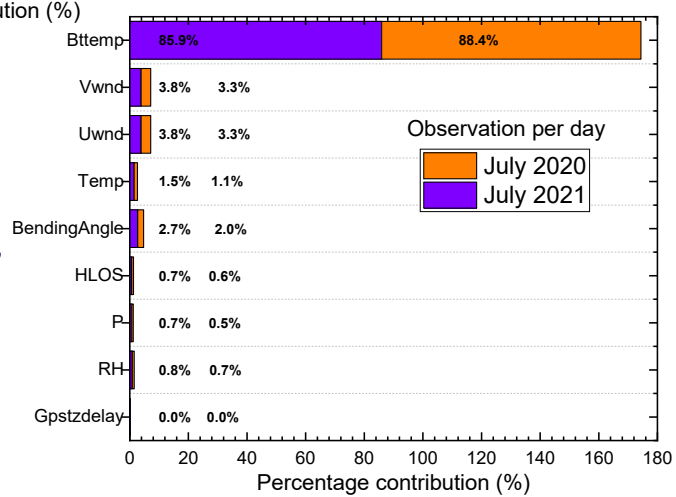
Upgraded DA system (similar to PS44) implemented on 21 May 2021

- Aeolus HLOS wind (both Rayleigh and Mie) assimilation started on 21 May 2021
- Parallel runs of upgraded DA, along with HLOS assimilation, also available from 21 May to 31 July 2020

Variables-wise observation impact







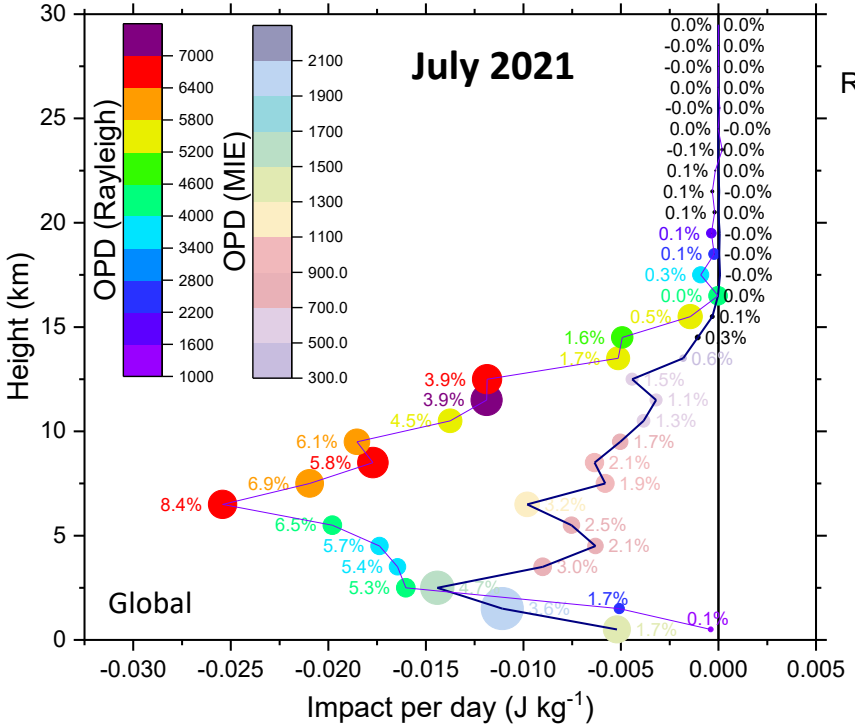
Uwnd and Vwnd contributor

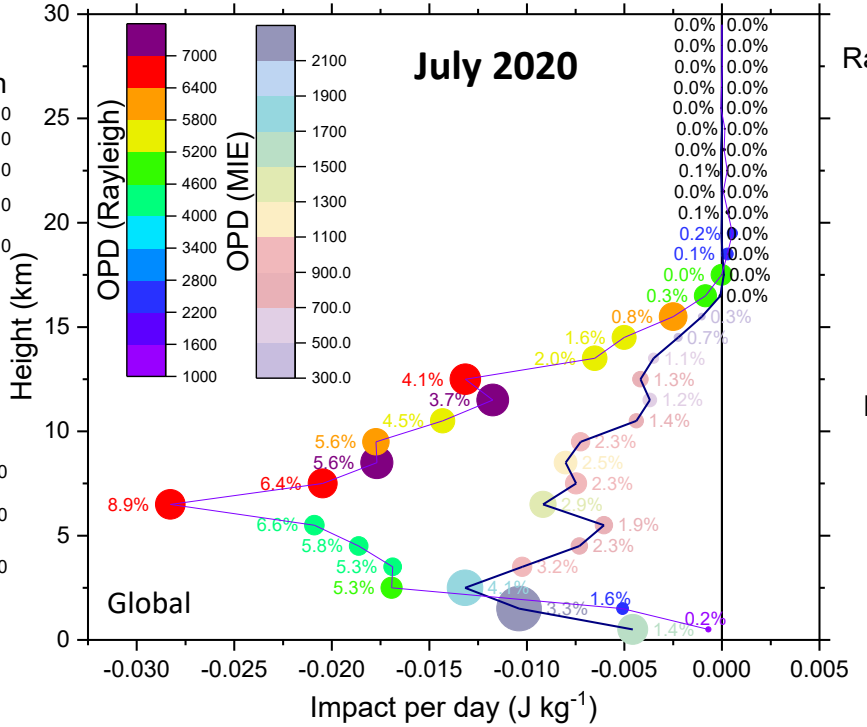
SONDE, Pilot, Winpro, Surface, Aircraft, BUOY

Satellite AMVs (Geo &Leo): GOES, JMA, INSAT, MSG, MetOp, MODIS, ASCAT

Percentages are w.r.t. to all observation

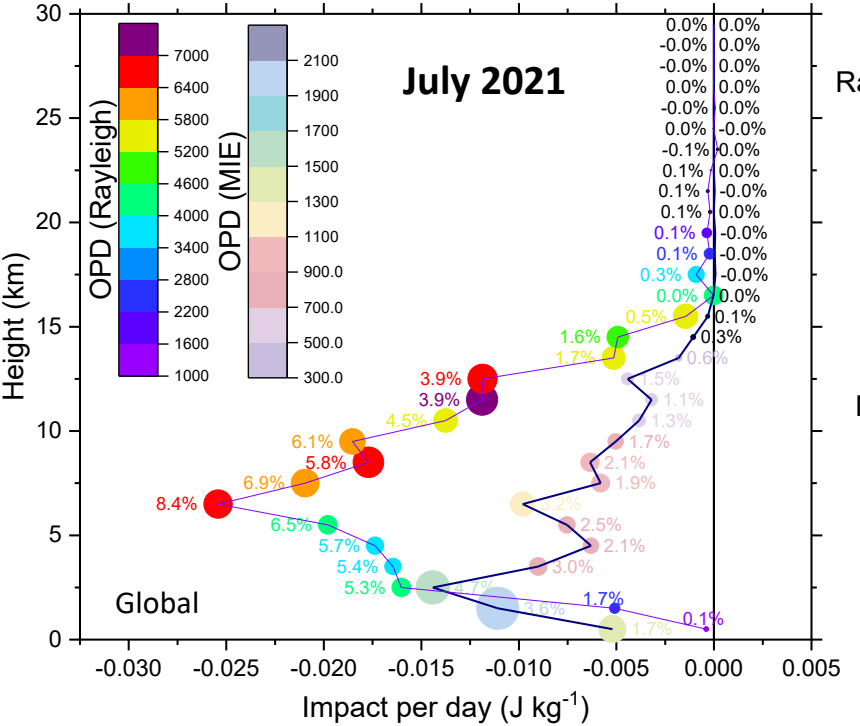
Height-wise impact of HLOSwind (Rayleigh and Mie retrievals)

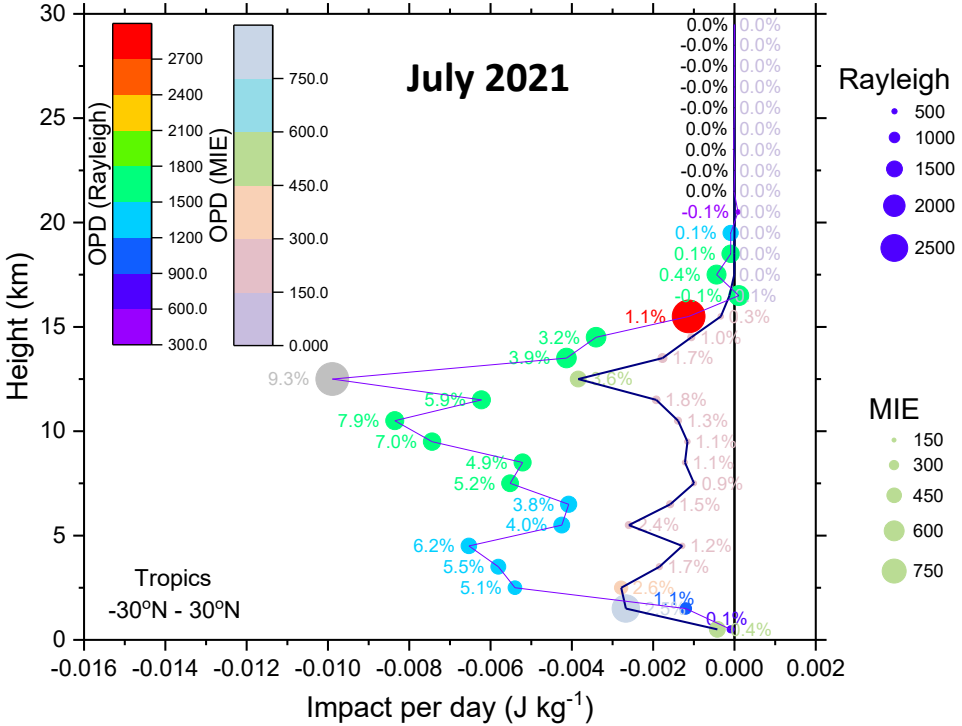




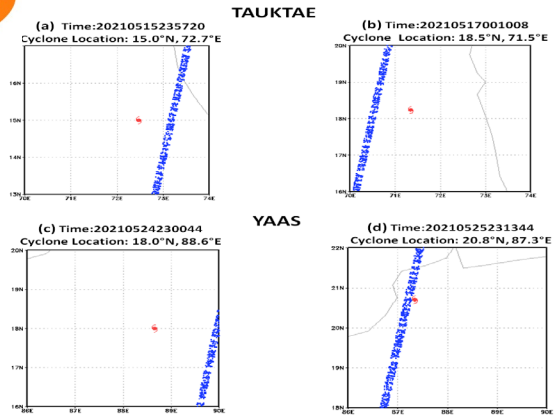
Percentages are w.r.t. total HLOS impact

Regional height-wise impact of HLOSwind (Rayleigh and Mie retrievals)



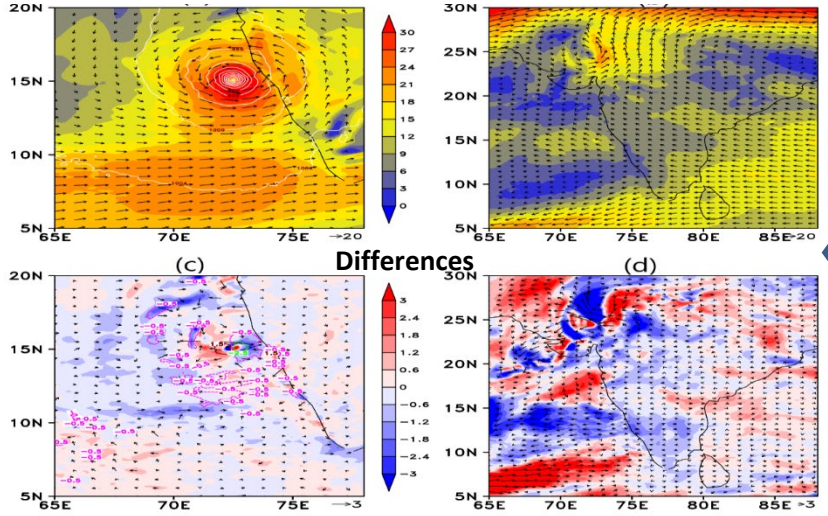


Aeolus passes during 2021 pre-monsoon NIO cyclone period and impact of assimilation



850 hPa wind and MSLP with Aeolus

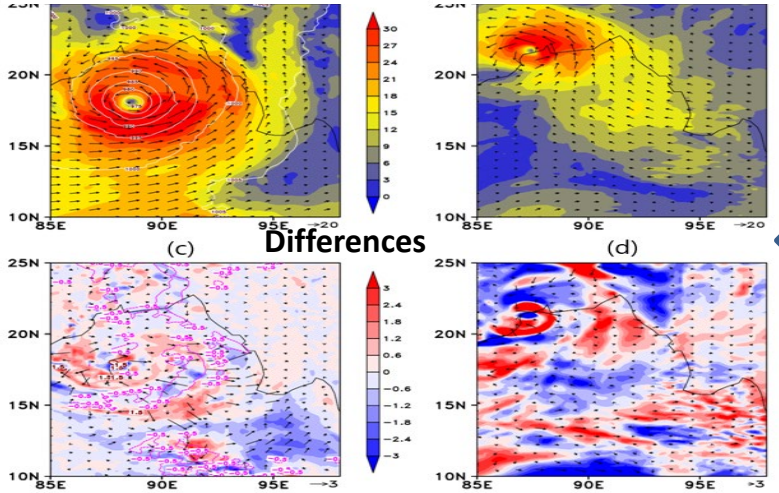
250 hPa wind with Aeolus



Tauktae

850 hPa wind and MSLP with Aeolus

250 hPa wind with Aeolus

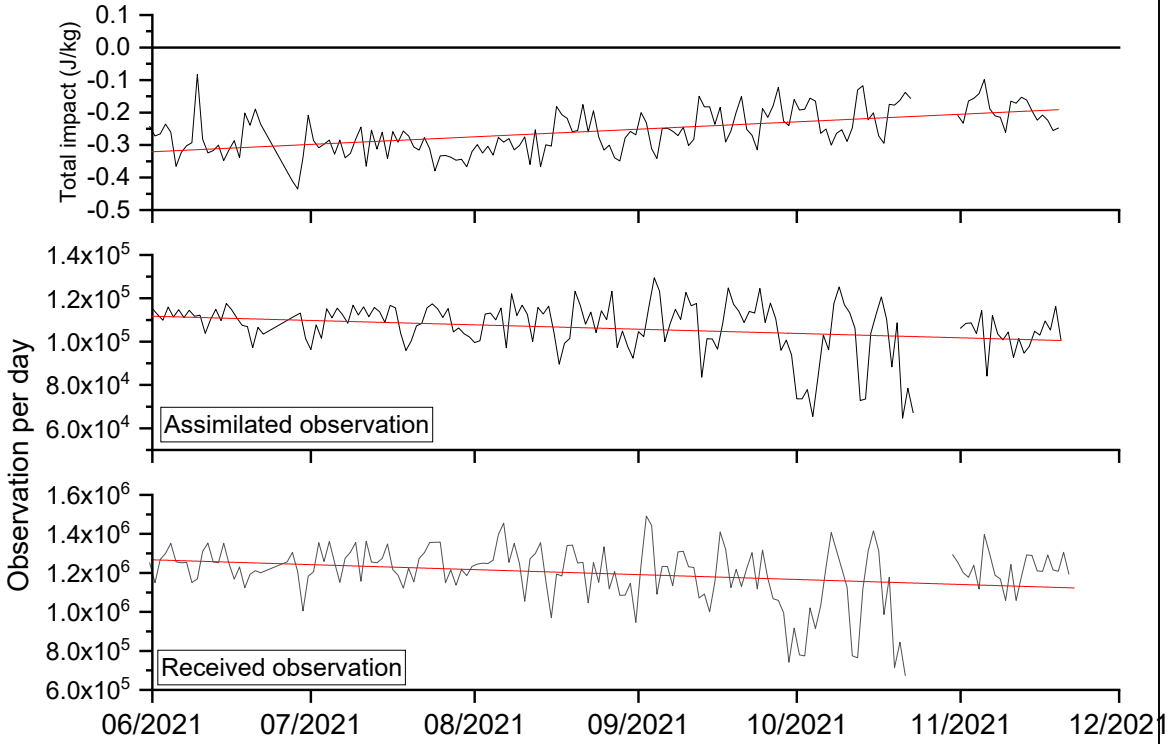


YAAS

Slight improvement is observed with the assimilation of HLOS wind in simulating cyclone center position and center pressure for both the system.

Under Review QJRMS

Status of Aeolus HLOSwind assimilation at NCMRWF



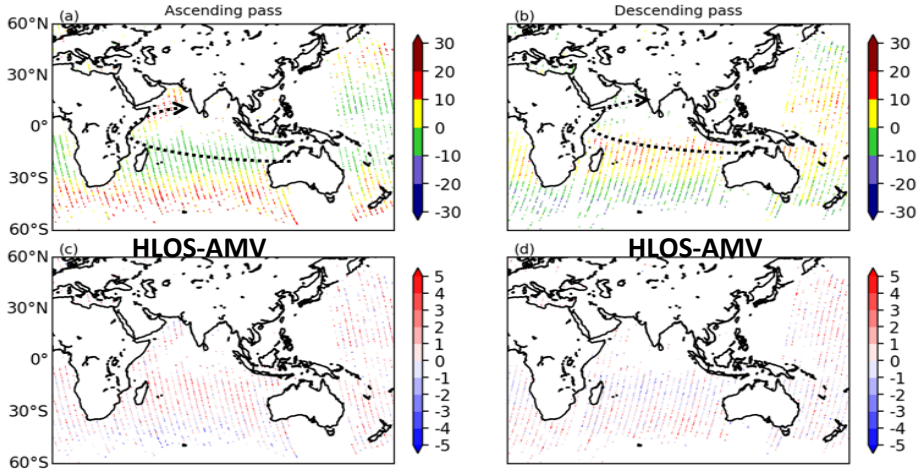
Summary

- HLOS has high impact per observations (ranked 3rd in our NWP system)
- Vertical profile of HLOS impact:
  - Impact increases with height for both Rayleigh and MIE
  - MIE winds impact peaked lower than Rayleigh
  - Regional variations in impact profiles look similar for both MIE and Rayleigh
- Higher beneficial impact of HLOS (both Rayleigh and Mie) wind at high altitude.

Thank you all for patience listening

Acknowledgement: We sincerely acknowledge all data providers and especially ESA for Aeolus data.

Aeolus HLOS validation against satellite AMVs(JJA,2020)



Low Level Jet

Westerlies/Easterlies are positive/Negative in the Aeolus ascending/descending passes

Tropical Easterly Jet

Sub-tropical Jets