Impact of satellite microwave observations in NCMRWF operational Numerical Weather Prediction

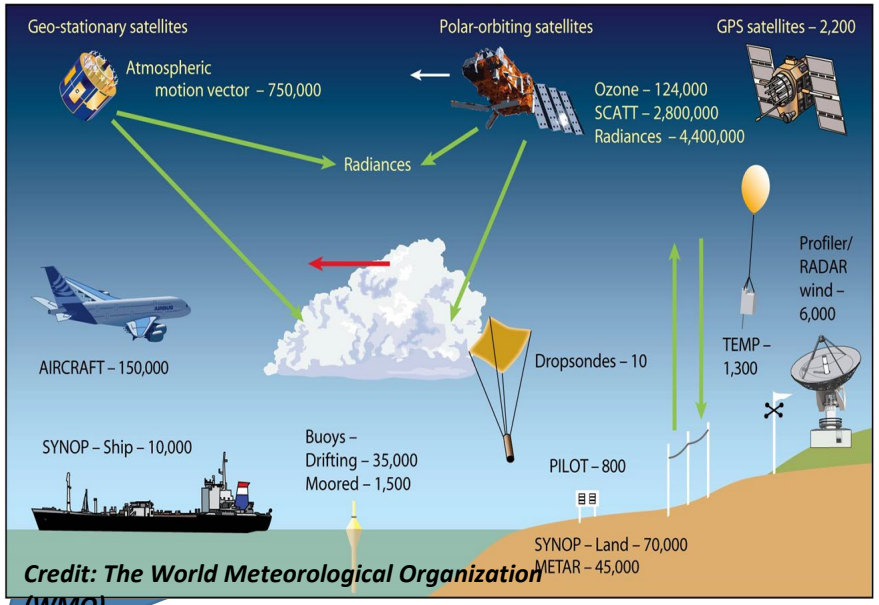
Sumit Kumar, S. Indira Rani, John P. George and DA Team

National Centre for Medium Range Weather Forecasting (NCMRWF), A-50, Sector–62, Noida-201309, India

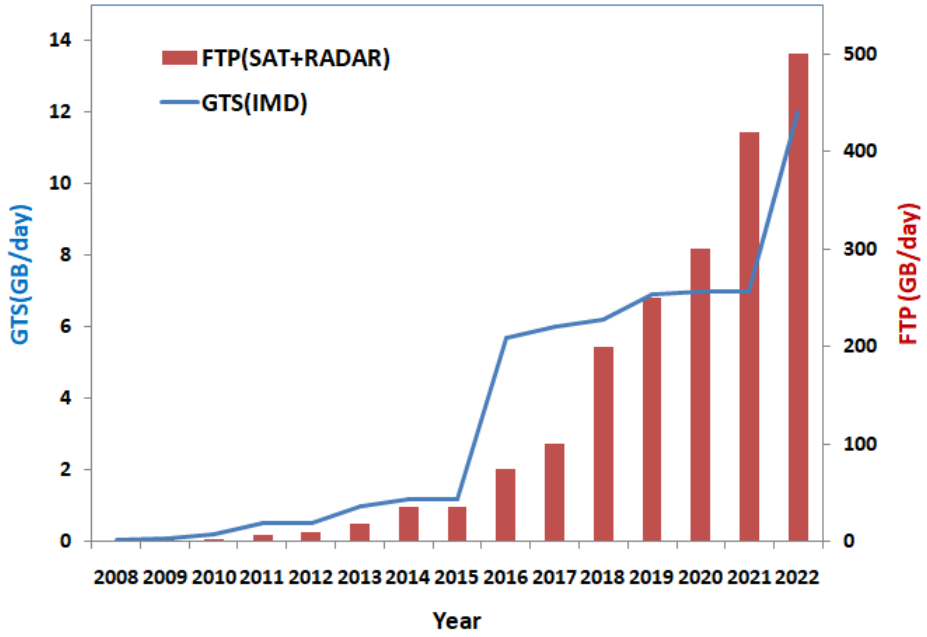
Acknowledge the financial support from ITWG

Global Observation Network

- NCMRWF *Hybrid-4D-Var data assimilation system is assimilating ~10^7 observations per a 6-h assimilation window
  - *Error of the day information provided by 22 member Ensemble forecast system of NCMRWF



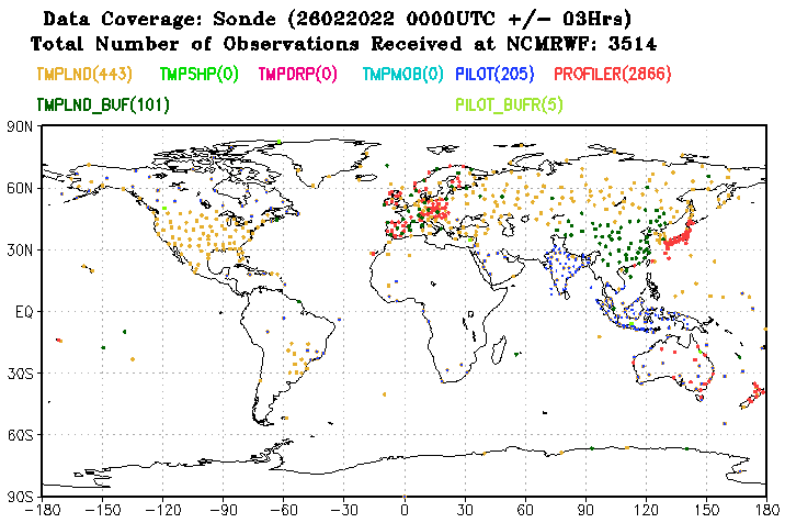
- Conventional observations
  - Surface-based (Land & Ocean)
  - Upper-air (Sonde, Wind profiler etc.)
- Satellite observations
  - IR and MW radiances from polar and geos. satellites
  - AMVs
  - Radio occultation
  - Scatterometer
  - etc

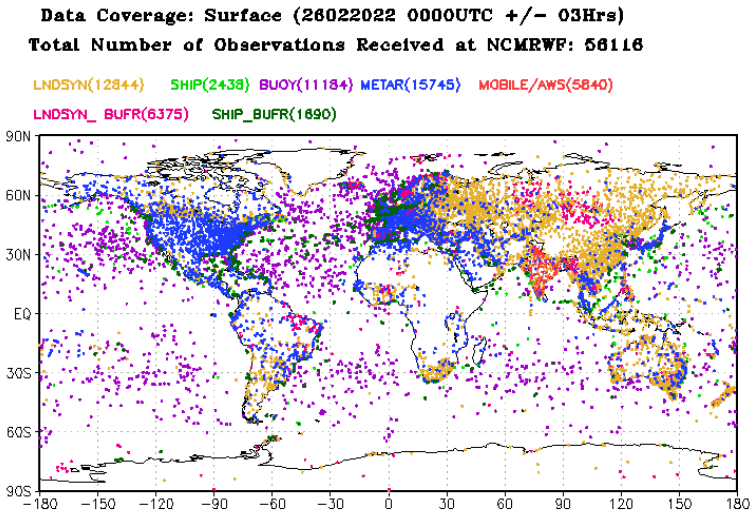


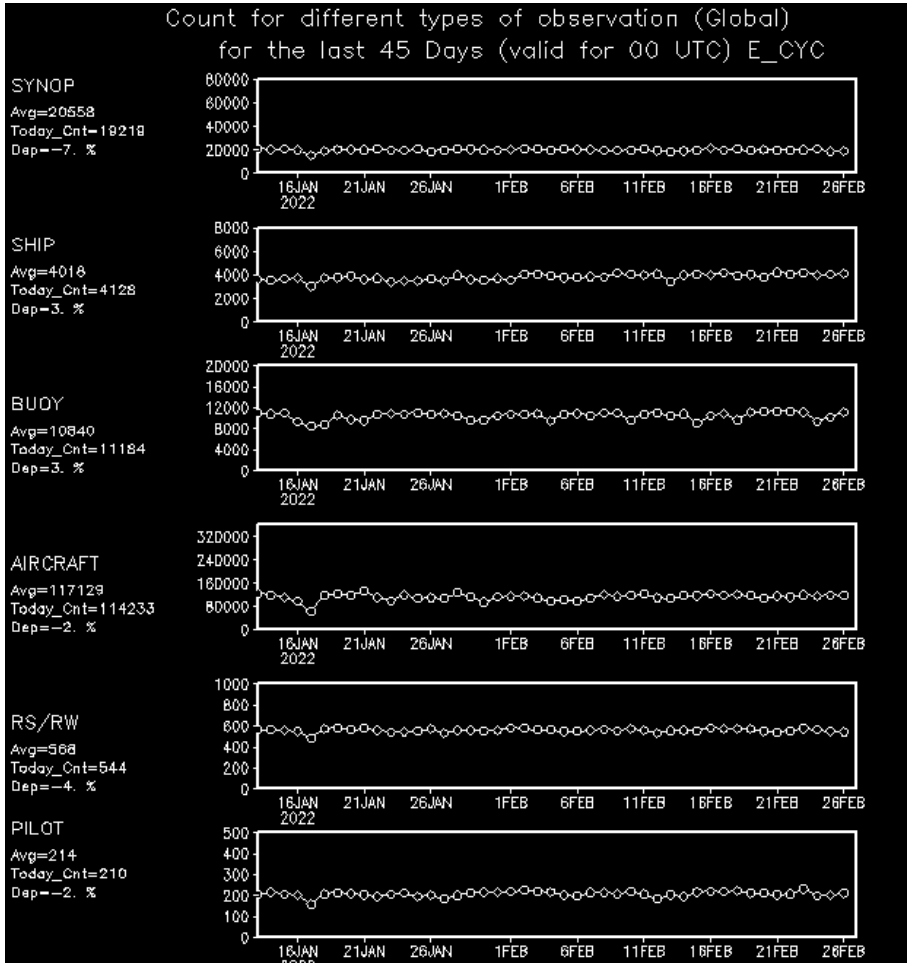
NCUM Global NWP System

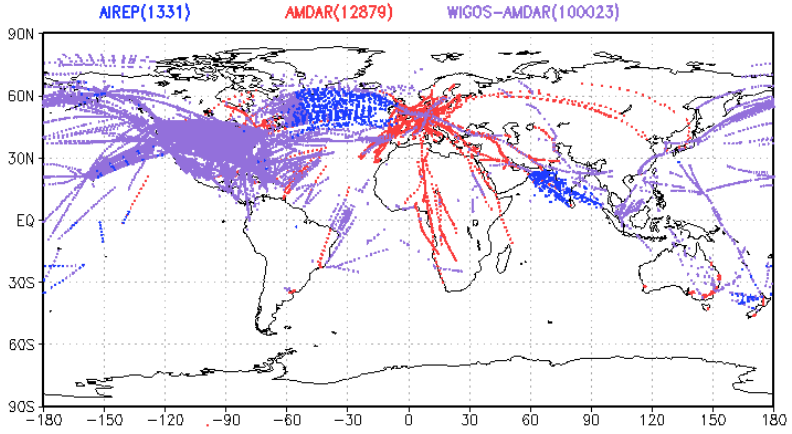
OPpS → OPS → Hybrid 4D-Var → NCUM → Post Processing & Product Generation

Data sources : Conventional observations





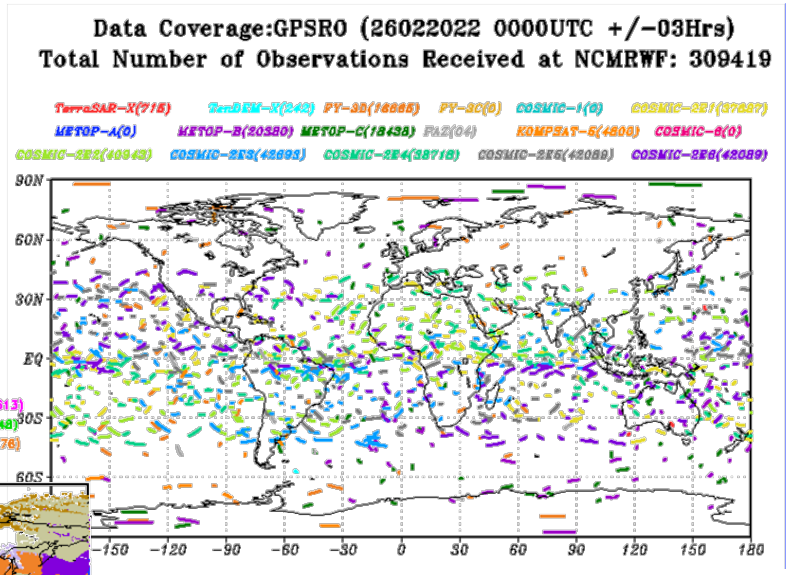


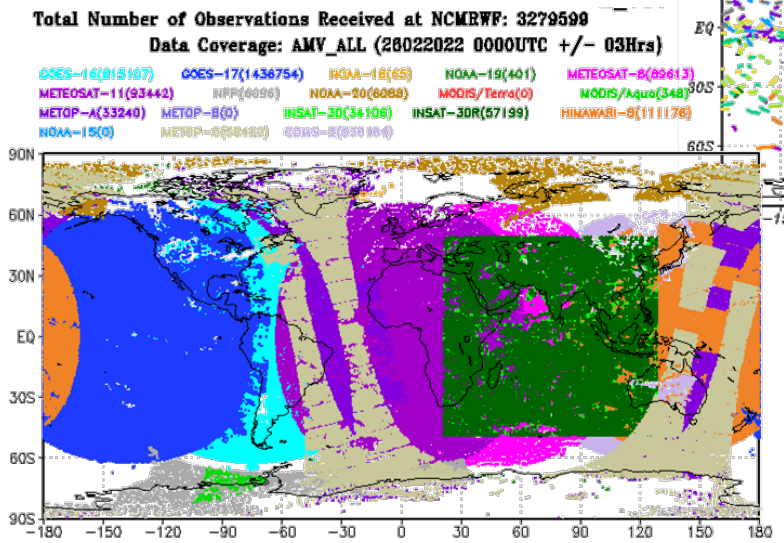


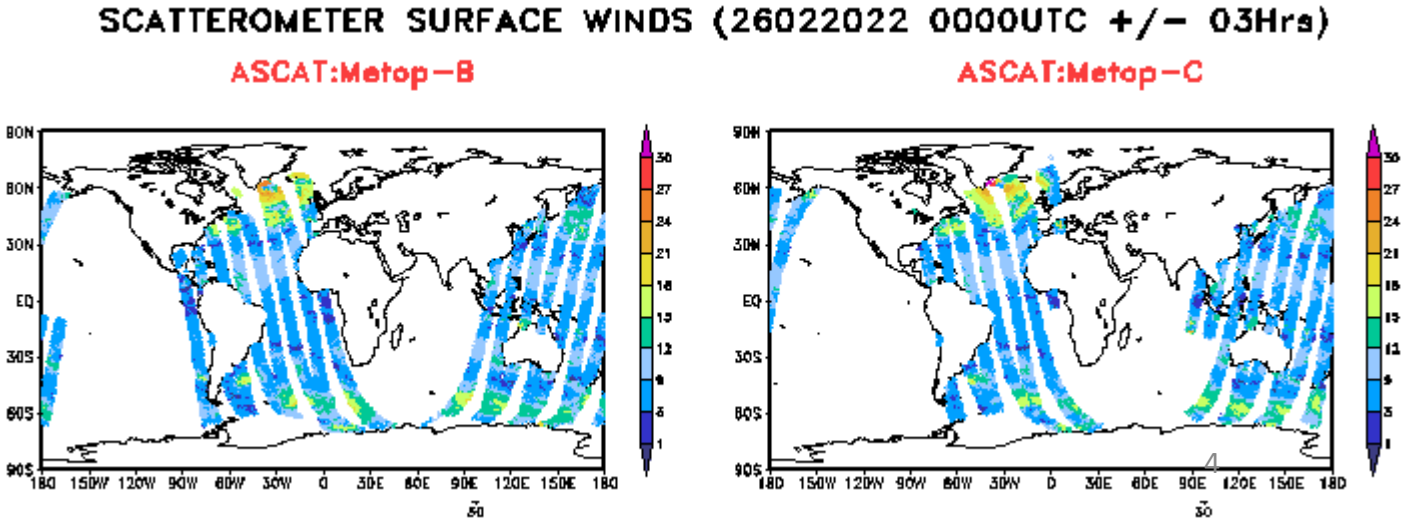
Instrument	Parameters
SYNOP-SHIP- METAR	10-m wind, MSL pressure, 2m-rel humidity, temperature
BUOY	Wind, temperature, MSL pressure
TEMP DROPSONDES	Wind, temperature, spec. humidity
PROFILER	Wind
PILOT	Wind
AIRCRAFT	Wind, temperature, spec. humidity

Data sources: Satellite observations

Obs. type	Instrument / Satellite
Hyper spectral IR sounder	IASI on MetOp-A +B +C; CrIS on NPP & NOAA20 AIRS on Aqua; CrIS on S-NPP
Geostationary multi-channel radiances	INSAT 3D (I & S), MET-7, MET-10, GOES-13, GOES-15, Himawari-8
MW sounders (T & Q)	AMSU-A on NOAA-15/18/19; Aqua and MetOp-A +B; ATMS on S-NPP ATMS on S-NPP & NOAA20 MHS on NOAA-18/19 and MetOp-A + B MWHS2 on FY-3C & FY-3D, SAPHIR
MW imager	SSMIS on DMSP-F17/F18; AMSR2 on GCOM-W; GMI on GPM MWRI
Atmospheric Motion Vectors (AMVs)	INSAT: 3D & 3R, MET-7/8/9, MET-10/11, GOES-13, GOES-15 /16, Himawari-8/9, NOAA-15/18/19, AVHRR, Aqua Modis, MetOp-A +B, NPP, Dual MetOp
Scatterometer	ASCAT on MetOp-A + B + C, WINDSAT, SCATSAT
Radio occultation	Spire, GeoOptics, KOMPSAT, PAZ, FY-3C& 3D, MetOp-A, B & C, GRACE-C & D, COSMIC-6, TerraSAR-X, TanDEM-X
AOD	MODIS: Aqua & Terra

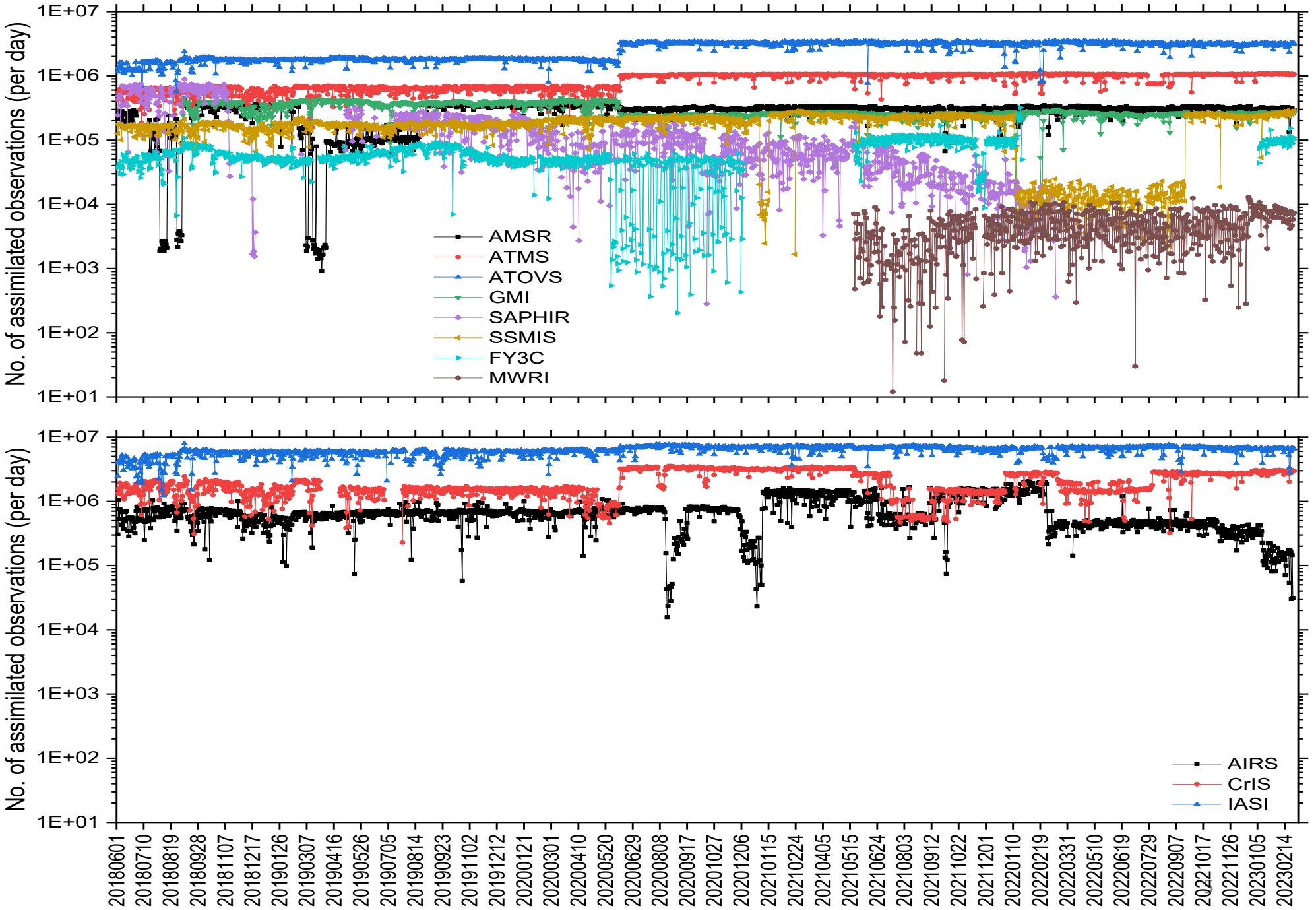




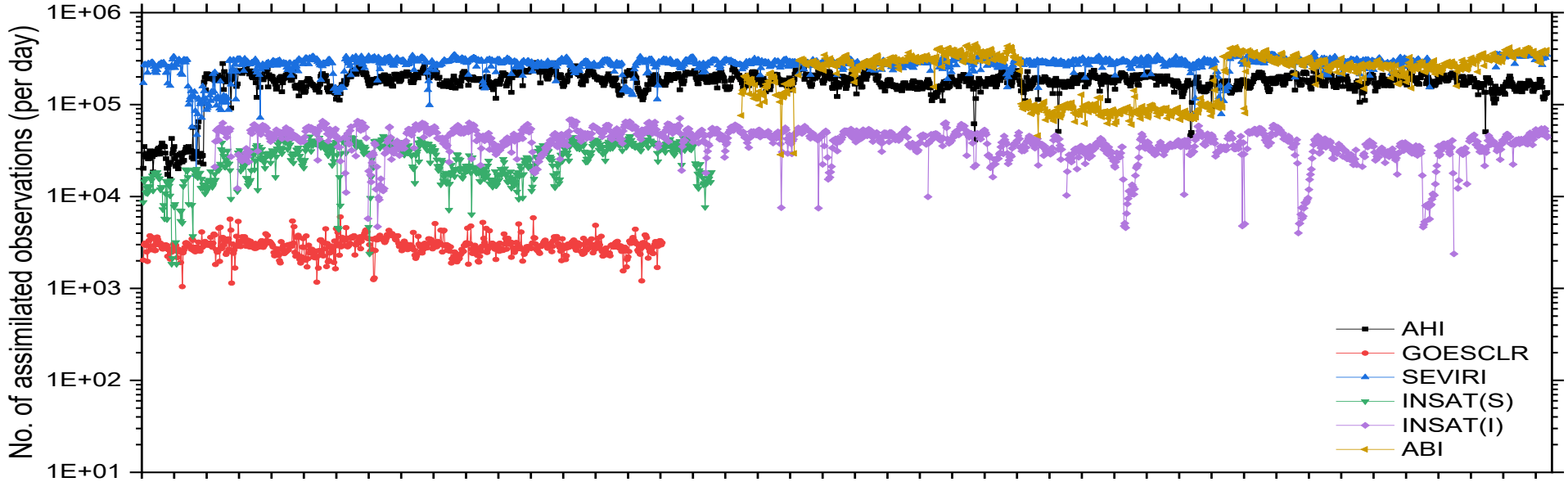


Microwave

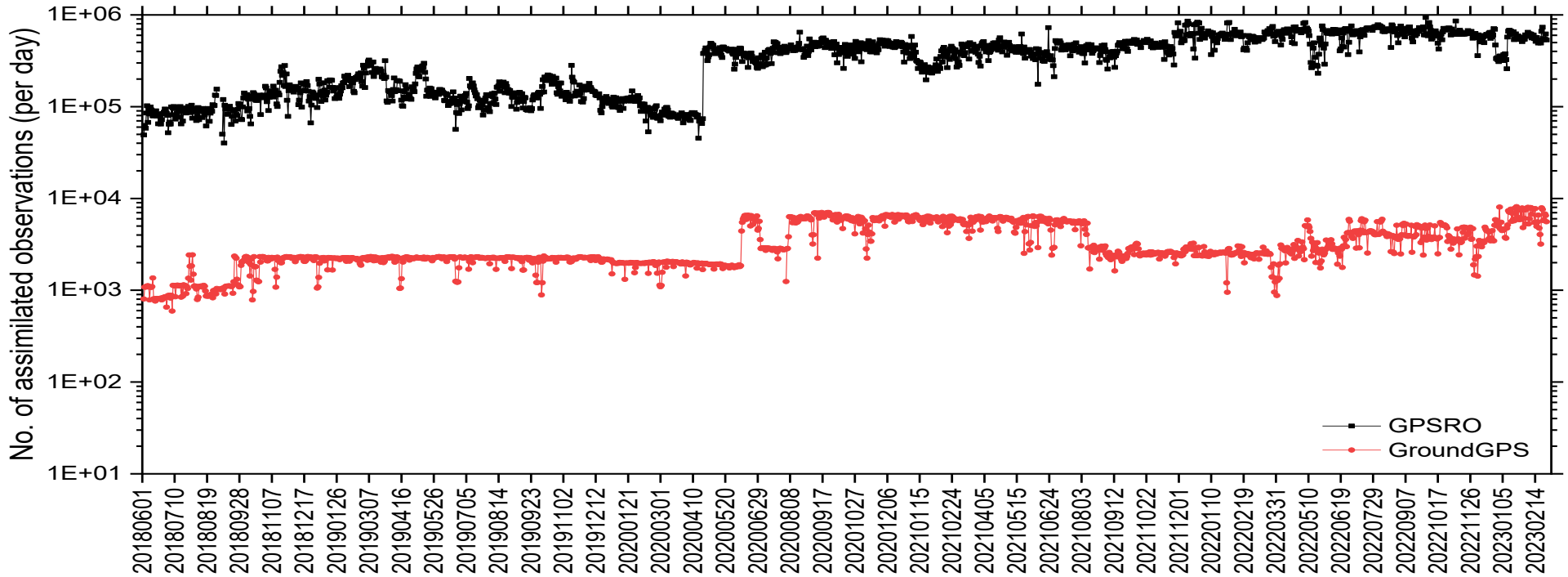
Hyper spectral (IR)



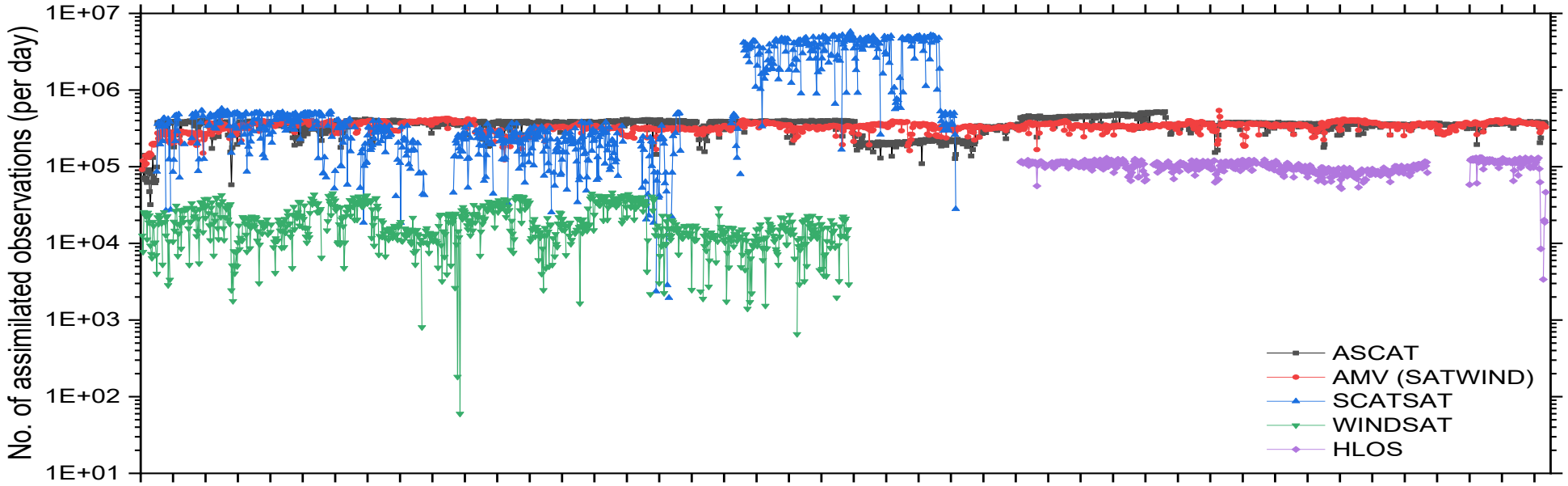
GEO:
Imager/Sounders



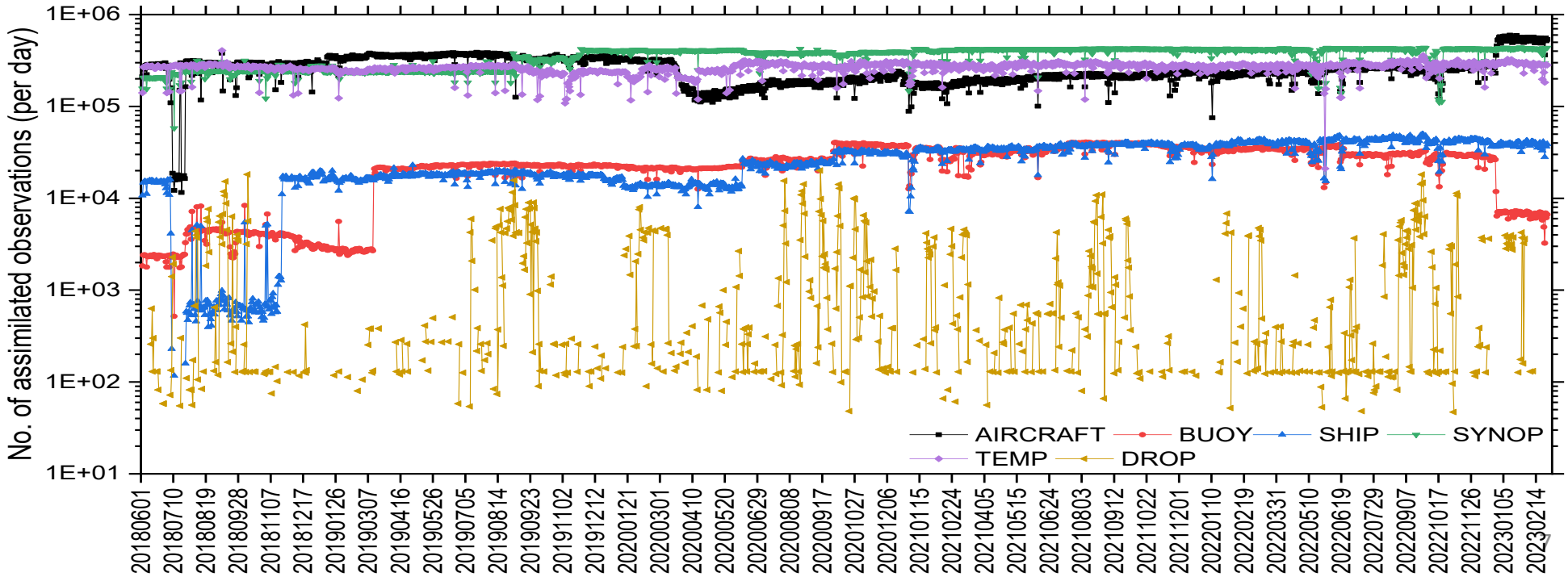
GPSRO &
GroundGPS



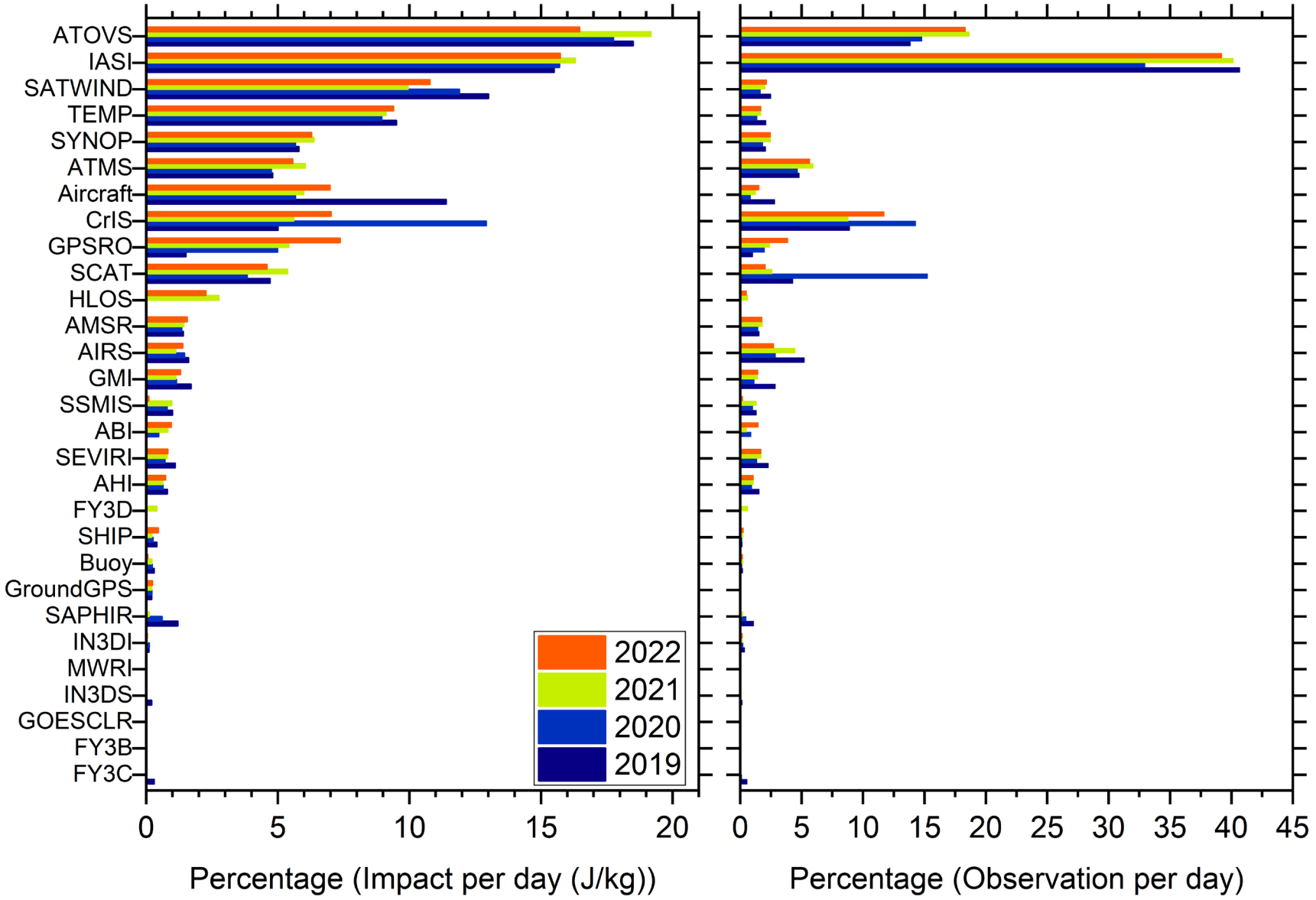
Satellite wind



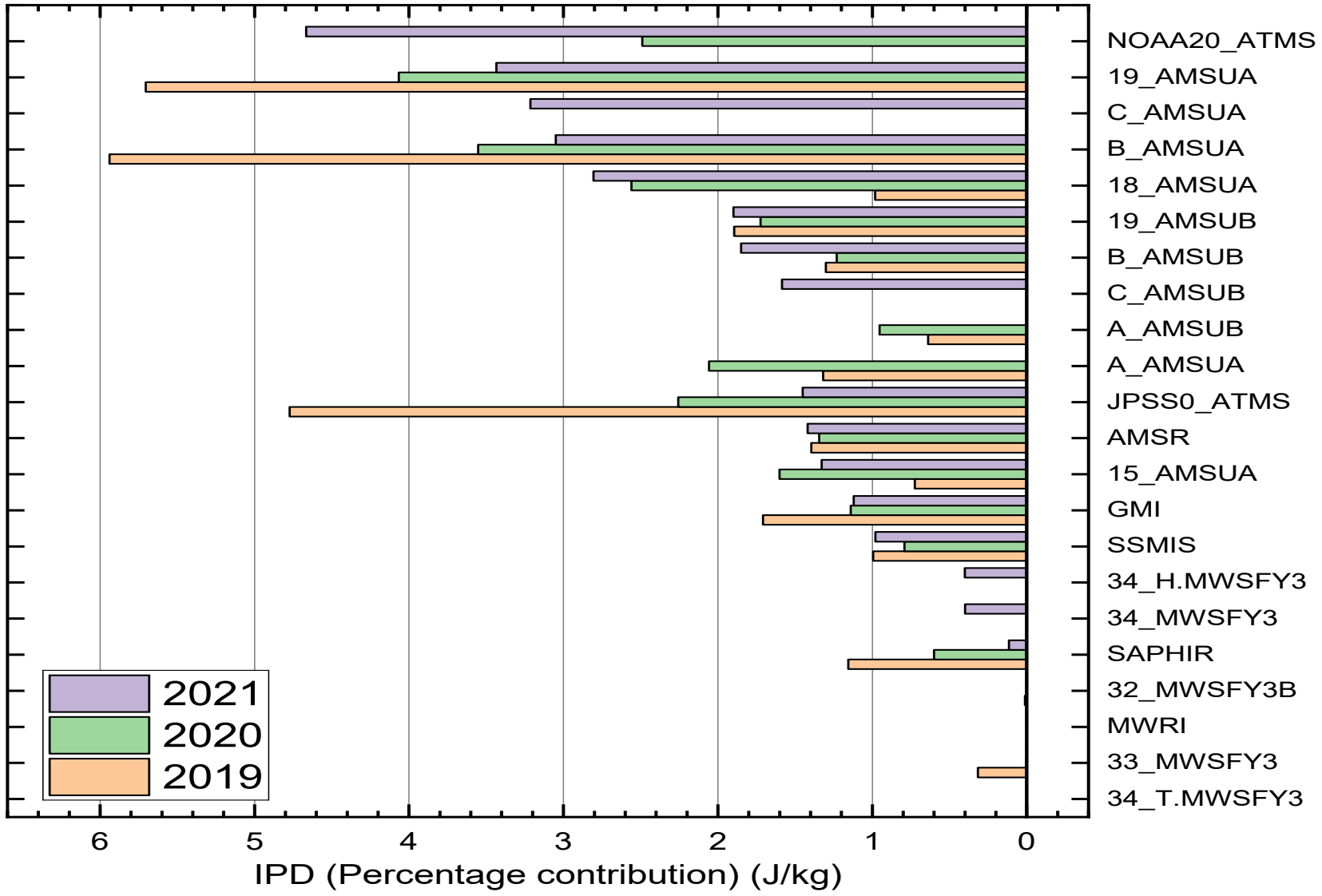
Conventional



Relative impact of observation

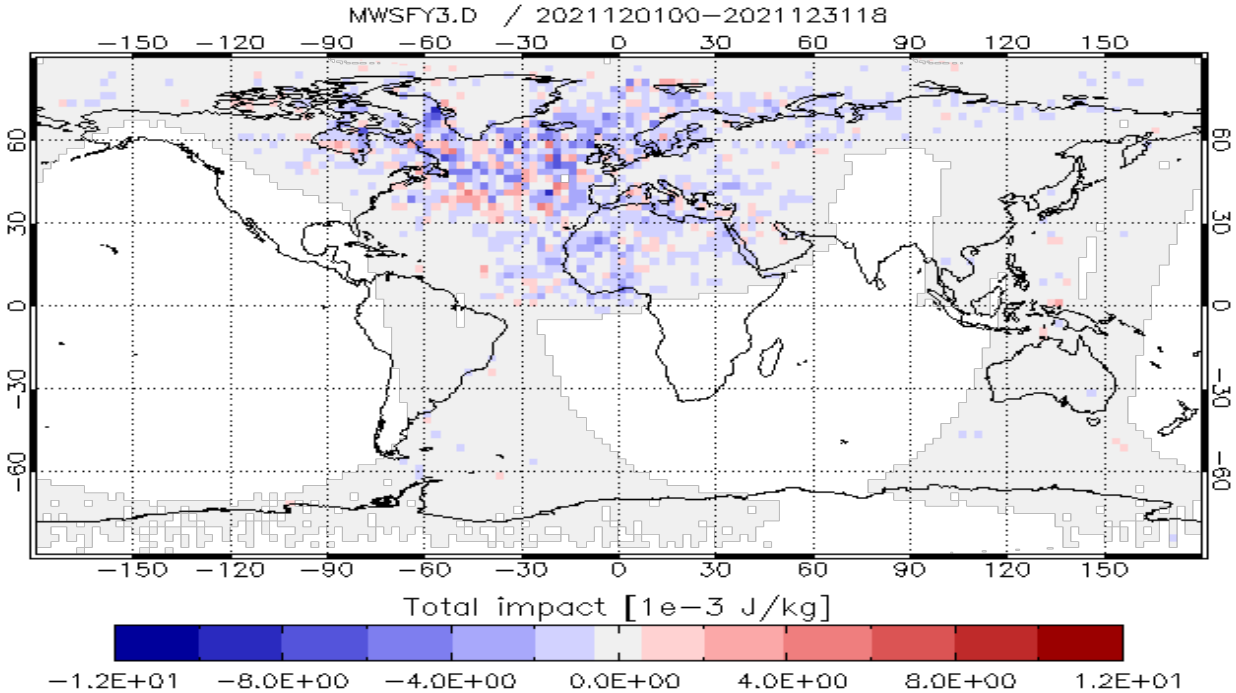


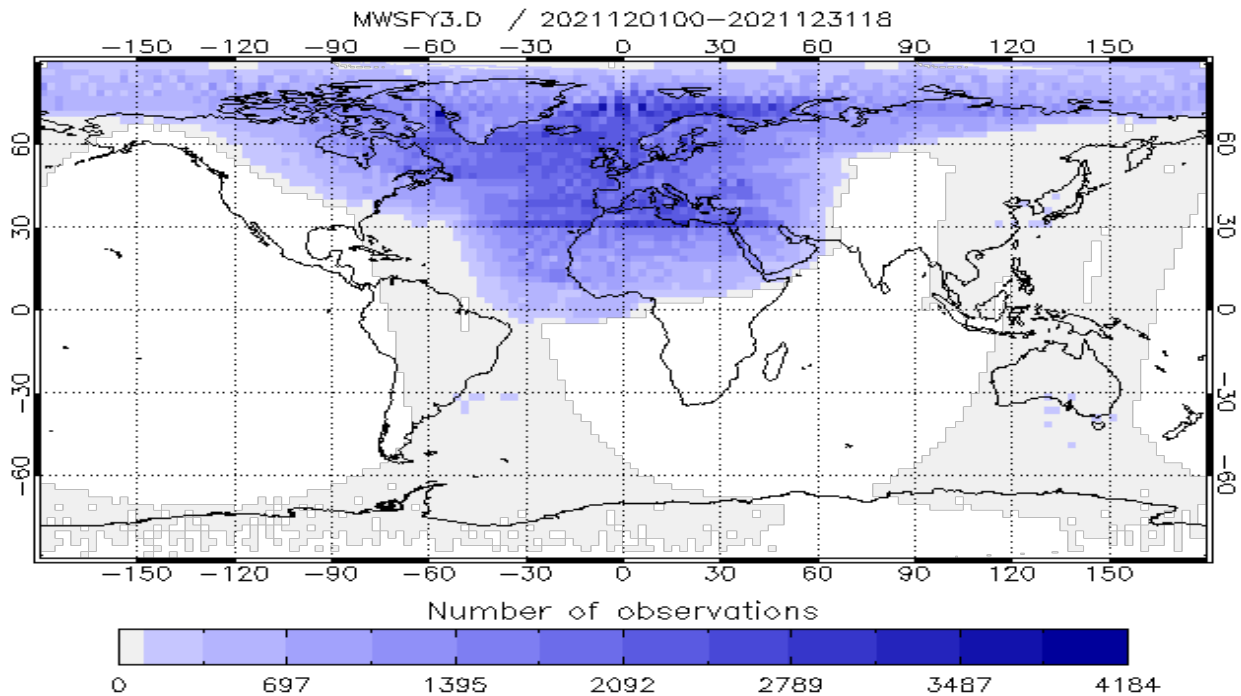
FSOI: Microwave instruments (Sounders & Imagers)



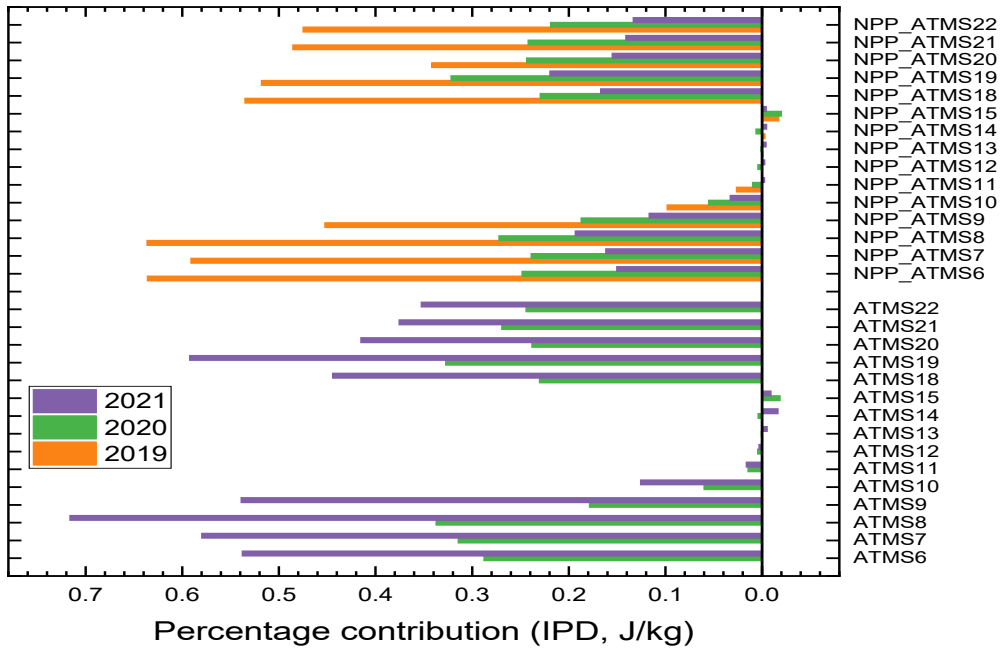
- **Sorted w.r.t. 2021 impact**

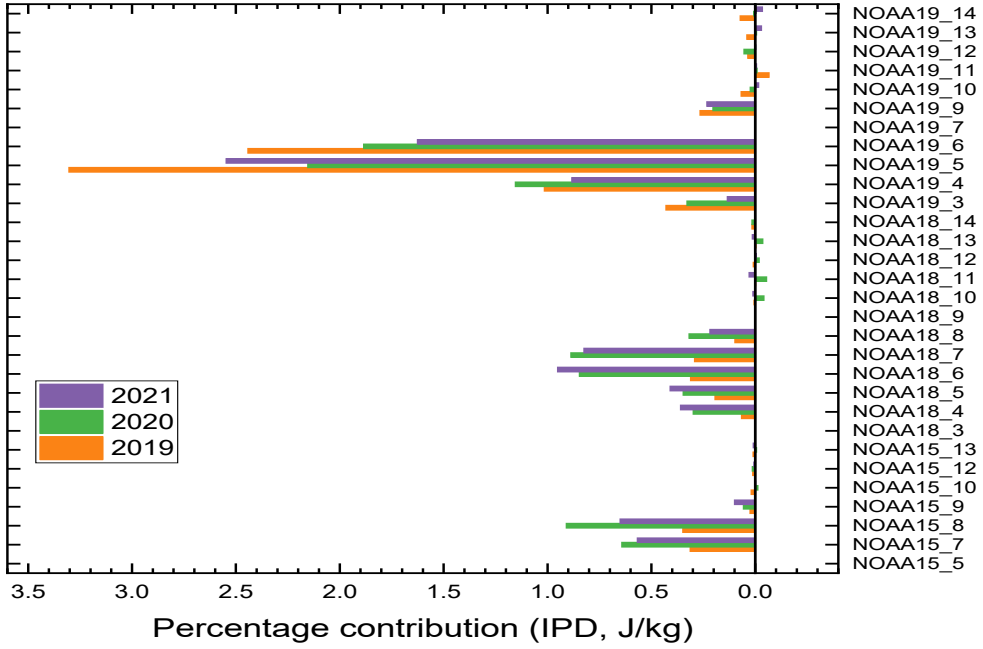
Example: limited data coverage
FY34: MWSF3

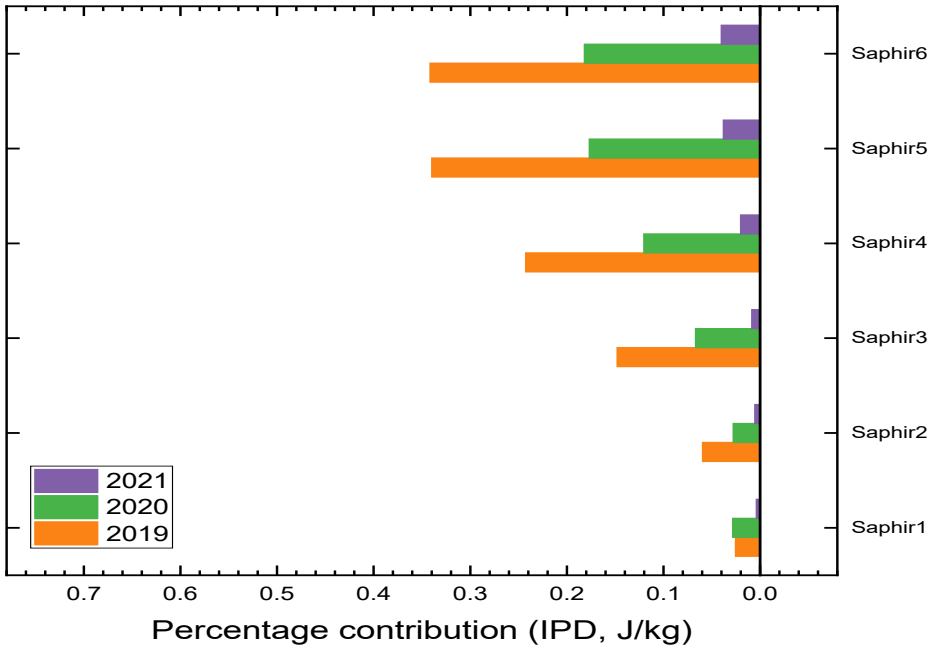


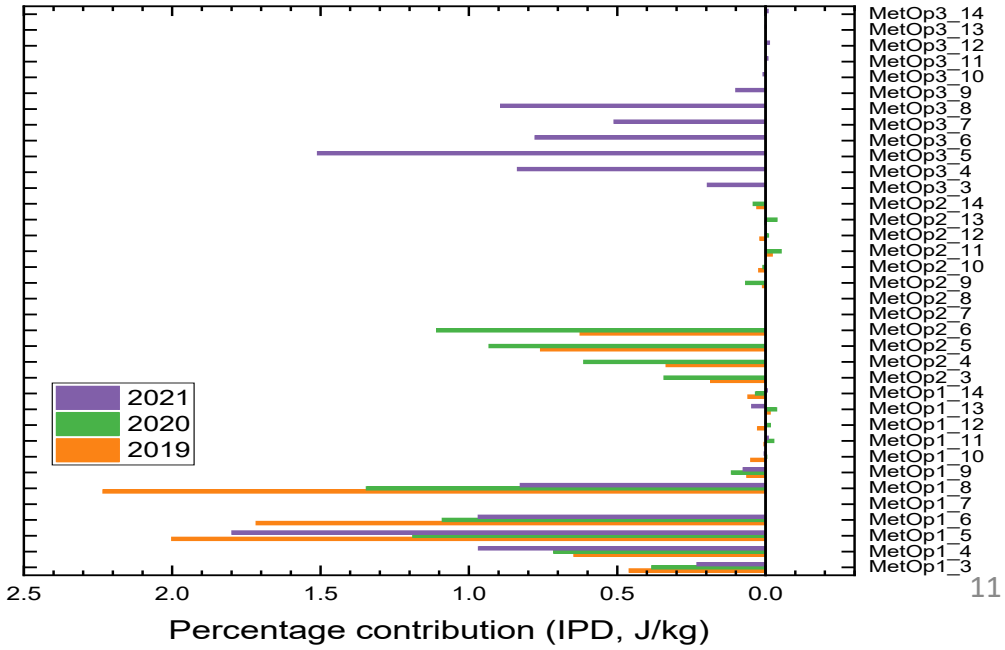


FSOI: MW Channel-wise contribution

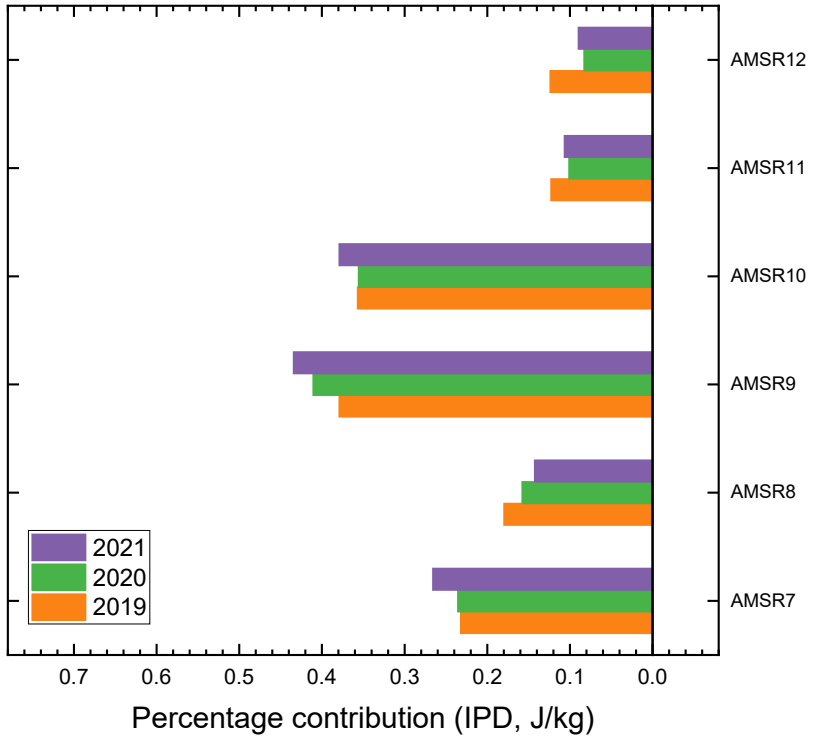


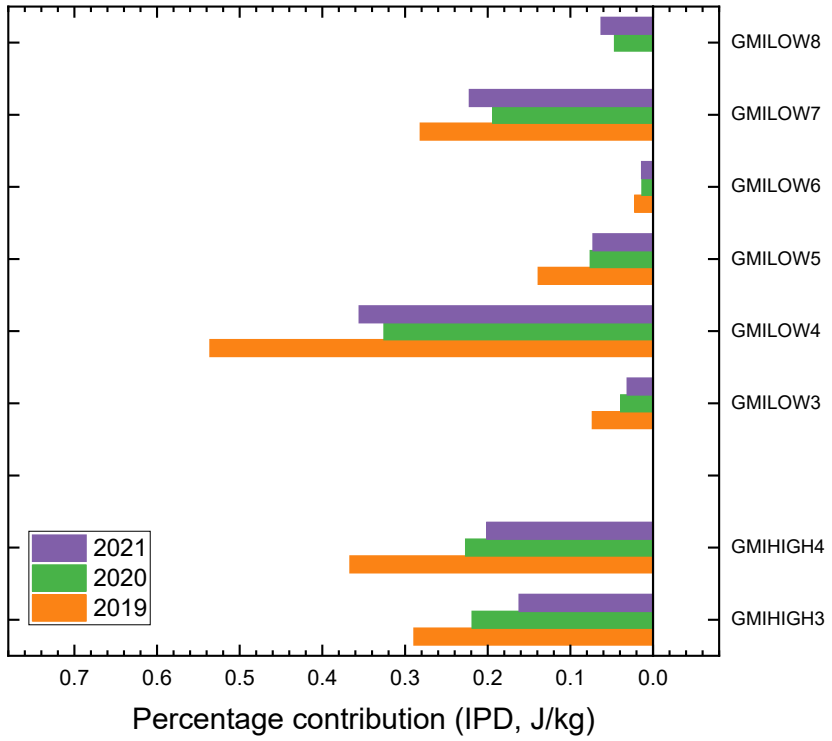


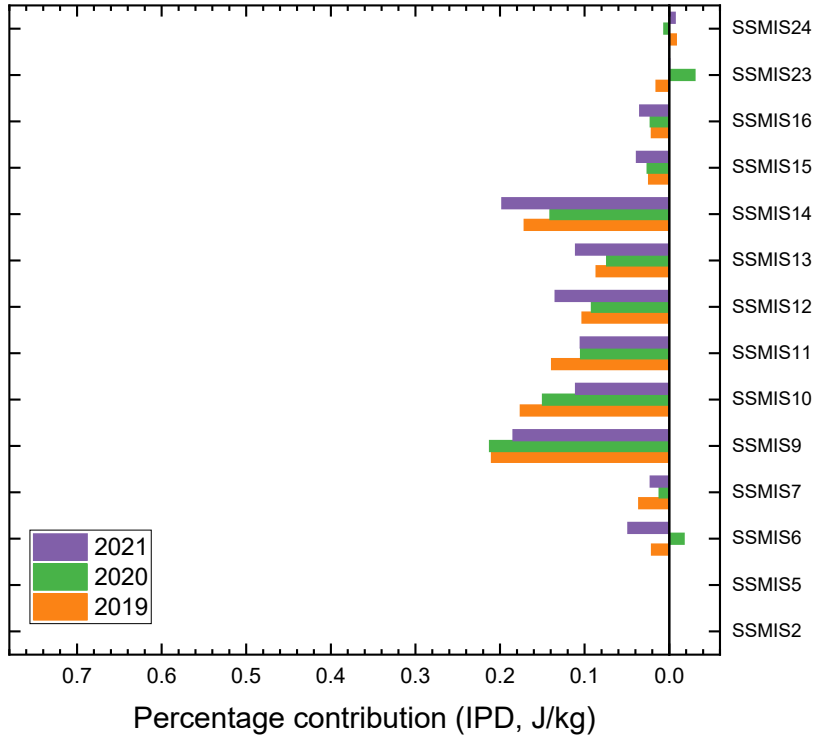




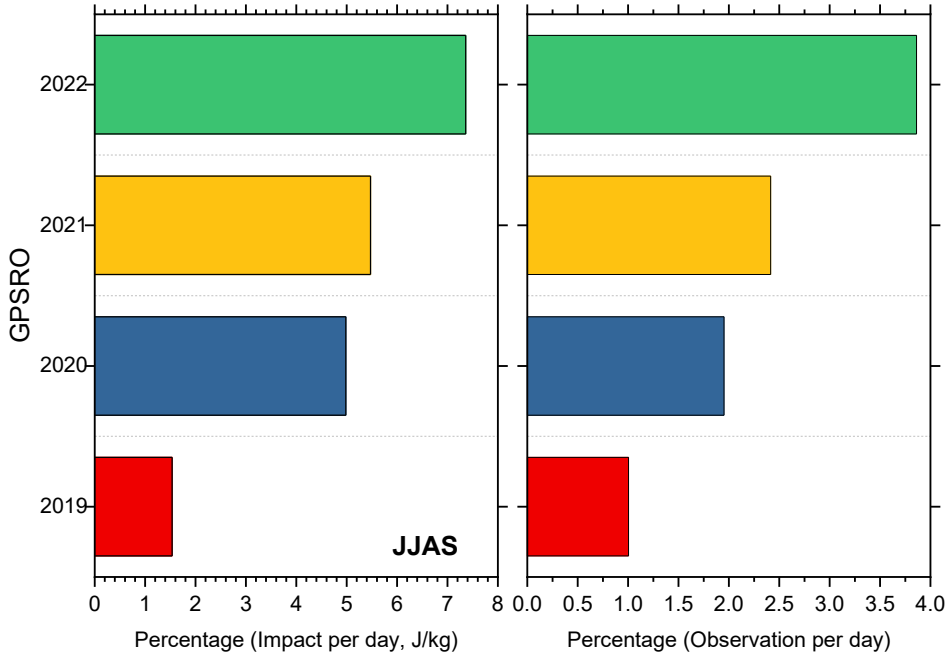
FSOI: MW Channel-wise contribution

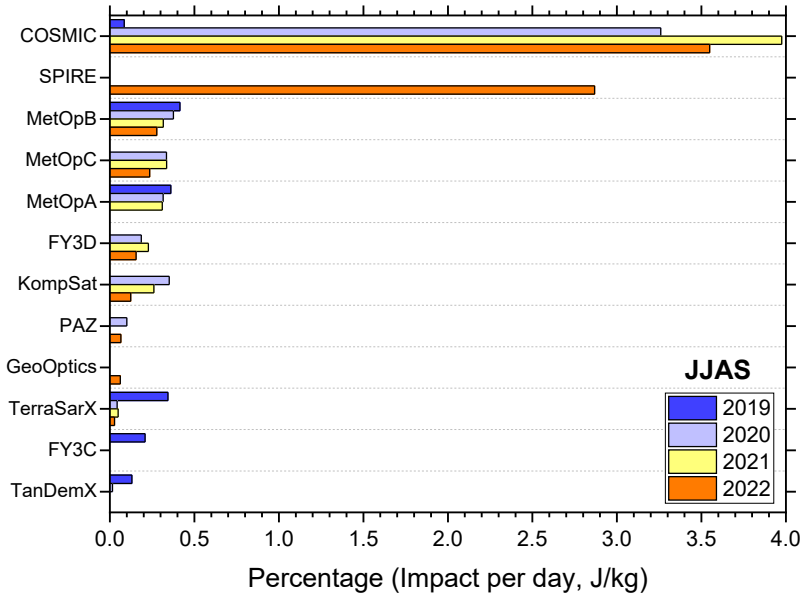


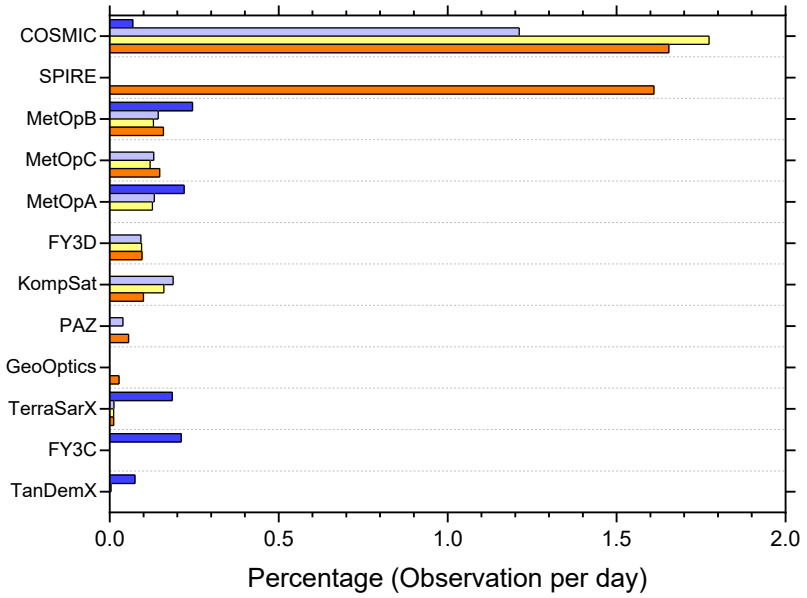




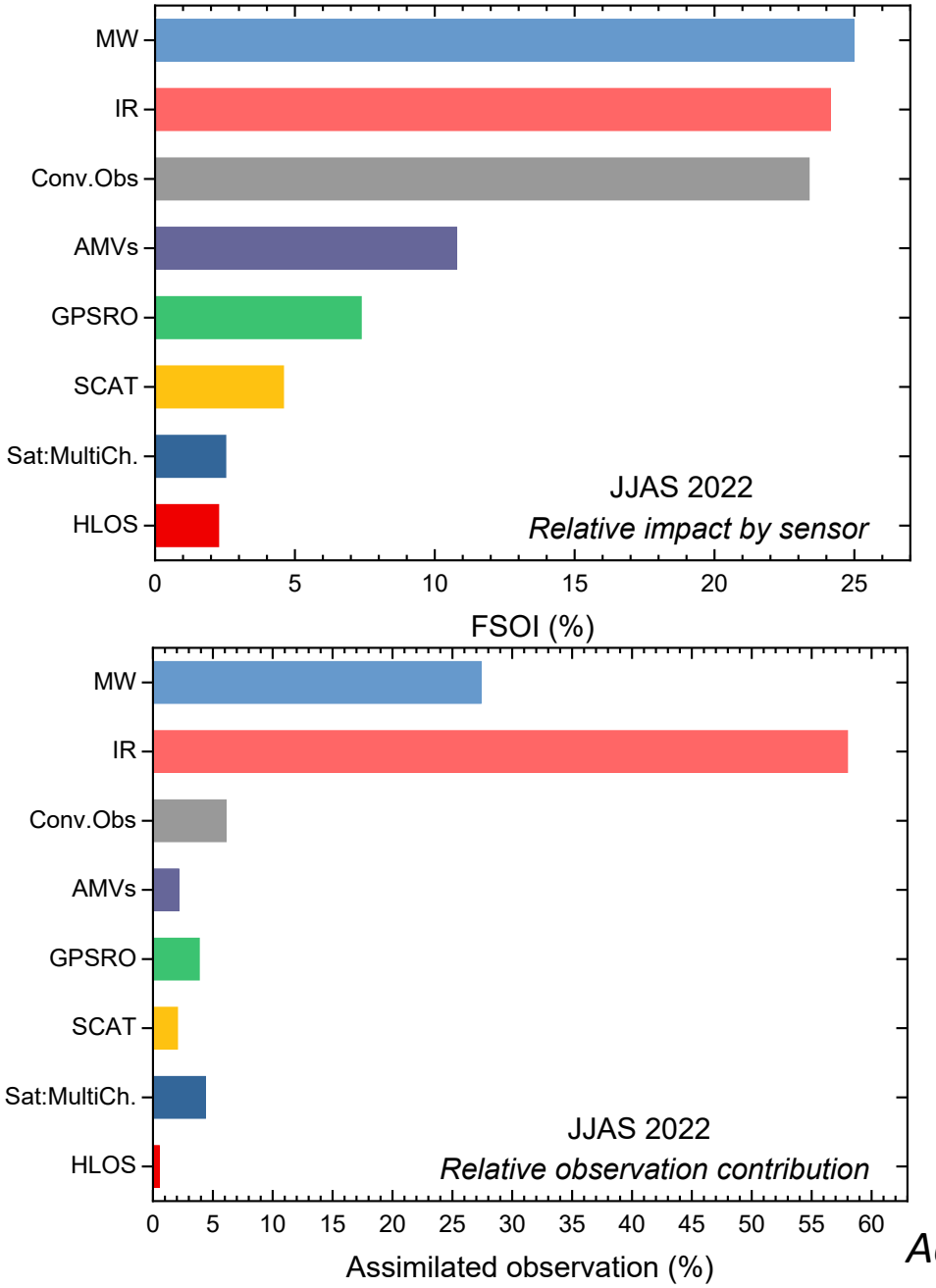
Progress of GPSRO observation assimilation and its impact in NCUM

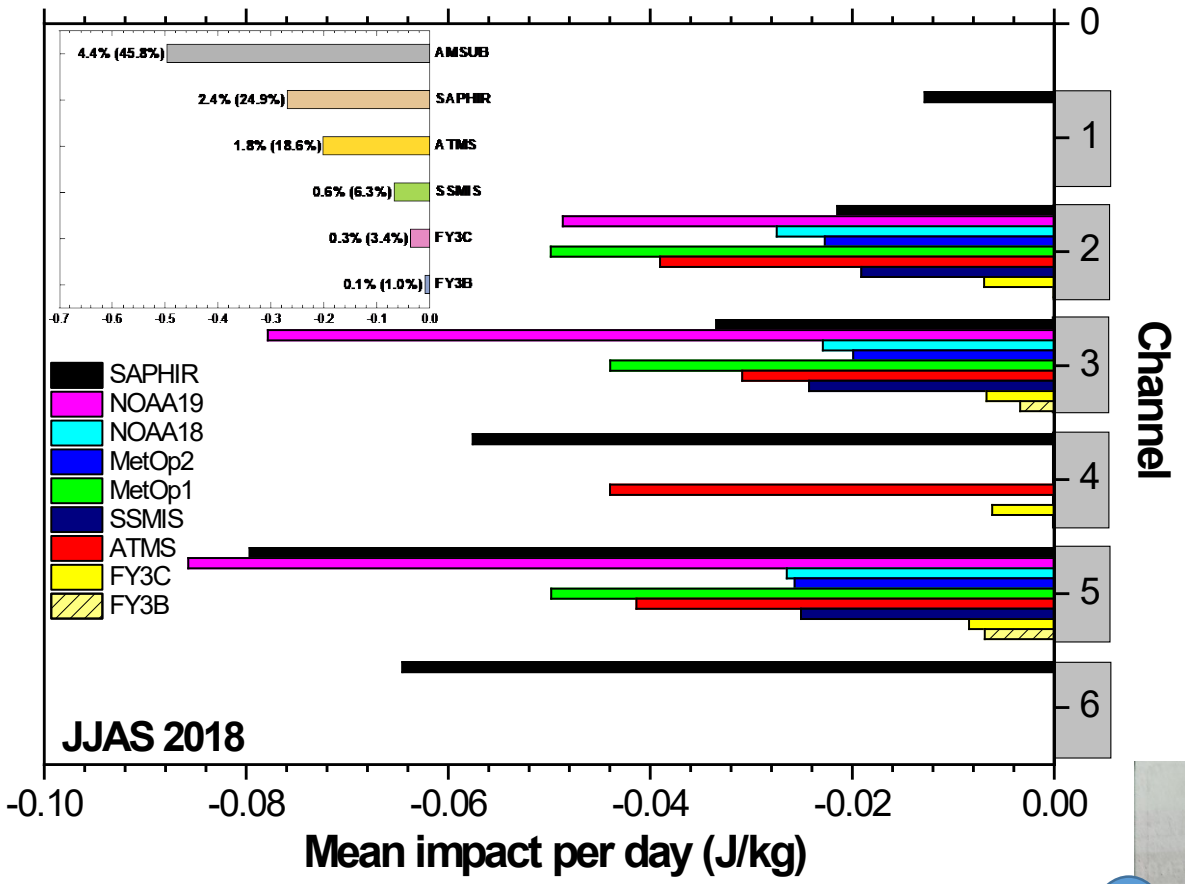




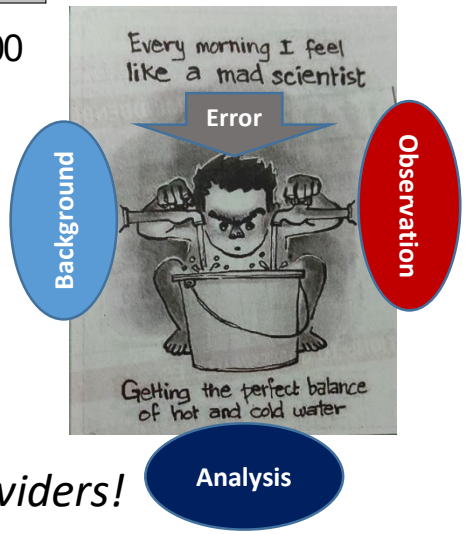


Summary: Impacts of Various Observing System





Thank you



Acknowledgment: We are extremely thankful to all data providers!