DBNet data reception, processing and assimilation at NCMRWF

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NCMRWF receives DBNet data through GTS. This includes the DBNet Regional ATOVs Re-transmission Service (RARS) data from Australia, Korea, Japan, and Hong Kong.

NCMRWF also receives EUMETSAT's ATOVS Retransmission Service (EARS) data through EumetCast.

Both RARS and EARS are routinely assimilated in the NCMRWF global and regional operational models.

IMD has three HRPT stations (New Delhi, Chennai and Guwahati). Currently these stations are under renovation and there is no data transmission services.
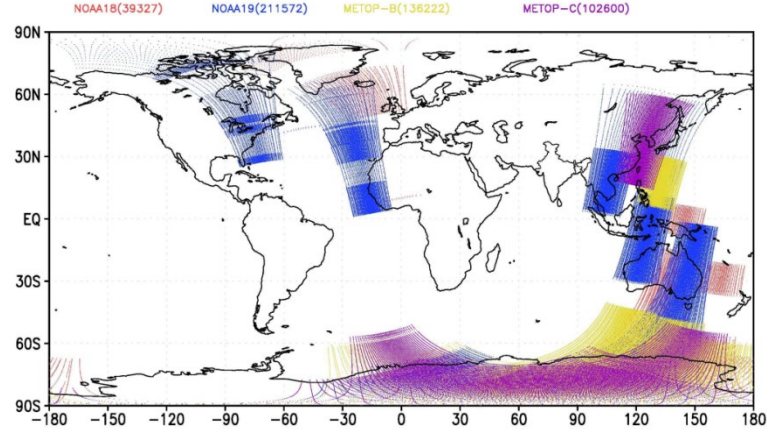
NCMRWF has taken the initiative to access level-0 data from two HRPT stations installed in India for Ocean (INCOIS, Hyderabad) and remote sensing (NRSC, Hyderabad) services.

Open source software and packages, ATOVS and AVHRR Pre-processing Package (AAPP), MetOpizer, and Community Satellite Processing Package (CSPP) Sensor Data Record (SDR) are used for the in-house processing of level-0 data.
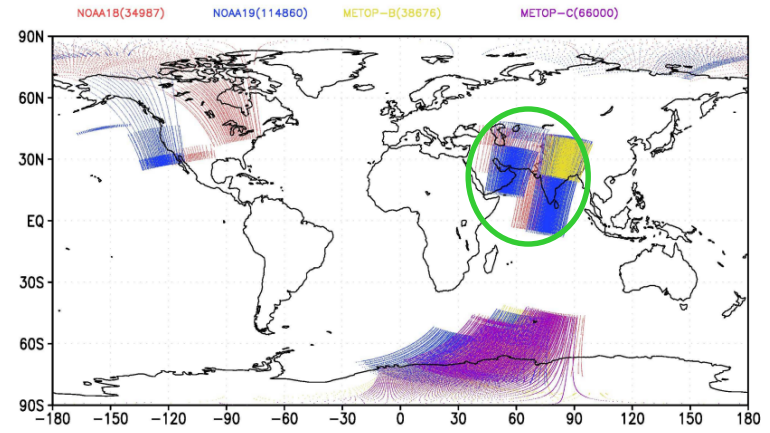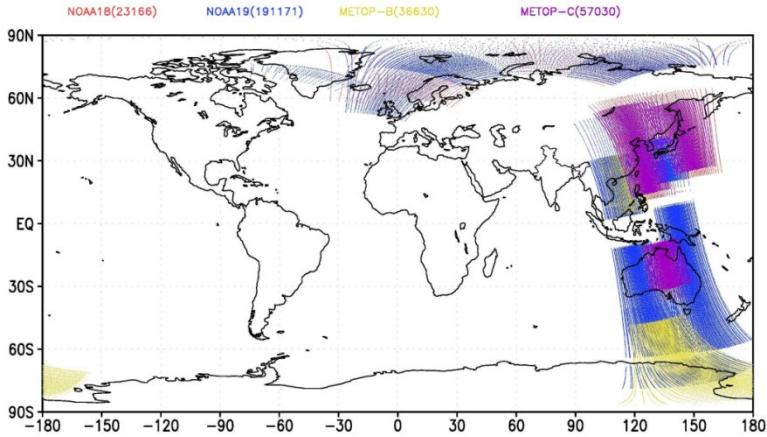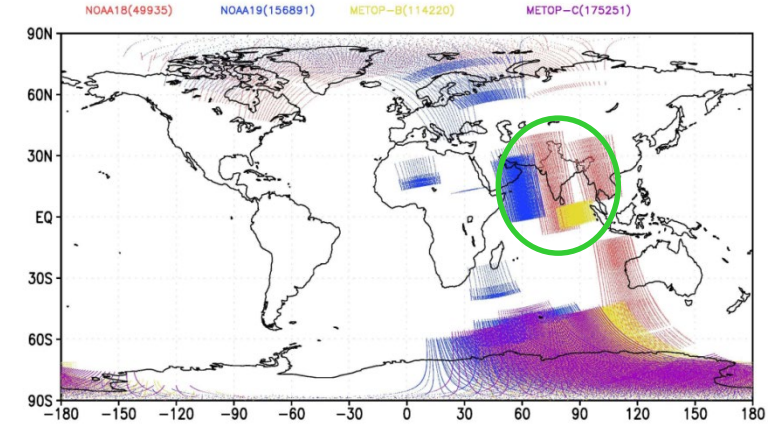
DBNet ATOVS Data Coverage

0000 UTC
NOAA18(39327)   NOAA19(211572)   METOP-B(136222)   METOP-C(102600)

0600 UTC
NOAA18(34987)   NOAA19(114860)   METOP-B(38676)   METOP-C(66000)

1200 UTC
NOAA18(23166)   NOAA19(191171)   METOP-B(36630)   METOP-C(57030)

1800 UTC
NOAA18(49935)   NOAA19(156891)   METOP-B(114220)   METOP-C(175251)

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DBNet Data Over the Indian Region

Data Provider	Satellites	Instruments
INCOIS/NRSC	NOAA-18/19	AMSU-A, MHS, HIRS
INCOIS/NRSC	Metop-B	AMSU-A, MHS, HIRS, IASI
NRSC	SNPP, NOAA-20	ATMS, CrIS

17.3850° N, 78.4867° E

Typical day coverage of DBNet data received from INCOIS, Hyderabad, India
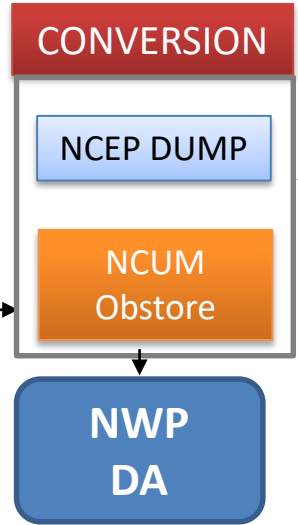
NOAA-18   NOAA-19   MetOP-B
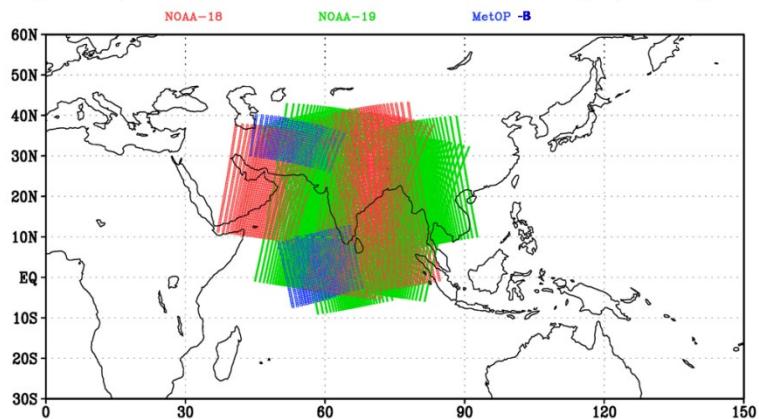
Typical day coverage of DBNet data received from NRSC, Hyderabad, India

NOAA-20   NPP
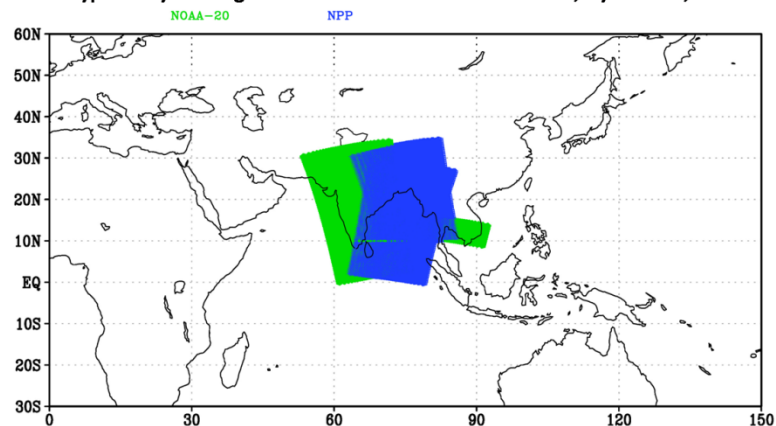
INCOIS DBNet Data Processing at NCMRWF
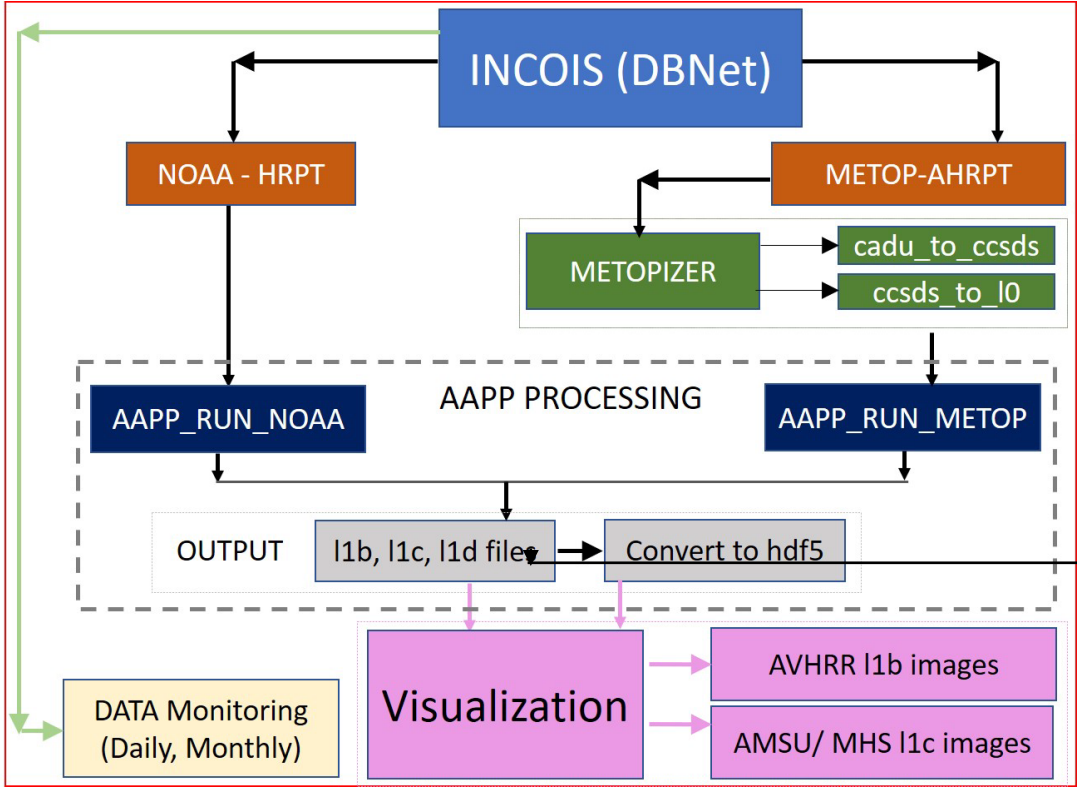
In House scripts developed for processing level-0 DBNet data

INCOIS (DBNet)

NOAA - HRPT

METOP-AHRPT

METOPIZER → cadu_to_ccsds
ccsds_to_l0

AAPP PROCESSING

AAPP_RUN_NOAA   AAPP_RUN_METOP

OUTPUT   l1b, l1c, l1d files → Convert to hdf5

DATA Monitoring (Daily, Monthly)

Visualization → AVHRR l1b images
AMSU/ MHS l1c images

CONVERSION

NCEP DUMP

NCUM Obstore

NWP DA

NRSC DBNet Station

RT-STPS CSPP

AAPP

ATMS, CRIS BUFR
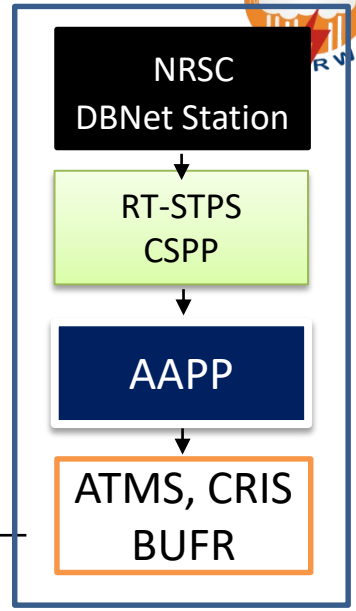
Thanks to Nigel for his guidance and suggestions

File naming conventions

W_in-NCM-hyd,AMSUA,DBNET+M01+hyd_C_DEMS_20221022030940_amsual1c_M01_20221022_0309_52373_bufr.in

NCMRWF

AMSUA,
HIRS,
MHS

Hyderabad

New Delhi

Centre_subcentre	Originator	CCCC	station abbreviation
28_10	in-IMD-del	DEMS	del
28_20	in-IMD-guw	DEMS	guw
28_30	in-IMD-che	DEMS	che
28_40	in-IMD-hyd	DEMS	hyd

Feeds of DBNet data from GTS | NWP SAF (eumetsat.int)

Thanks to Nigel for his guidance and suggestions

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Timeliness of Data Availability (INCOIS)

HRPT Data Delay at NCMRWF : 2023-01-01
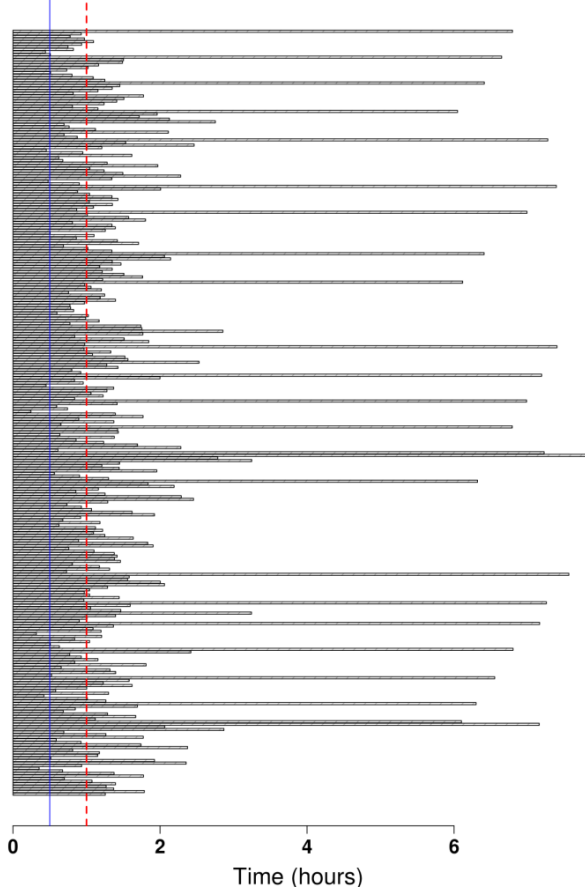
NCMRWF receives the DBNet data from NRSC with in 20 minutes of observation time.

NCMRWF is working with NRSC for sharing other DBNet data.

Applications
1. Image generation for now casting
2. NWP assimilation

# Image generation:Amphan (16-21 May 2020) super cyclone over the bay of Bengal

AMSU-A channel-2 imagery from NOAA-18, NOAA-19 and METOP-A valid for 16, 17, 18 and 19 May 2020.
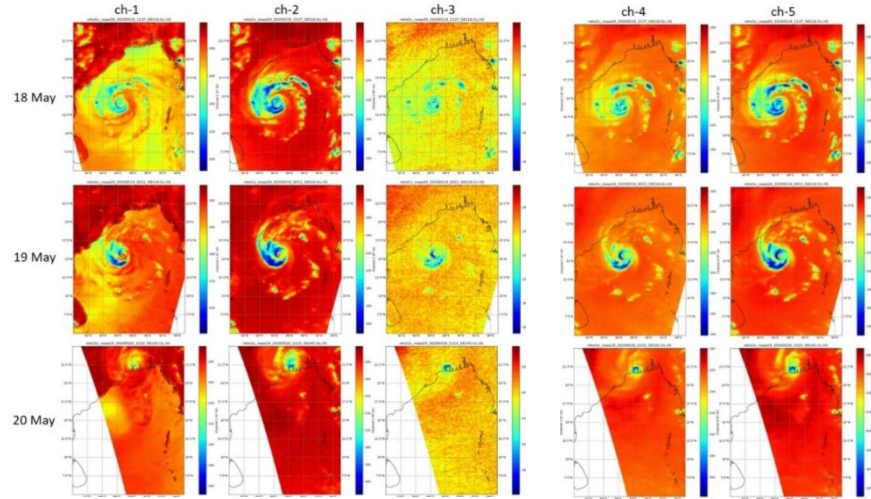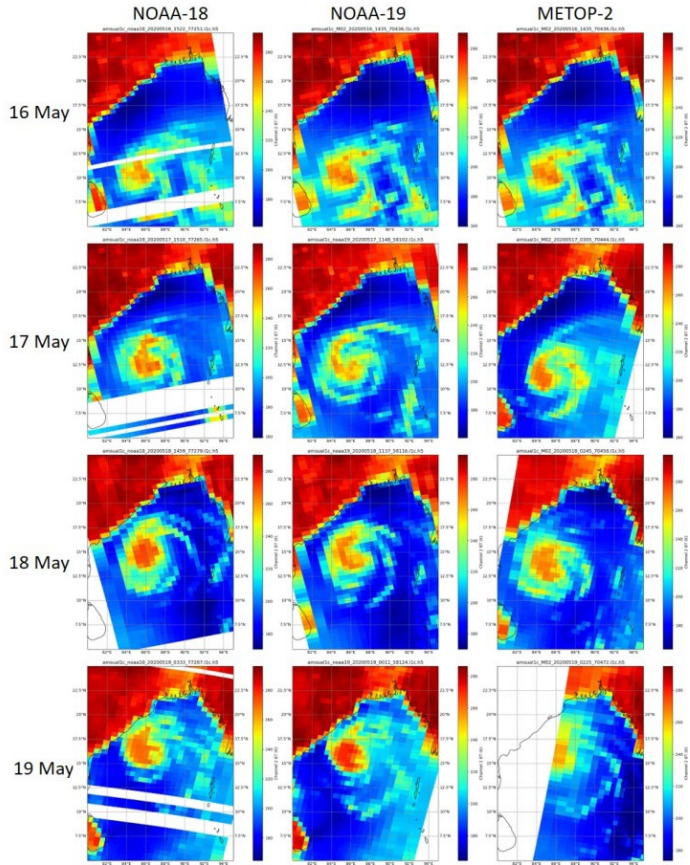
NOAA-19 MHS from 18 to 20 May 2020

Shared with IMD for Now casting

NWP Assimilation
Cyclonic Storm SITRANG over the BoB (22-25 October 2022)

✓ Low pressure area formed over North Andaman Sea 00 UTC of 20th Oct 2022 and became as a well marked low pressure area 12 UTC of 21st October.

✓ Concentrated into a depression over southeast and adjoining eastcentral BoB 03 UTC of 22nd Oct, moved northwestwards and intensified into a deep depression over westcentral BoB 00 UTC of 23rd Oct.

✓ Further, it moved nearly northwards and intensified into the cyclonic storm (CS) "SITRANG" 12 UTC of 23 Oct and then gradually recurved north-northeastwards and crossed Bangladesh coast between Tinkona and Sandwip close to Barisal (near 22.150N/90.350E) 16-18 UTC of 24th October as a cyclonic storm with maximum sustained wind speed of 80-90 kmph gusting to 100 kmph.

✓ Continuing to move north-northeastwards, weakened into a deep depression over northeast Bangladesh 21 UTC of 24, and into a depression over interior Bangladesh 00 UTC of 25th October.
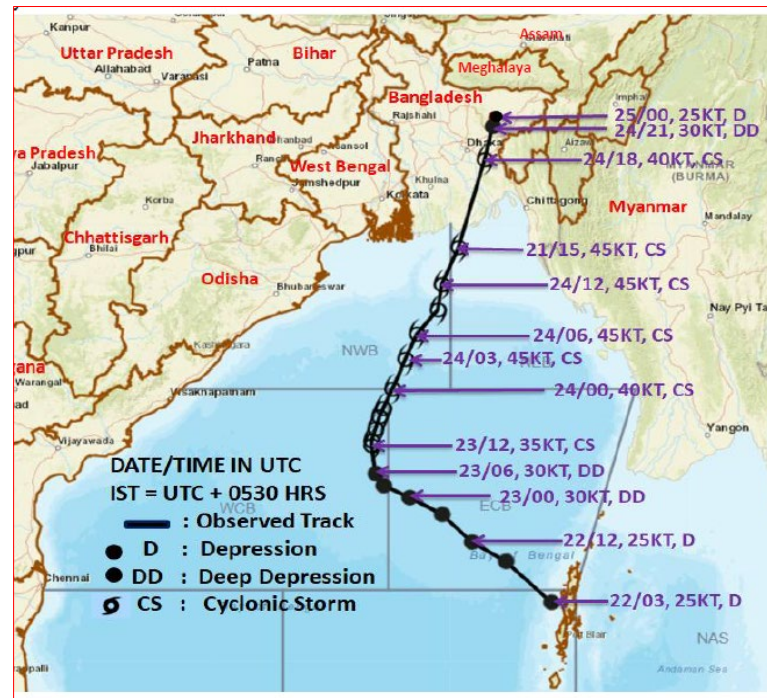
Observed track of cyclonic storm 'SITRANG" over the BoB during 22nd- 25th October, 2022 (*IMD Report, 2022*)

Design of experiments

CNTL	EXP
Surface Sonde Satwind Scatwind Aircraft	CNTL + ATOVS (DBNet (India))

➢ NCUM system with 4DVAR at 12 km horizontal resolution.

➢ DA started at 00 UTC of 15th October 2022 and continued up to 00 UTC of 26 Oct 2022.

➢ 7 days Long forecast

ATOVS (AMSU-A, MHS) DBNet data reception at NCMRWF at 06 and 18 UTC
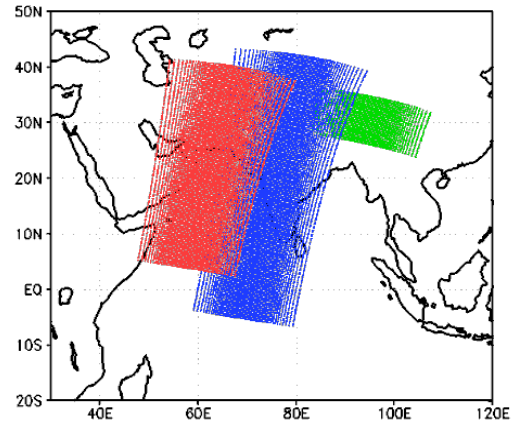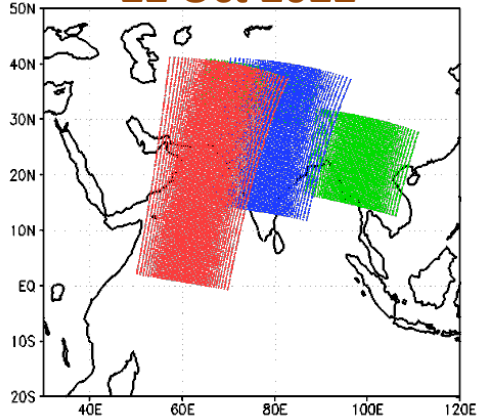
Satellite passes (06 UTC)

NOAA18
NOAA19
MetOp-B
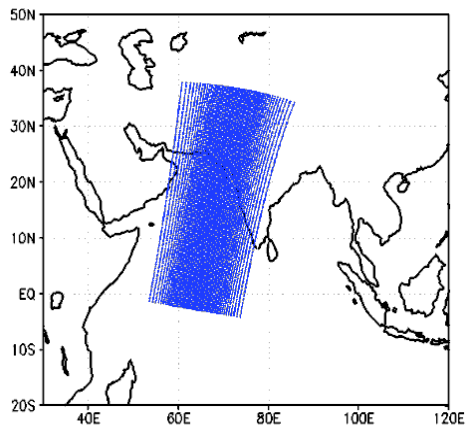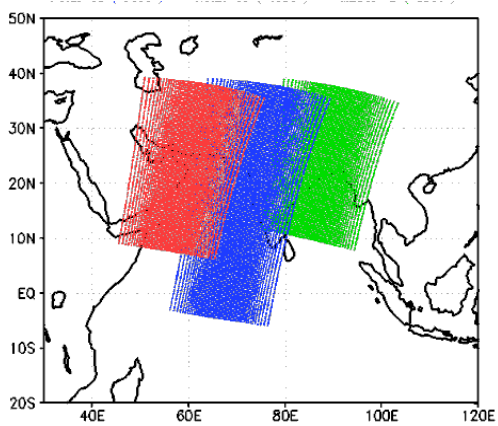
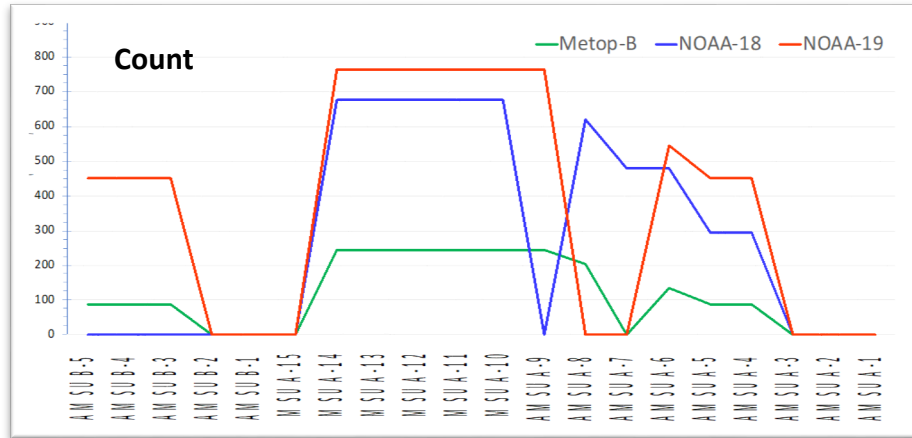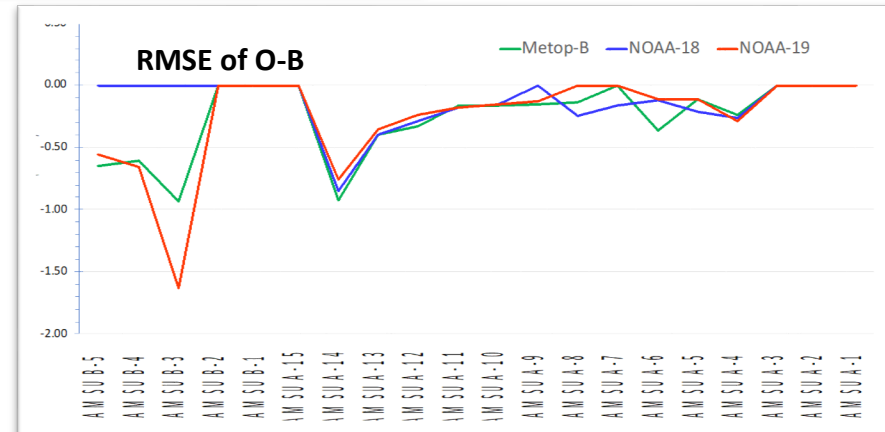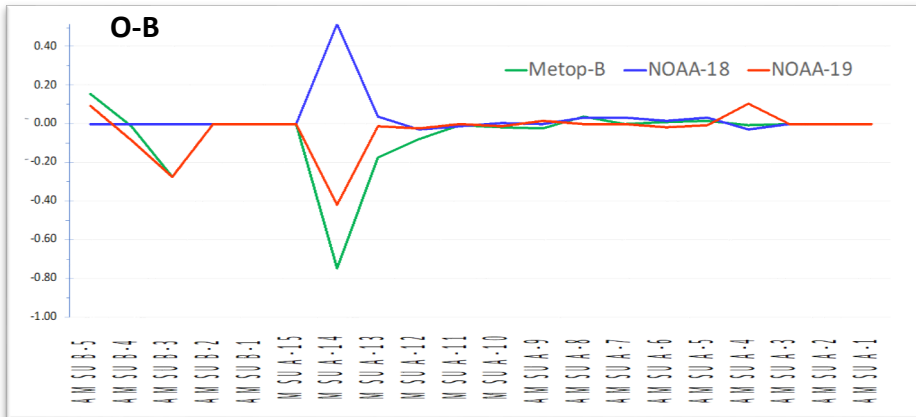19 Oct 2022
20 Oct 2022
21 Oct 2022
22 Oct 2022
23 Oct 2022
24 Oct 2022

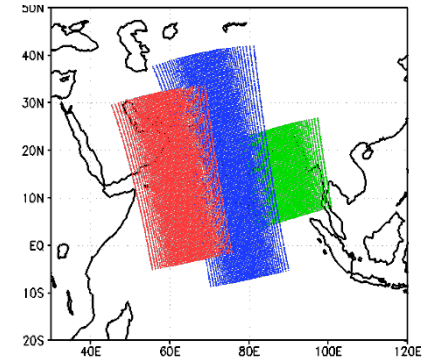# Satellite passes (18 UTC)

19 Oct 2022
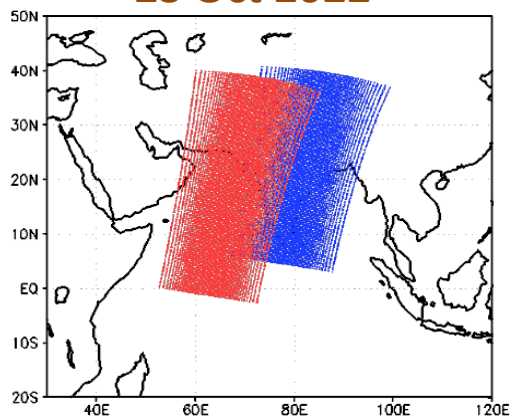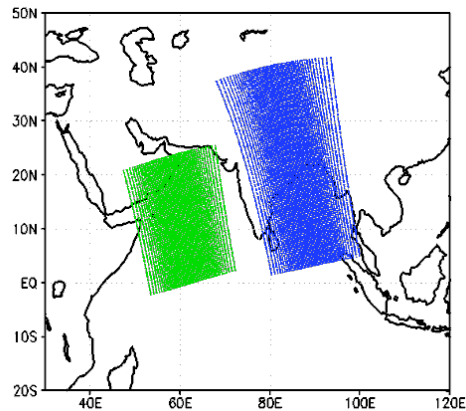
20 Oct 2022

21 Oct 2022

NOAA18
NOAA19
MetOp-B
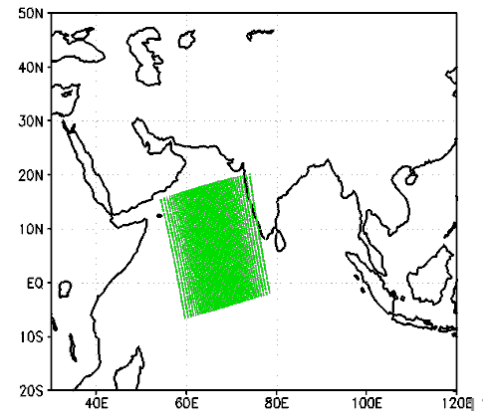
22 Oct 2022

23 Oct 2022

24 Oct 2022

Assimilation Statistics

19 Oct 2022 1800 UTC

Channels assimilated

AMSUA- 4,5, 9,10,11,12,13,14

MHS - 3, 4,5 (only over Ocean)
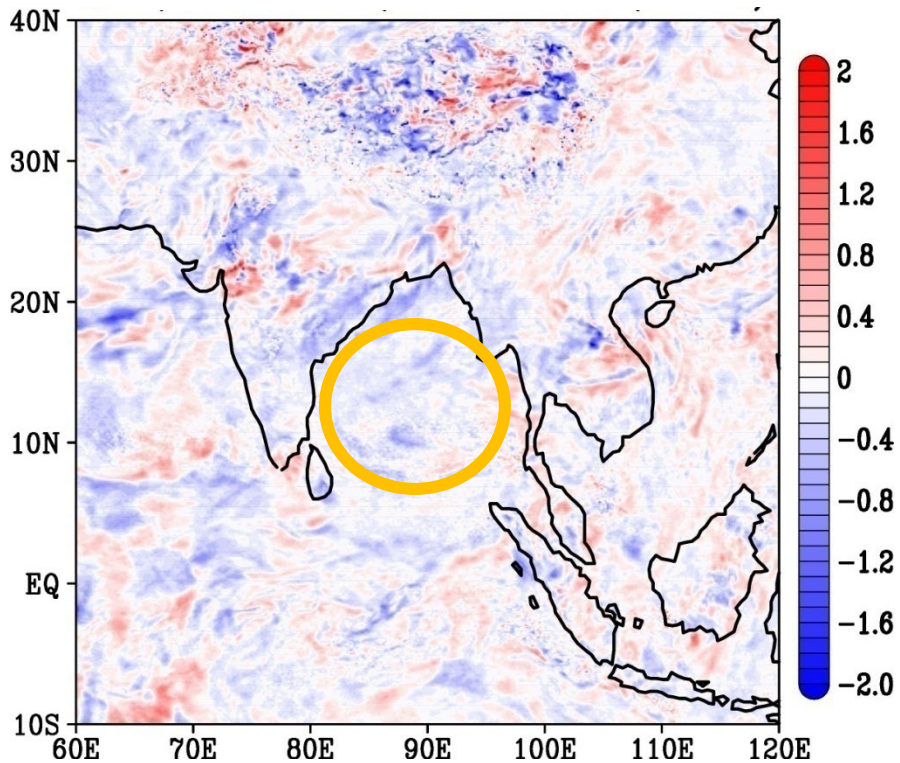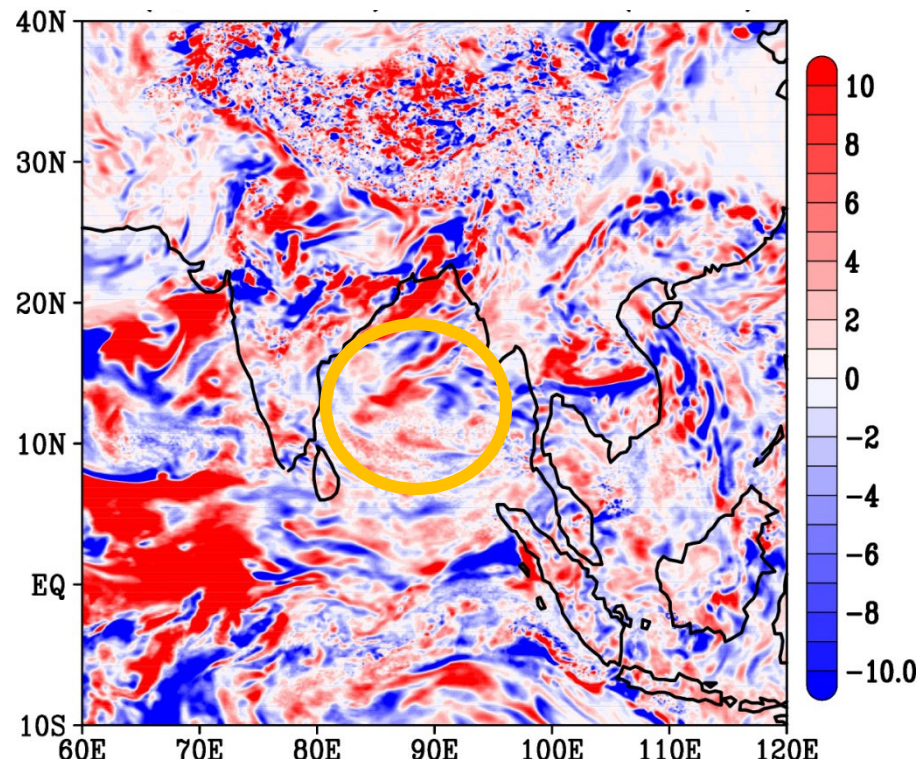
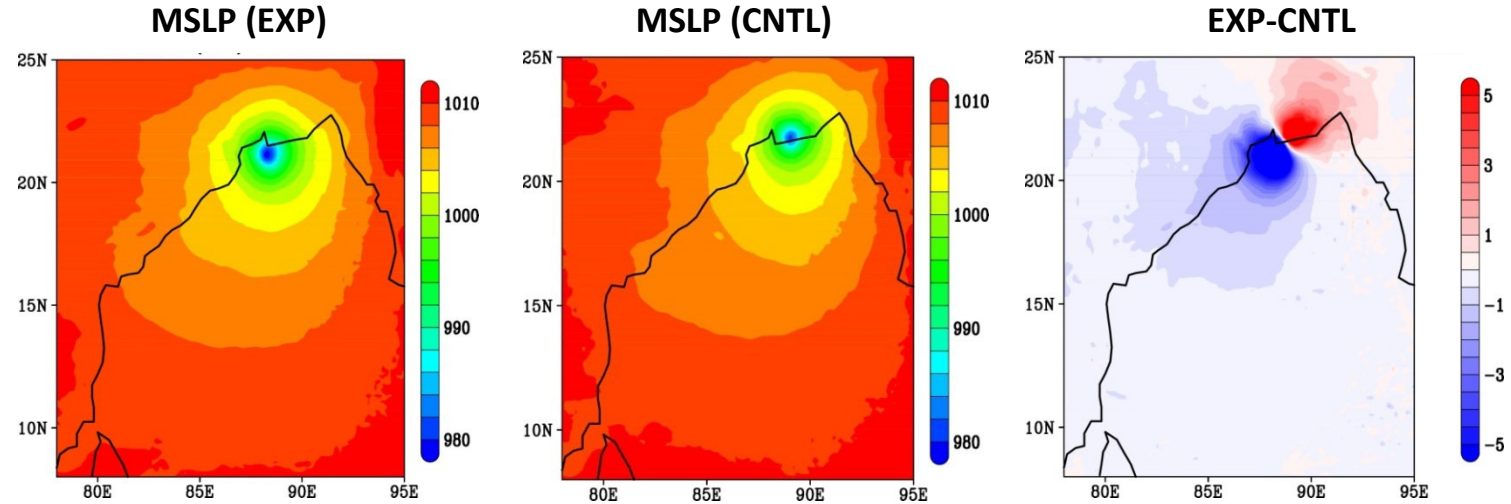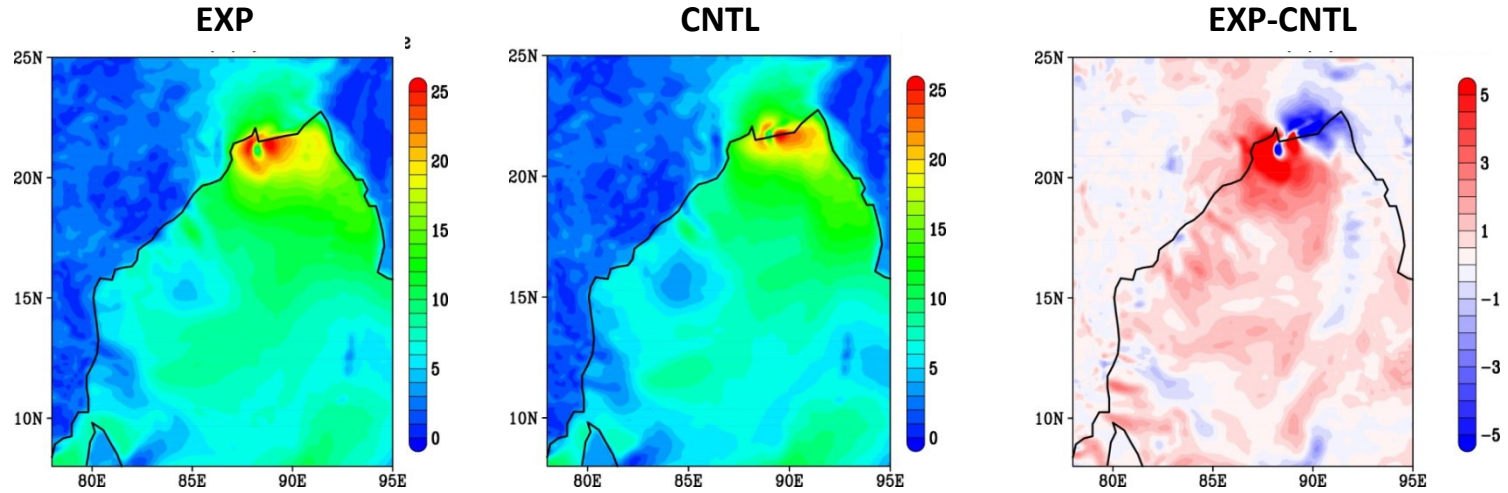# Analysis Differences: Temperature and Relative Humidity at 700 hPa (19 October 2022 0000UTC)

Temperature (EXP-CNTL)
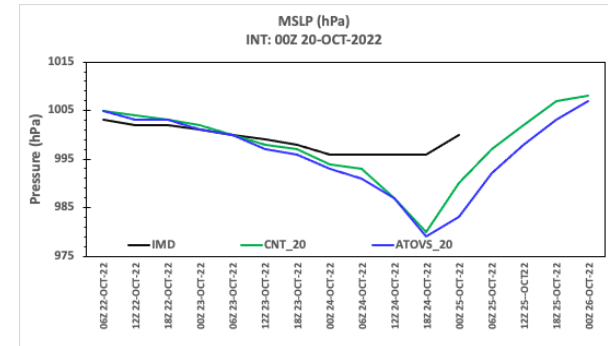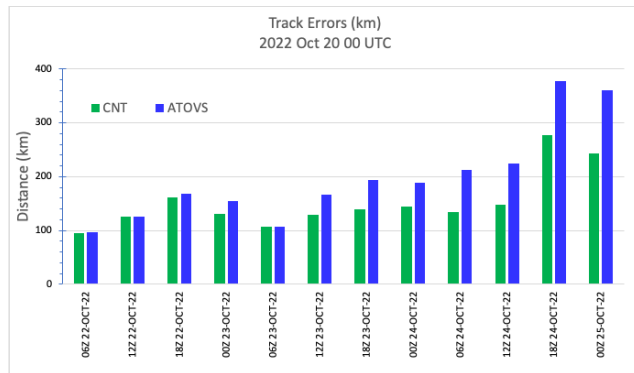
Relative Humidity (EXP-CNTL)

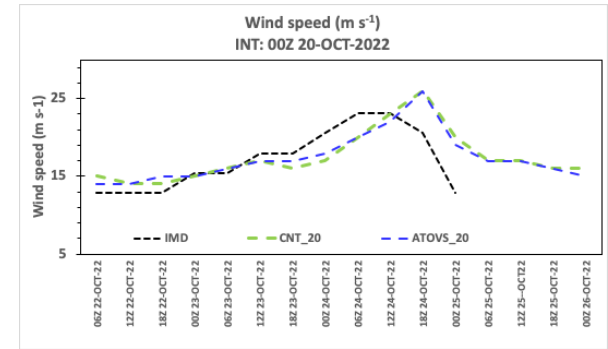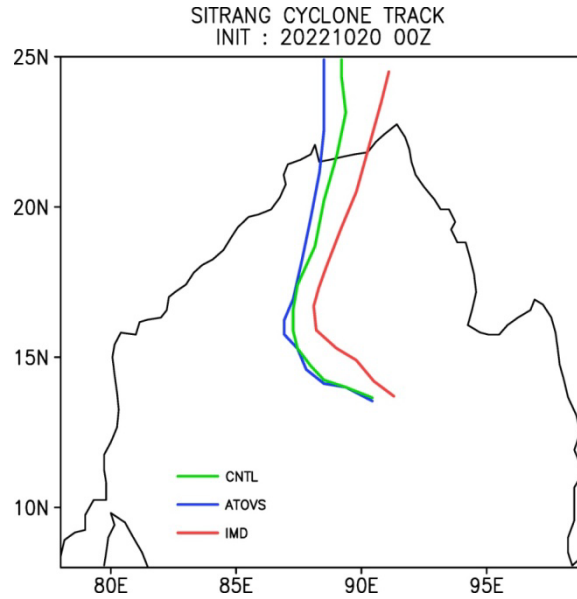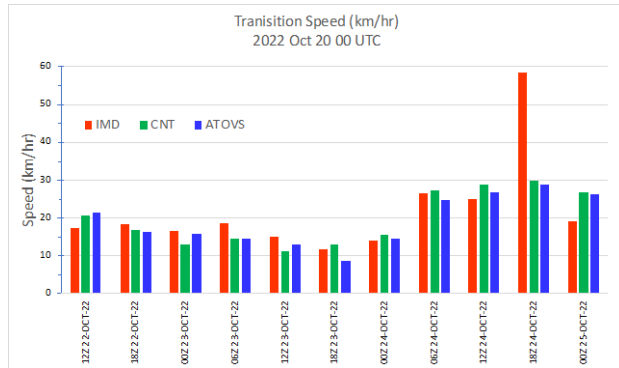# Day-5 Forecast : Mean sea level pressure (IC-00Z 20221019)

MSLP (EXP)

MSLP (CNTL)

EXP-CNTL

Day-5 Forecast : Surface wind speed (IC-00Z 20221019)

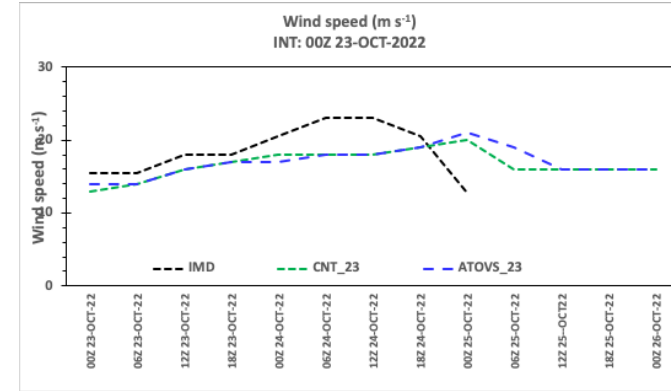EXP   CNTL   EXP-CNTL

Cyclone Track and intensity

Transition Speed (km/hr) 2022 Oct 20 00 UTC

Track Errors (km) 2022 Oct 20 00 UTC

SITRANG CYCLONE TRACK INIT : 20221020 00Z

Wind speed (m s⁻¹) INT: 00Z 20-OCT-2022

MSLP (hPa) INT: 00Z 20-OCT-2022

Cyclone Track and intensity

Transition Speed (km/hr)
2022 Oct 23 00 UTC

SITRANG CYCLONE TRACK
INIT : 20221023 00Z

Wind speed (m s⁻¹)
INT: 00Z 23-OCT-2022

Track Errors (km)
2022 Oct 23 00 UTC

MSLP (hPa)
INT: 00Z 23-OCT-2022
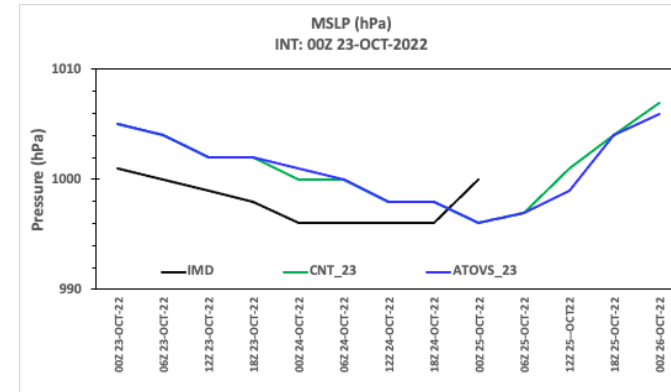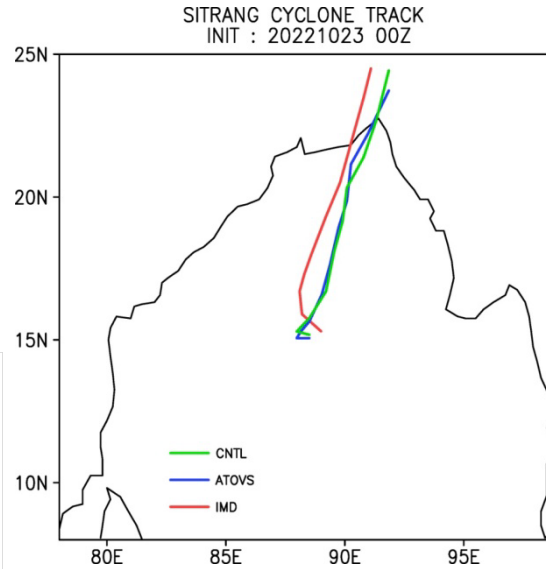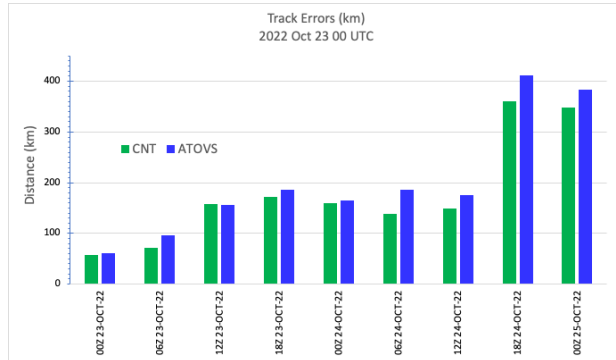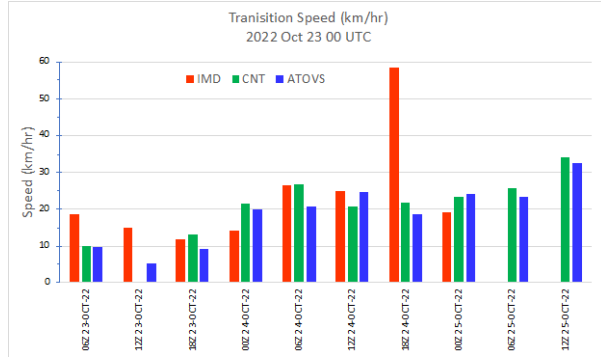
Summary

DBNet level 0 data from INCOIS and NRSC has been processed at NCMRWF using open source softwares (AAPP, OPS-LRS, Metopizer, RT-STPS, CSPP).

The data latency from NRSC is less than 20 minutes.

Indian DBNet data in WMO prescribed BUFR has been generated in real-time and the same is ready to disseminate through GTS.

Image generation during cyclone season for now casting purpose.

A case study of cyclone over the Bay of Bengal shows, assimilation of DBNet ATOVS slows down the system over the Ocean, whereas speeds up after landfall. Needs to run more cases for a clear conclusion.

Similar experiment need to performed in a regional and high resolution rapid refresh (HRRR) systems to understand the impact of these data.

Thank you