NOMAD and the usage of Megha-Tropique data-products

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Members of LACy

Pr. Serge Baldy
Director

Dr. Hassan Bencherif **Vice-Director**

Professors
: 2

Readers
: 3

Lecturers
: 5 + 1

Scientific Assistant
: 1

Post-Doc
: 3

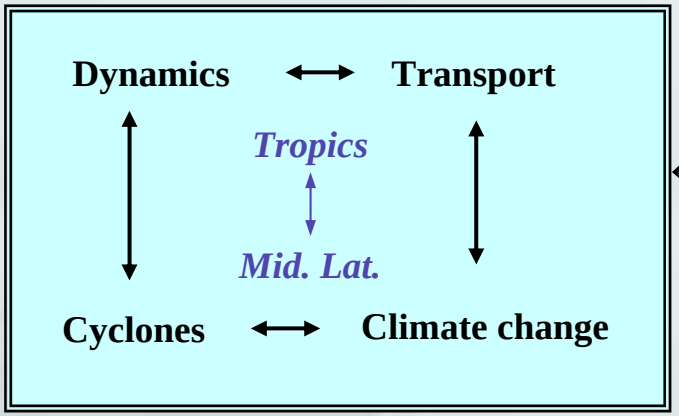
Ph.D Students
: 6

Engineers
: 4

Assistant Engineers
: 2

Technicians
: 2

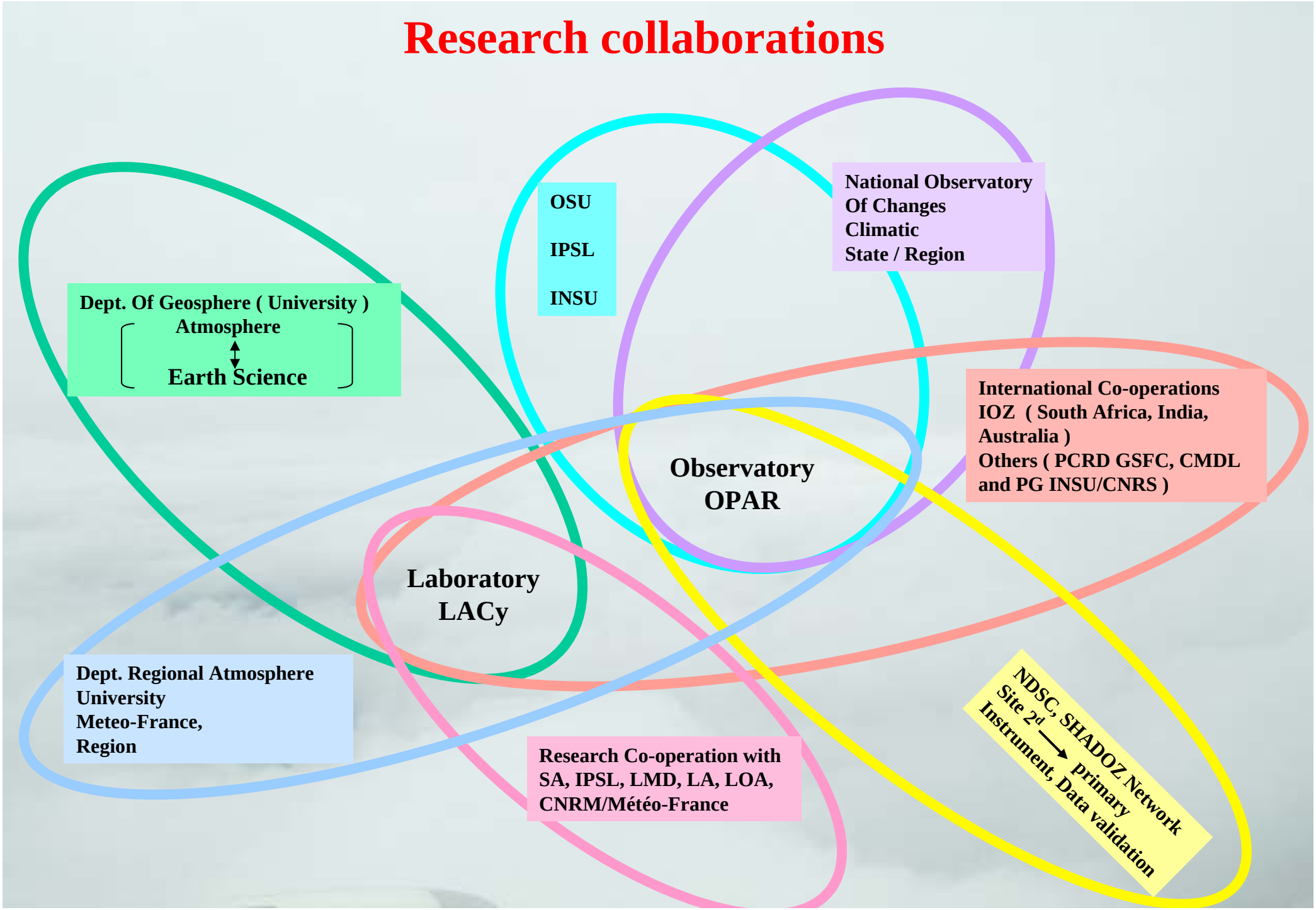
Potential Research Topics of LACy



- STE, Troposphere, Ozone
- Convection / STE, Atmospheric Waves and cirrus
- Strato - Tropical, dynamical barrier and transport
- Long-term trends, Climate Change
- Dynamics of Tropical Cyclones (modelling and forecast)

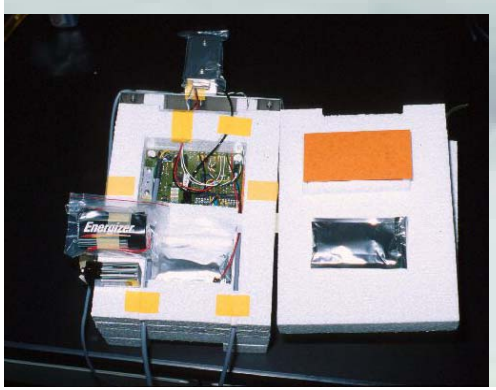
Meteo-France : Research on Tropical Cyclone

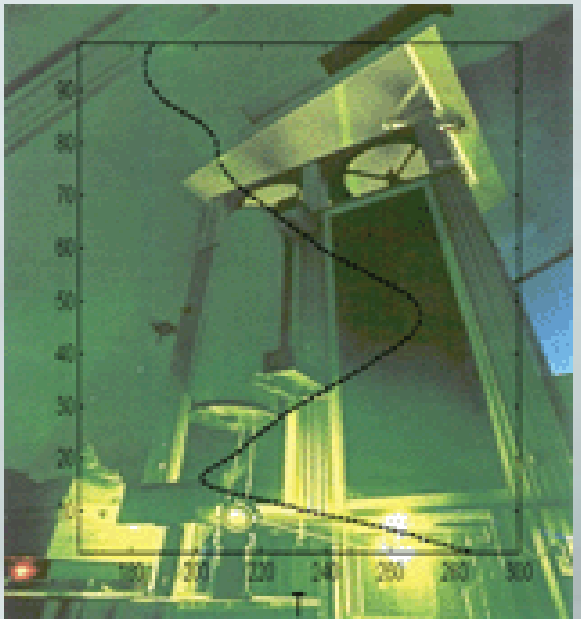
Research collaborations



Instruments / Measurements

- **LiDARs** : ozone, temperature and aerosol profiles
- **Radiosondes** : pressure, temperature, ozone, water vapour
- **Spectrometer** UV-visible (SAOZ) : total ozone columns
- **Radiometer** micro-waves : water vapour profiles





NOMAD

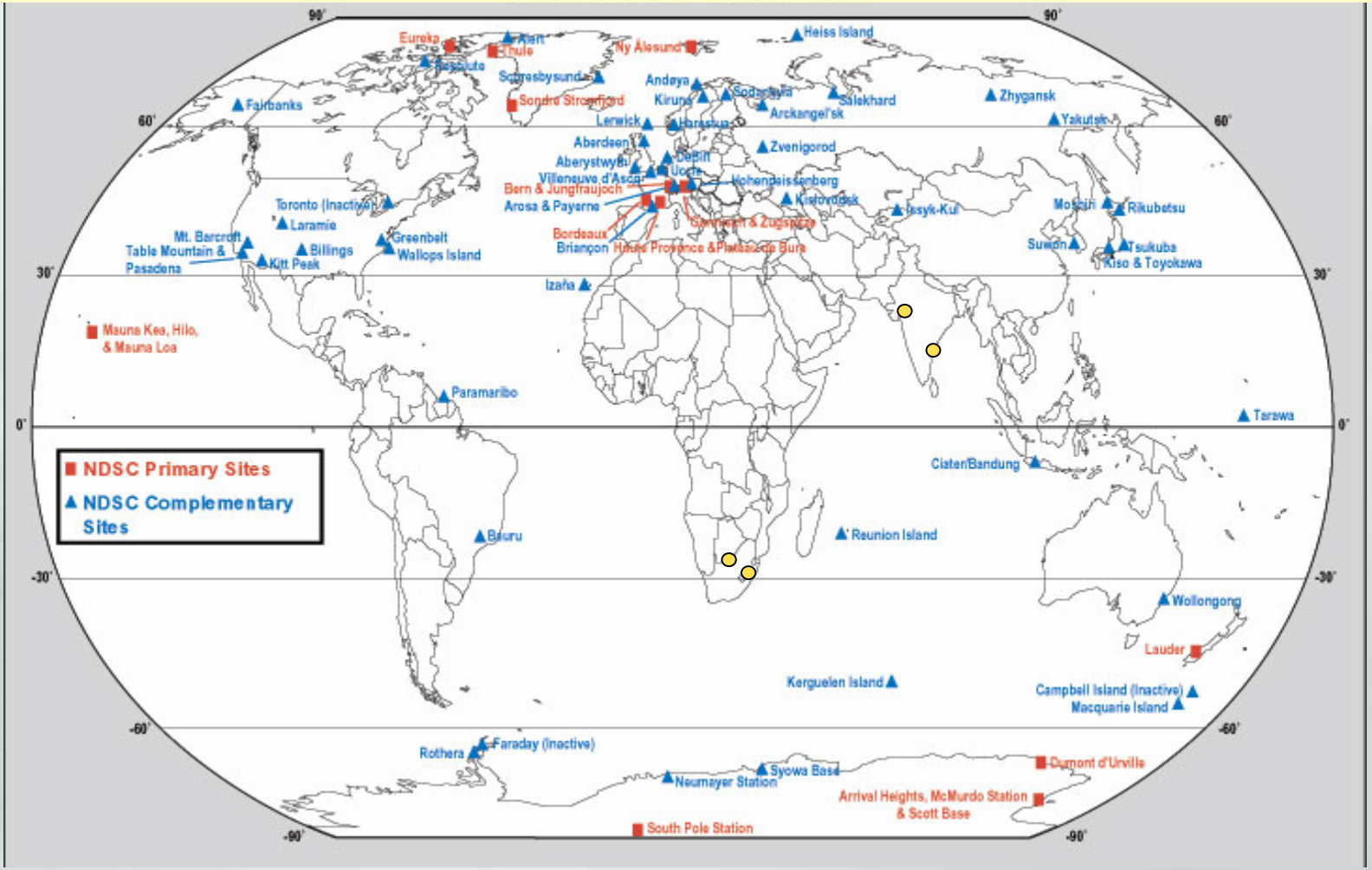
Network for Observation of upper troposphere and Middle Atmosphere Dynamical changes

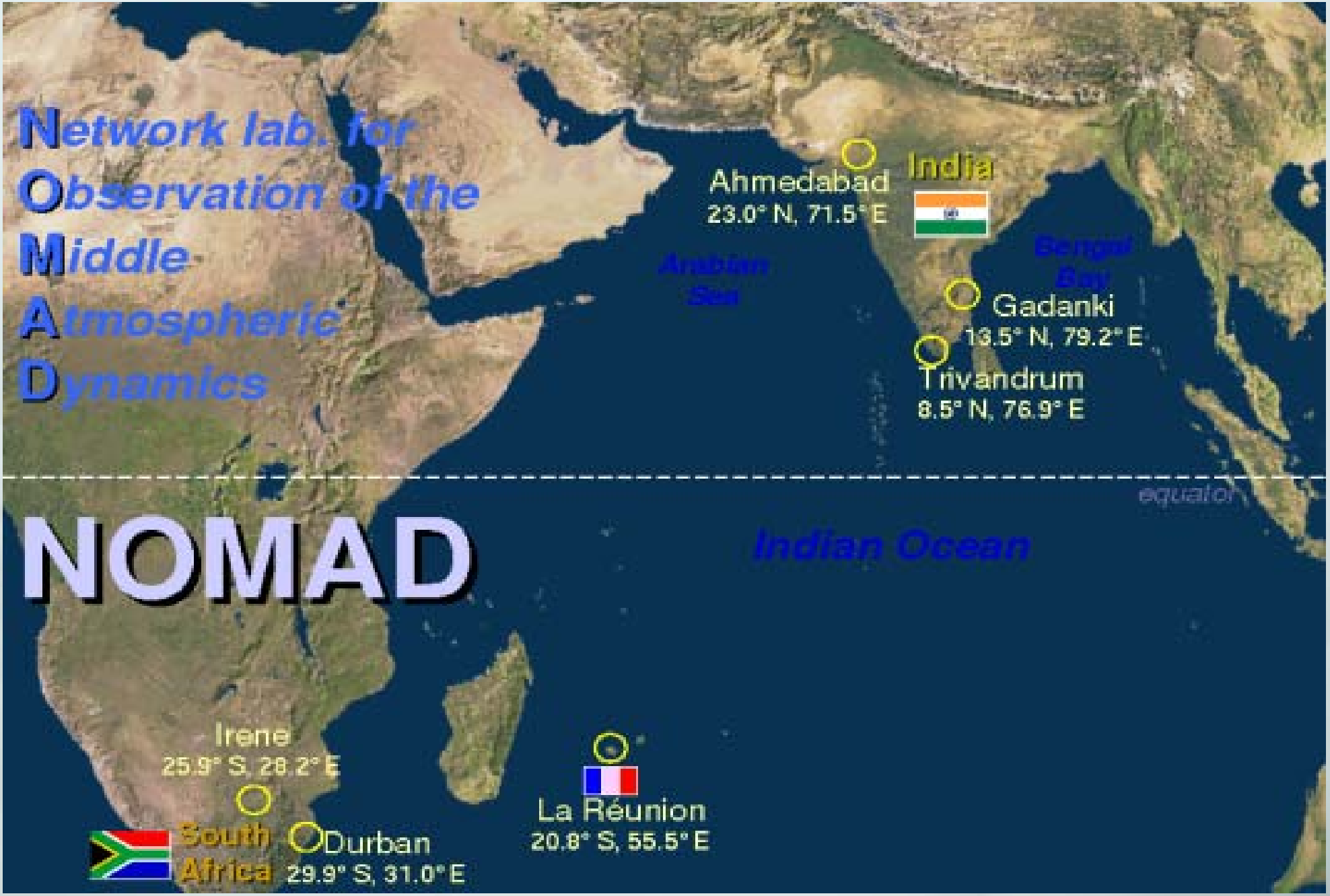
Objectives:

The objective of the proposal (NOMAD) is as follows;

- **Study on temperature and ozone variabilities over tropical and subtropical UTLS region using TRENDRUN (a multi-parameter code).**
- **Study on trace gases (O_3, H_2O and Aerosol) variability and its horizontal transport using satellite (TOMS, SAGE 2, ODIN, ENVISAT, INSAT, METEOSAT, Mega-Tropique …) and ground-based instruments like Lidars, Radars and Radiosondes.**
- **Study on dynamical processes of stratospheric dehydration / rehydration using *in situ* observations and models (MSDOL, MIMOSA, Meso-NH, …).**
- **Middle atmospheric temperature structure and dynamics using Lidars over the Indian Ocean Region (Reunion-21°S, Durban-30°S, Gadanki-13°N, in addition to NDSC sites : OHP-46°N, Lauder-45°S, Mauna-Loa-20°N).**

Now it is called as
Network for the Detection of Atmospheric Composition Change (NDACC).




Network lab. for
Observation of the
Middle
Atmospheric
Dynamics
Ahmedabad
23.0° N, 71.5° E
India
Arabian Sea
Bengal Bay
Gadanki
13.5° N, 79.2° E
Trivandrum
8.5° N, 76.9° E
equator
NOMAD
Indian Ocean
Irene
25.9° S, 28.2° E
South Africa
Durban
29.9° S, 31.0° E
La Réunion
20.8° S, 55.5° E

Ground-based instruments available for the research action

La Reunion (21°S, 55°E)

Instrument	Specification	Observations
Lidar Rayleigh	532 nm	Temperature profiles from 30 km to 70 km
Lidar Raman (N_2)	532 / 607 nm	Temperature profiles from 10 km to 30 km
Mie Lidar	532 nm	Aerosol extinction profile from 0 km to 40 km
UV Visible Spectrometer (SAOZ)	Daily	Integrated column ozone
Radiosonde/Ozonesonde*	Weekly	Humidity, Temperature and Ozone profiles from 0 km to 25 km
DIfferential Absorption Lidar (DIAL)	308 / 355 nm	Ozone profiles from 17 km to 45 km
DIfferential Absorption Lidar (DIAL)	289 / 316 nm	Ozone profiles from 4 km to 17 km
Lidar Raman (Water Vapour)	532 nm	Water vapour profiles from 3 km to 16 km

Durban (30.0°S, 31.0°E)

Instrument	Specification	Observations
Rayleigh Lidar	532 nm	Temperature profiles from 30 km to 70 km
Raman Lidar (N_2)	532 / 607 nm	Temperature profiles from 10 km to 30 km
Mie Lidar	532 nm	Aerosol Extinction profiles from 4 km to 40 km
UV Visible Spectrometer (SAOZ)	Daily	Integrated column ozone
Radiosonde / Ozonesonde	Weekly	Humidity and Temperature profiles from 0 km to 25 km

Irene (25.0°S, 27.2°E)

Instrument	Specification	Observations
Radiosonde / Ozonesonde	Weekly	Humidity, Temperature and Ozone profiles from 0 km to 30 km

Gadanki (13.5°N; 79.2°E)

Instrument	Specification	Observations
Rayleigh Lidar	532 nm	Temperature profiles from 30 km to 80 km
Mie Lidar	532 nm	Aerosol measurements from 4 km to 40 km
Radiosonde	Daily twice (00 and 05 GMT)	Temperature, dew-point temperature and relative humidity profiles from 0 km to 25 km
MST radar	Daily	Zonal, Meridional and Vertical wind profiles from 4 km to 24 km

Ahemdabad (23.0°N; 81.5°E)

Instrument	Specification	Observations
Rayleigh Lidar	532 nm	Temperature profiles from 30 km to 80 km
Mie Lidar	532 nm	Aerosol measurements from 4 km to 40 km
Radiosonde	Daily twice (00 and 05 GMT)	Temperature, dew-point temperature and relative humidity profiles from 0 km to 25 km

Satellite observations

SAGE-II, TOMS, ENVISAT, METEOSAT-5 and MEGHA-TROPIQUE provide us, the over all picture of aerosol, water vapour and ozone measurements.

Tool of analysis and the usage of Models

The multi-parameter model: TRENDRUN

The TRENDRUN model adapted by *Portafaix* [2001] will be used to obtain the actual temperature trends. This model has been tested already and confirmed by using more than two decades of the temperature observations from the South African Weather Service (SAWS) dataset obtained over Durban and from SAOZ and TOMS ozone measurements over Reunion Island.

Advection of PV (Potential Vorticity) by MIMOSA model

The model MIMOSA, a Meso-Scale Modelization of Isentropic transport, is a high-resolution advective model, which provides the information about the air-mass transport over meridional scale by the application of Potential Vorticity [*Hauchecorne et al., 2002*].

The high resolution PV contour advection model MIMOSA runs on the on a semi-hemispherical or a hemispherical orthogonal grid with a resolution of 3 points per degree. The PV is advected at each grid point by an external model (ECMWF or NCEP …) and relaxed with a 10 days time constant in order to take into account diabatic transport for periods longer than 2 weeks.

The code DYBAL to detect Dynamical barrier

The code DYBAL developed at LACy (Reunion) will be used to detect and characterize the subtropical barrier based on the Nakamura's [1996] formalism. It is suitably developed and tested by *Portafaix et al.* [2003].

Meso-NH Simulation

This an integrative tool, used by the LACy-CNRS to diagnose the study on stratosphere-troposphere exchange mechanism. It is also used for the quantification of water vapor in the troposphere and stratosphere height region. It is found from a case study that Meso-NH could provide a better identification of water vapor transport as high as tropopause level during the passage of cyclone.

MSDOL Global modeling

The MSDOL mechanistic model is to describe the dynamical / chemical phenomenon associated with air-masses/trace gases transport. It can make use of many outputs which may be derived from satellite experiments, or from assimilated data, and from other models as well. Such data combination is expected to provide a better mapping and to help in term of interpretation/understanding of dynamical processes on regional and global scale.

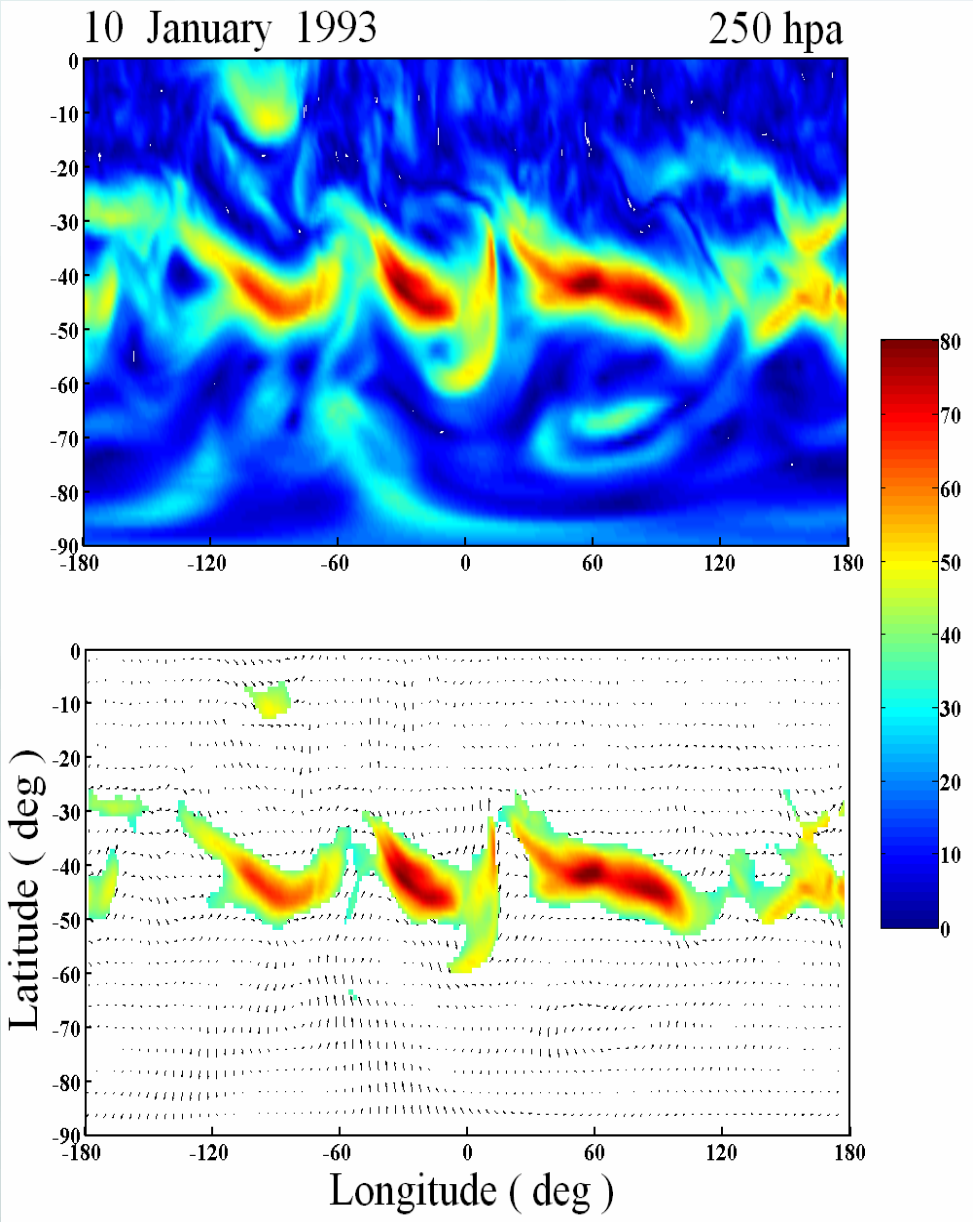
Usage of Megha-Tropiques data products

- To understand the dynamics of tropical and sub-tropical regions

  (Latitudinal coverage : 23º N to 23º S)

- To assimilate and model the tropical cyclones
- To study and understand the Cyclone/Convective system especially in tropical regions.
- Studies related to ITCZ.
- For better understanding the water budget and STE.
- To compare and validate the lidar measurements of water vapour.
- For better understanding of tropical cirrus

Jet Stream Characteristics



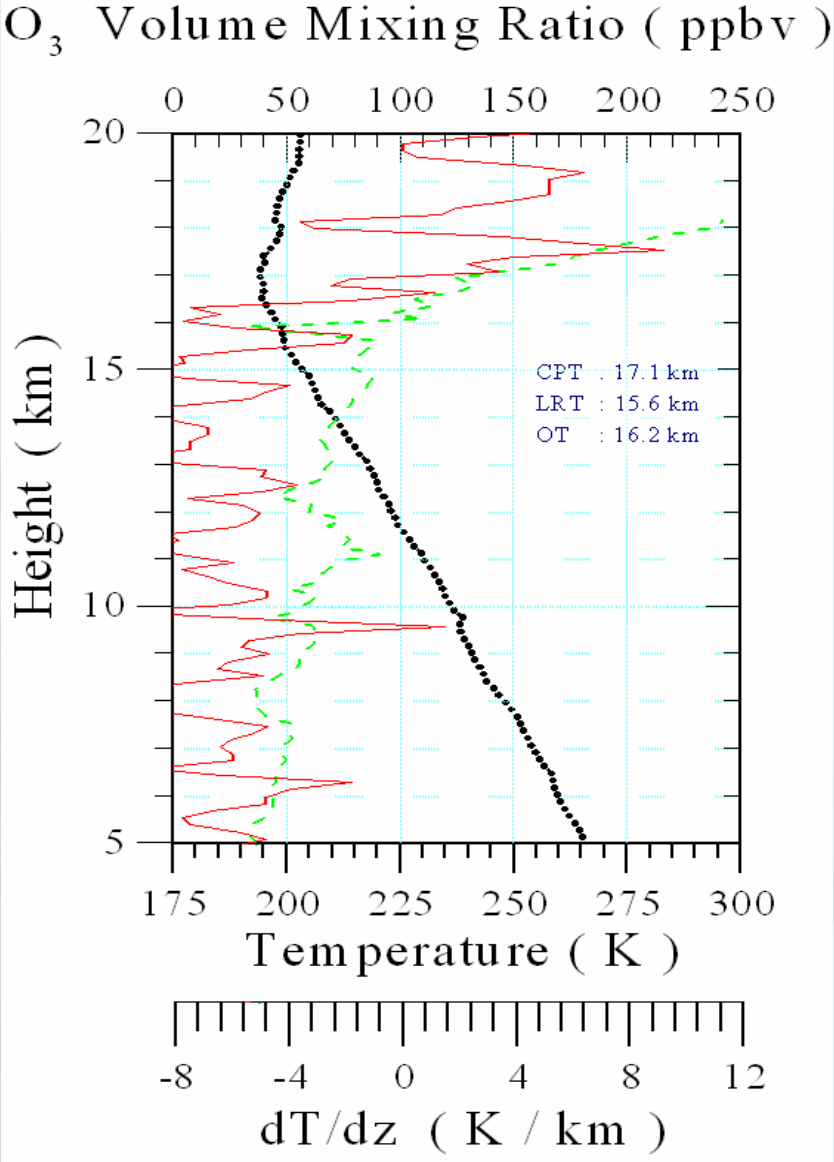
- *The maximum wind speed is in the range of ~70 - 110 m/s. The monthly variations show relatively annual oscillation with exhibiting high wind speed from May to September.*

- *The latitudinal occurrence of maximum wind shows a seasonal dependence. It is found to occur at –30° to –45° during May to September and –40° to -70° for the remaining months.*

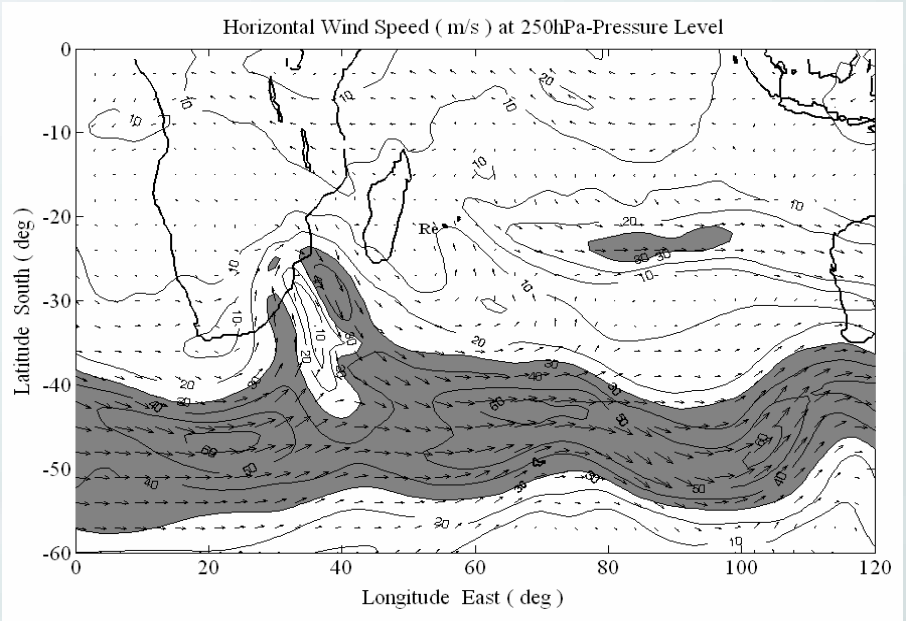
- *The longitudinal extend show that the jet streams are of maximum coverage and the flow of wind is horizontally oriented with zonal characteristics. The direction of flow indicates that the jet streams are of easterly for most of the cases.*

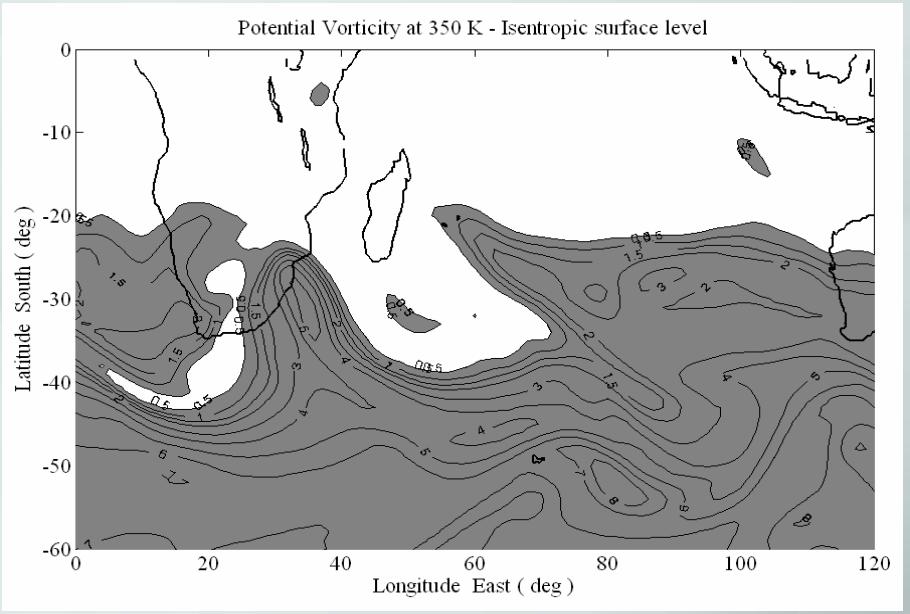
- *The pressure level of maximum wind occurrence reveals that the jet streams are confined to occur in between 400 hpa and 50 hpa (i.e., 7.5 km - 20 km) with more number of cases at 300 hpa - 200 hpa (i.e., 9.5 km - 12.5 km).*

Tropopause Characterstics



Indefinite Ozone Tropopause case






Thank you for your kind attention
Merci pour votre attention