



## IASI/IASI NG experience and development of science and scientific applications for NWP, climate and air quality

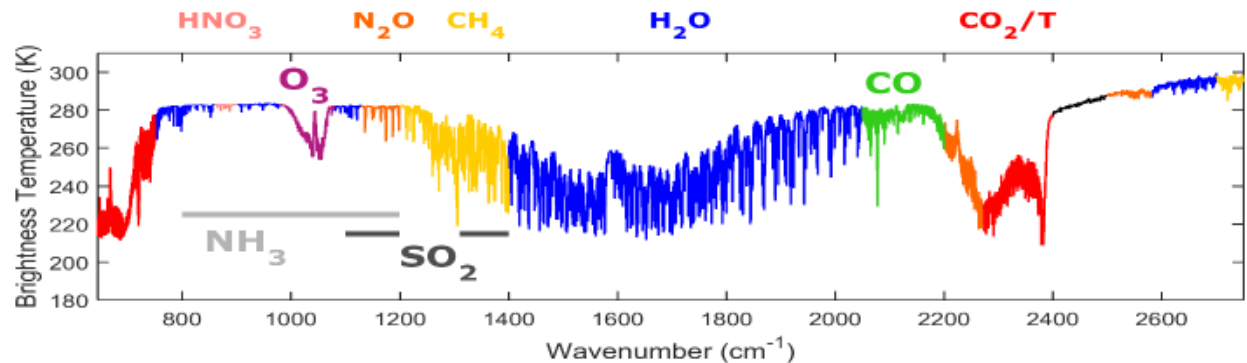
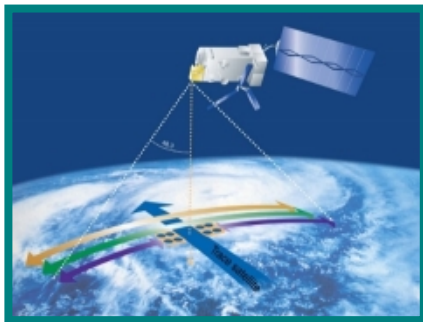
*[10'] Carole Deniel, CNES, Paris-France*

*With contributions of F. Bermudo, A. Deschamps, O. Vandermarcq (CNES)*

*C Clerbaux (LATMOS/ULB) & C Crevoisier (LMD,X) & N. Fourrié (CNRM)*

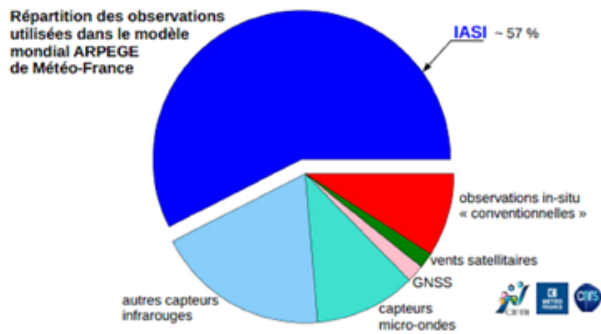
# IASI : Infrared Atmospheric Sounding Interferometer & IASI-NG

- Developed by CNES in partnership with Eumetsat,
- 3 IASI instruments are currently operational on the European Metop-A, Metop-B and Metop-C weather satellites, launched in 2006, 2012 and 2018 by ESA and Eumetsat. IASI-NG new-generation instrument will fly on the Metop-SG.
- IASI (FT Michelson) measure spectra on continuous spectral coverage: 3.62-15.5  $\mu\text{m}$  => 8461 channels, spectral resolution: 0.5  $\text{cm}^{-1}$  with a sampling of 0.25  $\text{cm}^{-1}$  & 2x2 pixels (12km), +/- 48.3° across-track scanning
- IASI NG (Mertz interferometer) will continue on METOp-SG with a Spectral resolution and SNR improved by a factor of 2 / IASI !



# 3 Applications supported by CNES (& others..)

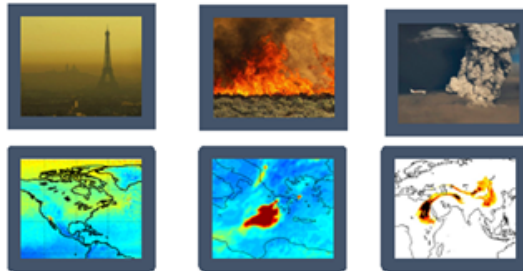
## Numerical Weather Prediction



Observations used in Météo-France global model ARPEGE

IASI has the **largest single impact** of any instrument on any satellite on **forecast skills** of NWP centers (Météo-France, UK MetOffice, ECMWF, etc).

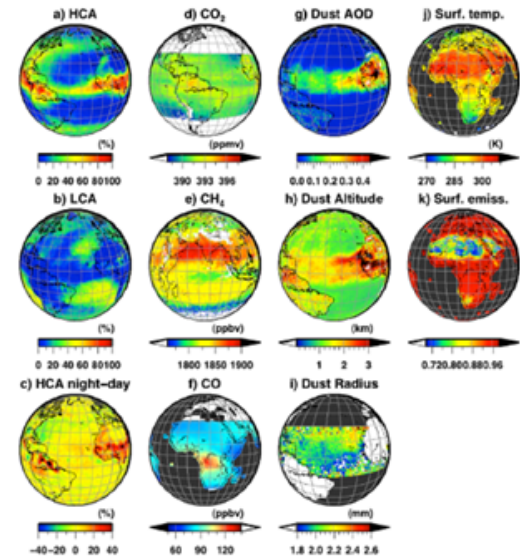
## Atmospheric composition



NH<sub>3</sub>, CO from fires, volcanic ash as examples of extreme events monitoring

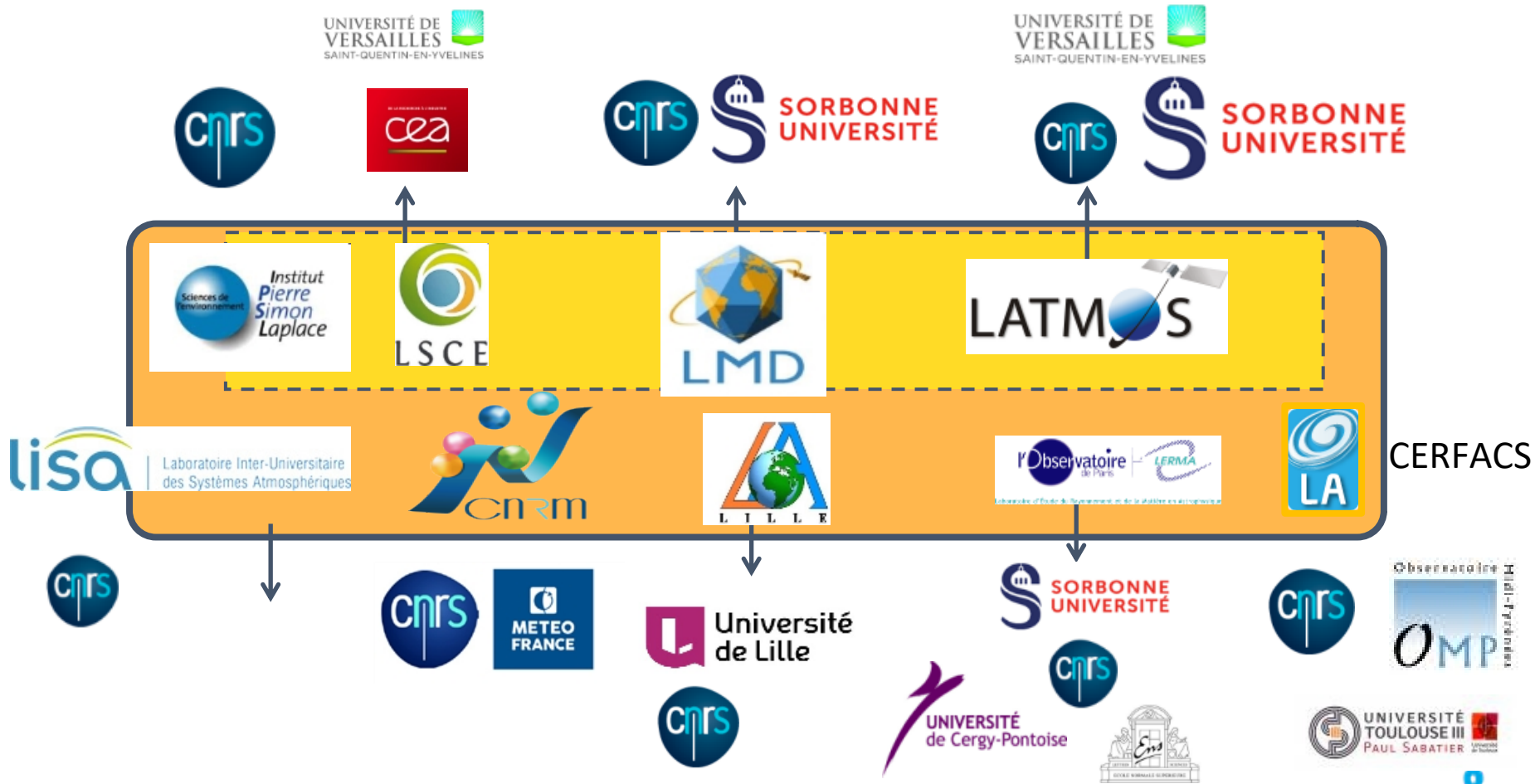
**27 atmospheric species** are currently observed by IASI in near-real time. Some of them are now routinely assimilated at ECMWF.

## Climate



**13 out of 16 of GCOS Essential Climate Variables for Atmosphere** are observed simultaneously with IASI.

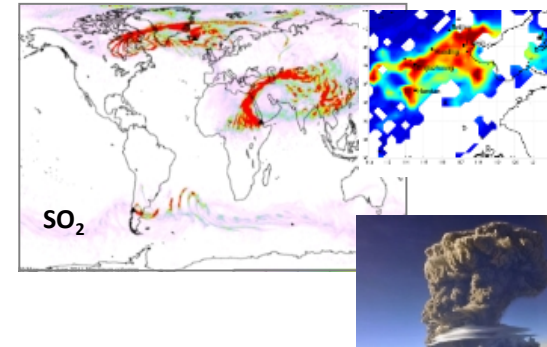
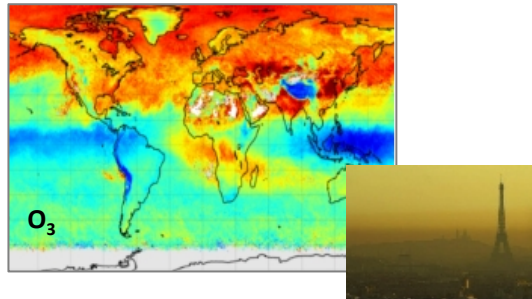
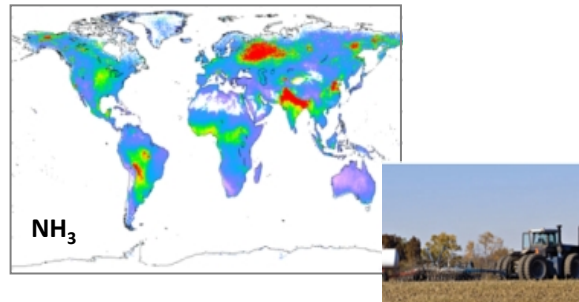
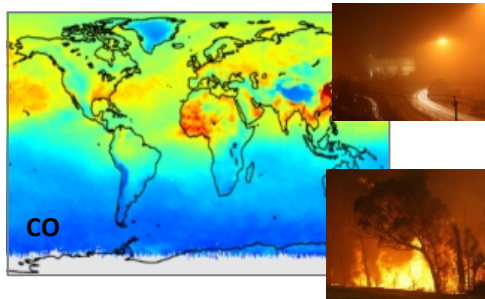
# 10 French Laboratories for IASI & IASI NG project



# Overview of IASI and IASI-NG missions

**A very high number of species detected / measured by IASI :** H<sub>2</sub>O CO<sub>2</sub> N<sub>2</sub>O O<sub>3</sub> CO HNO<sub>3</sub> HDO NH<sub>3</sub> PAN HONO C<sub>4</sub>H<sub>4</sub>O CH<sub>4</sub> C<sub>2</sub>H<sub>2</sub> C<sub>2</sub>H<sub>4</sub> C<sub>3</sub>H<sub>6</sub> CH<sub>3</sub>OH HCOOH CH<sub>3</sub>COOH CH<sub>3</sub>CHO CFC-11 CFC-12 HCN OCS SO<sub>2</sub> H<sub>2</sub>S, aerosols

**~200 users** (via AERIS data pole) + **pollution forecast** (Copernicus Atmospheric Monitoring Service) + **volcano alert** (Volcanic Ash Advisory Centers), Climate Change Initiative for Ozone, (AC SAF of EUMETSAT for CO and SO<sub>2</sub> NRT products)



# Essential Climate Variables



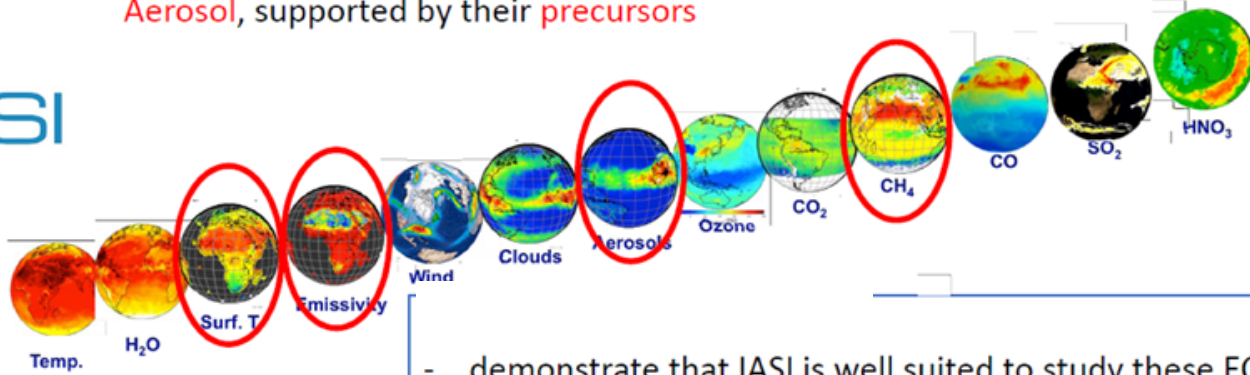
The Global Climate Observing System (GCOS) has established a list of **16 Essential Climate Variables (ECVs) for the Atmosphere** for long term monitoring (trend, seasonal and internannual variations) and understanding of underlying processes.

## GCOS Essential Climate Variables for the Atmosphere:

**Surface:** Air temperature, Wind speed and direction, Water vapour, Pressure, Precipitation, Surface radiation budget

**Upper-Air:** Temperature, Wind speed and direction, Water vapour, Cloud properties, Earth radiation budget (including solar irradiance)

**Composition:** Carbon dioxide, Methane, and other long-lived greenhouse gases, Ozone and Aerosol, supported by their precursors



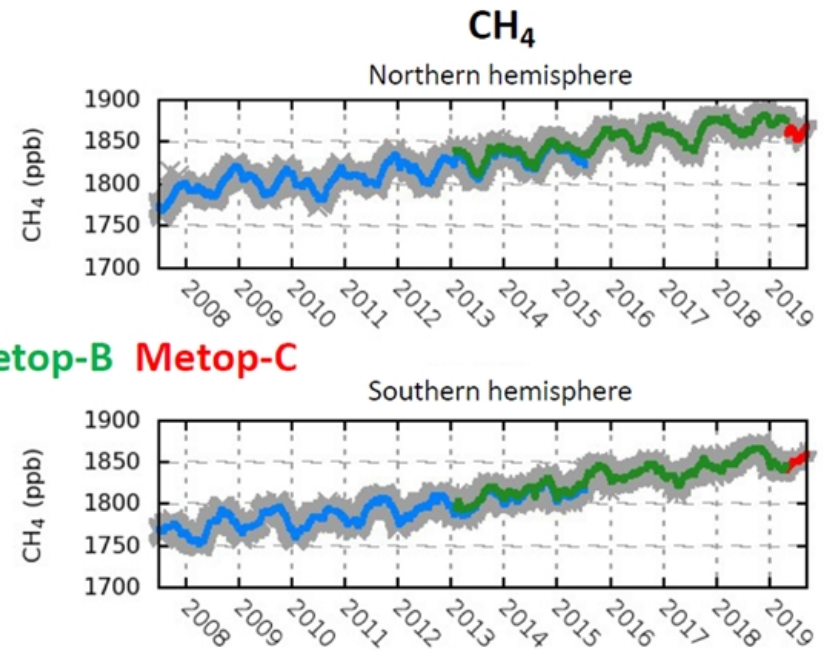
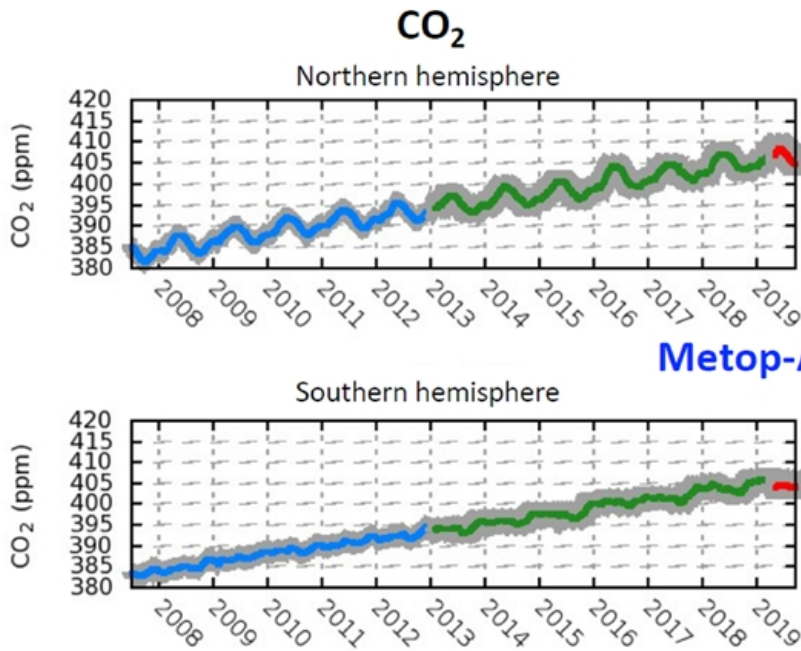
- demonstrate that IASI is well suited to study these ECVs on the long term
- by showing its long-term stability in terms of measures (radiances)
- by illustrating its ability to monitor ECVs and study processes



# Monitoring of anthropogenic Greenhouse gases



Daily/monthly time series of mid-tropospheric CO<sub>2</sub> and CH<sub>4</sub>



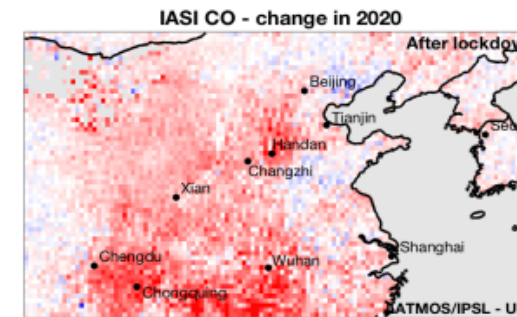
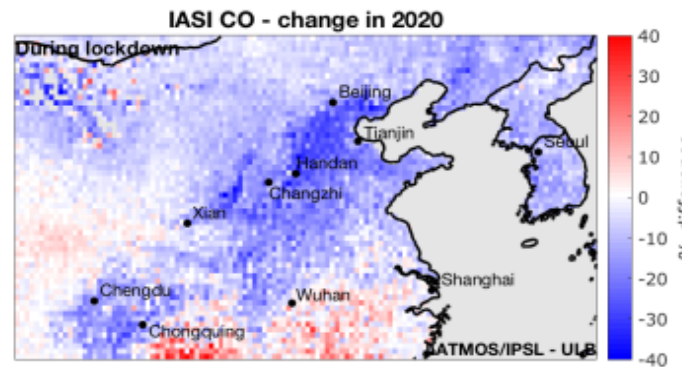
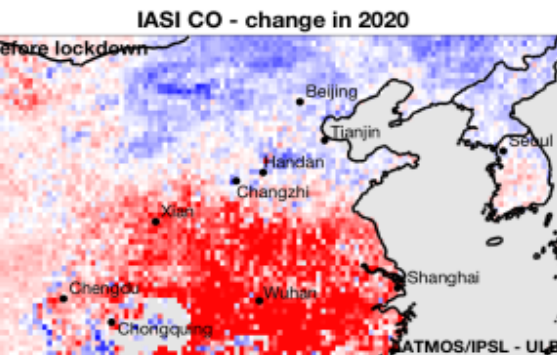
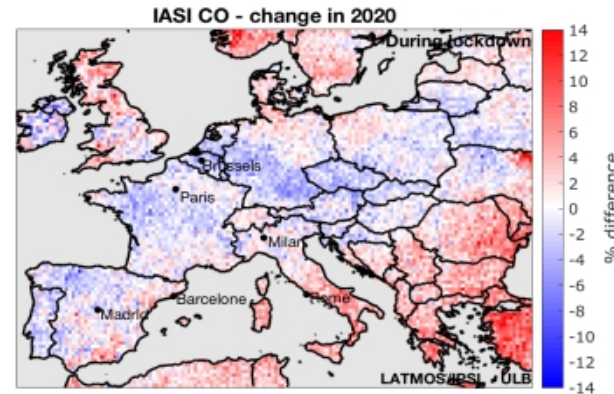
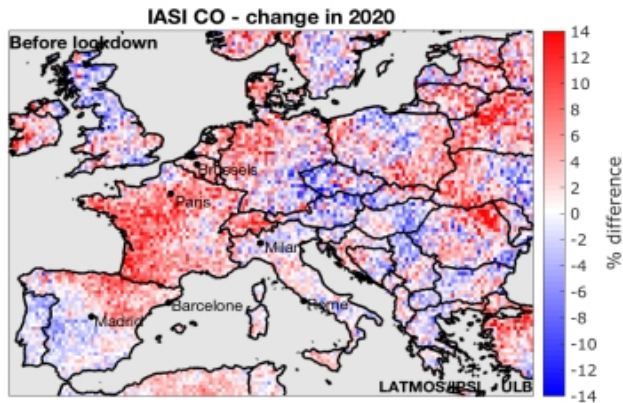
Metop-A Metop-B Metop-C

12 year trend: CO<sub>2</sub> +2.1 ppm yr<sup>-1</sup> | CH<sub>4</sub>: +8.2 ppb yr<sup>-1</sup>

Crevoisier et al., in prep.

## IASI : CO data during COVID Crisis : 2020 / average of the 2 previous years

Source C. Clerbaux



**before** lockdown: the period 01/01 – 22/01

**during** lockdown: the period 11/02 – 20/03

**after** lockdown: the period 21/03 -19/04



**THANK YOU !**

- You can see more about IASI & IASI-NG projects on :  
<https://iasi.cnes.fr/fr> <https://iasi-ng.cnes.fr/fr>
- You can have data on AERIS data base  
<https://iasi.aeris-data.fr/>
- You can see the IASI Movie (done by LATMOS):