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 µm => 8461 channels, spectral resolution: 0.5 cm⁻¹ with a sampling of 0.25 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

NH₃, 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

Coordination Group for Meteorological Satellites - CGMS

Add CGMS agency logo here (in the slide master)
Overview of IASI and IASI-NG missions

A very high number of species detected / measured by IASI: H2O CO2 N2O O3 CO HNO3 HDO NH3 PAN HONO C4H4O CH4 C2H2 C2H4 C3H6 CH3OH HCOOH CH3COOH CH3CHO CFC-11 CFC-12 HCN OCS SO2 H2S, 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 SO2 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 (radiiances)
- by illustrating its ability to monitor ECVs and study processes
Monitoring of anthropogenic Greenhouse gases

Daily/monthly time series of mid-tropospheric CO₂ and CH₄

12 year trend: CO₂ +2.1 ppm yr⁻¹ | CH₄: +8.2 ppb yr⁻¹

Crevoisier et al., in prep.
IASI: CO data during COVID Crisis: 2020 / average of the 2 previous years

Before lockdown: the period 01/01 – 22/01
During lockdown: the period 11/02 – 20/03
After lockdown: the period 21/03 – 19/04

Source: C. Clerbaux
THANK YOU!

- You can see more about IASI & IASI-NG projects on:
  
  [https://iasi.cnes.fr/fr](https://iasi.cnes.fr/fr)  [https://iasi-ng.cnes.fr/fr](https://iasi-ng.cnes.fr/fr)

- You can have data on AERIS data base

  [https://iasi.aeris-data.fr/](https://iasi.aeris-data.fr/)

- You can see the IASI Movie (done by LATMOS):