



**United nations / Germany International Conference:
International cooperation Towards Low-Emission and Resilient Societies
22-24 Nov 2017, Bonn**

CNES actions towards risk mitigation and climate change monitoring

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Overview of EO missions



In operation....

...in development



NOAA

NASA

EUMETSAT

ESA

ISRO

CNSA

UKSA

DLR

ISA

CSA

JAXA

Data centers, science, applications

4 data centers:

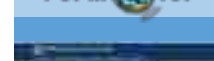
- ❖ Theia (land)
- ❖ Odatis (ocean)
- ❖ Form@ter (solid Earth)
- ❖ Aeris (atmosphère)

Science project funding

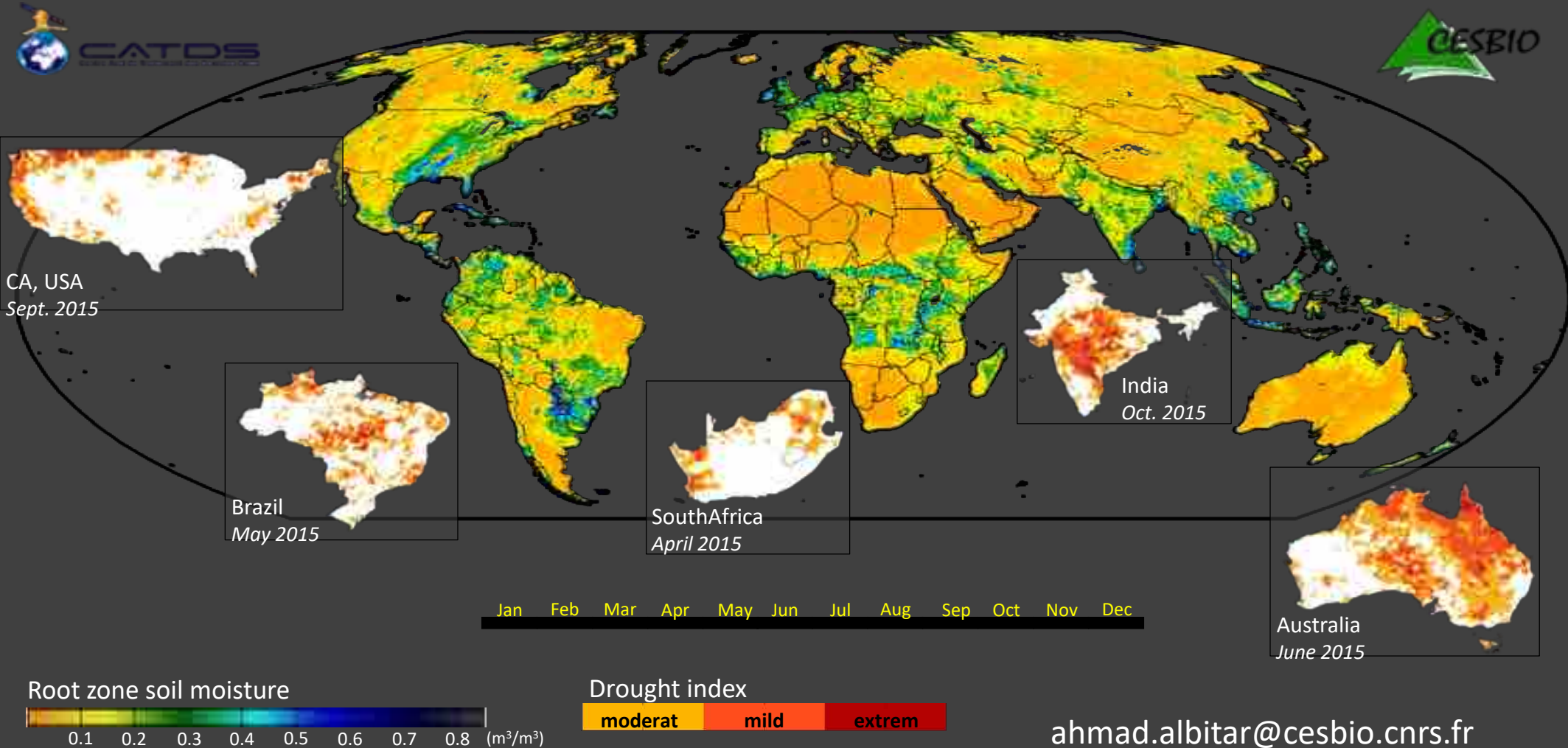
- ❖ ~10 M€ / year
- ❖ CNES projects science teams.
- ❖ Satellite Earth observation science

Applications

- ❖ From on-going or planned missions to applications (eg SWOT)
- ❖ From societal needs towards new uses for space data



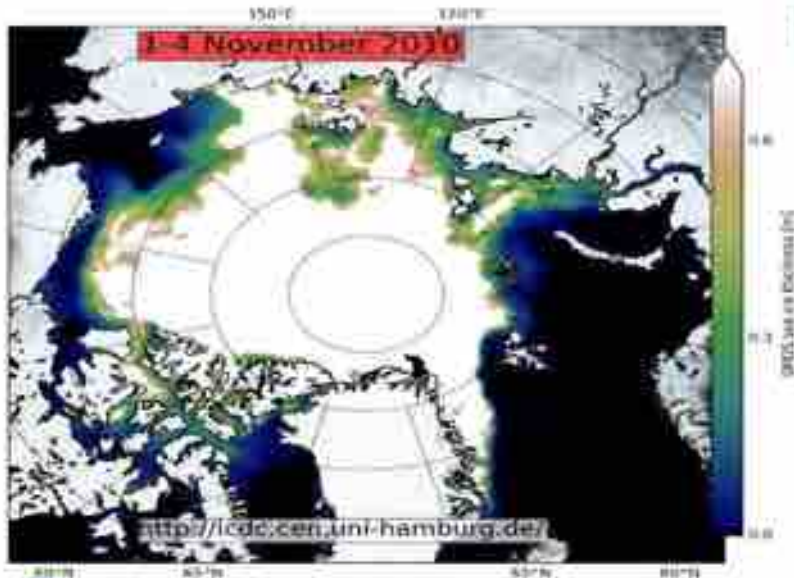
SMOS monitoring 5 major droughts in 2015



Sea ice melting seen by SMOS

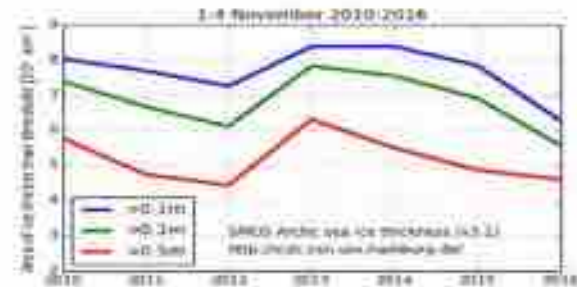


**Towards a climate data record:
7 years of Arctic freeze-up observed with SMOS**



**Merci pour votre patience!
Des questions?**

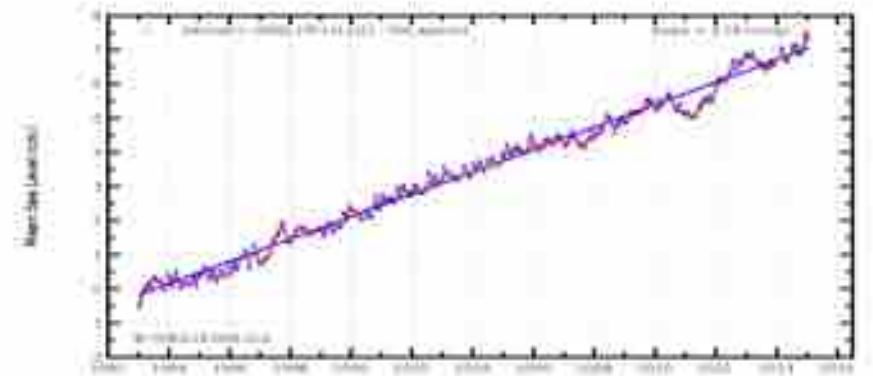
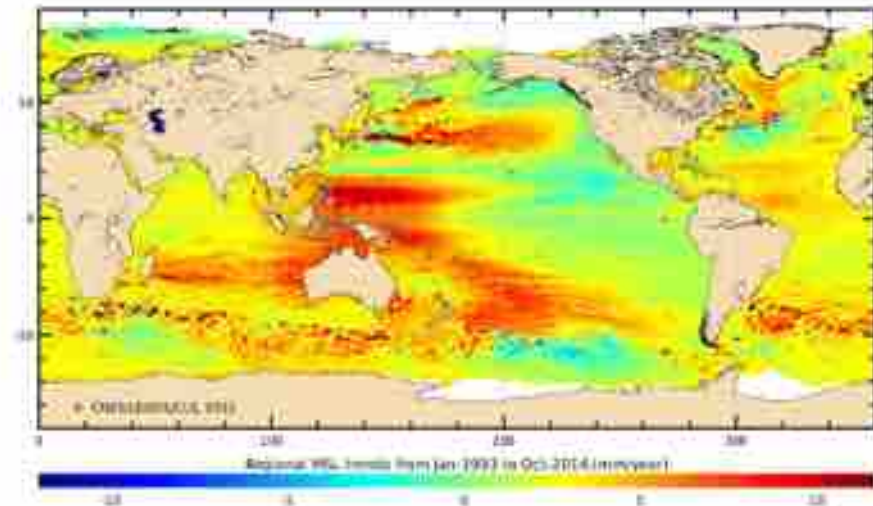
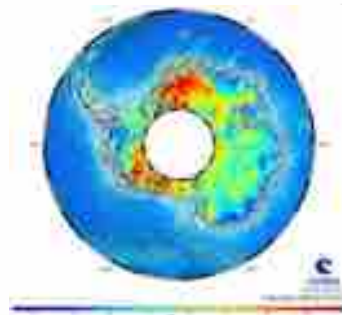
**2016 slowest sea ice growth
since 2010 Kaleschke, L**



Séminaire restitution TOSCA mars 21-22 2017 YHK



Climate: Reference altimetry and sea level since 1990s



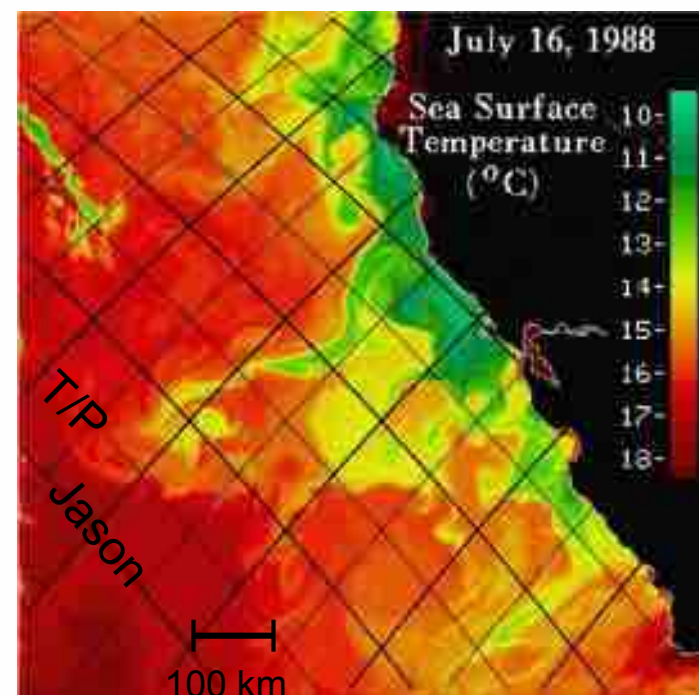
SWOT

Level of the oceans and inland waters

A joint CNES/NASA project to map variations in the levels of inland and ocean waters.

CNES is providing the platform and cooperating with NASA on the instruments, in particular the Karin instrument (a highly innovative wide-swath altimeter).

CNES is also in charge of the satellite-control ground segment and is developing a mission ground segment for data processing.
The French contribution is partly financed by the French future investments programme (PIA).



Launch planned for 2021

IASI 1, 2, 3 instruments: a unique climate serie

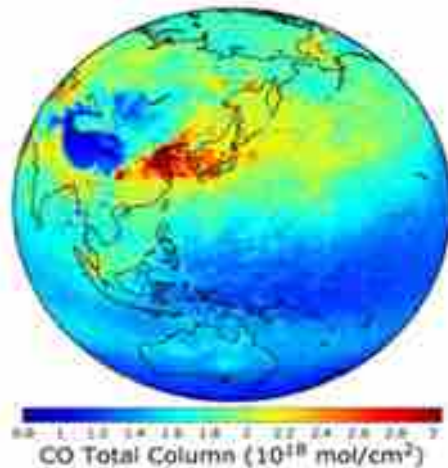
3 IASI instruments (FTS) developed by CNES for Eumetsat, on MetOp series

- ❖ MetOp- A 2006
- ❖ MetOp-B 2012
- ❖ MetOp-C 2018

IASI provides information for Numerical Weather Prediction (T & WV) and is the unique opportunity to retrieve simultaneously various climate and chemical variables (O₃, CO, GHG, aerosols, surface characteristics, etc.) using the **full IR spectrum at a resolution of 0.5 cm⁻¹**.

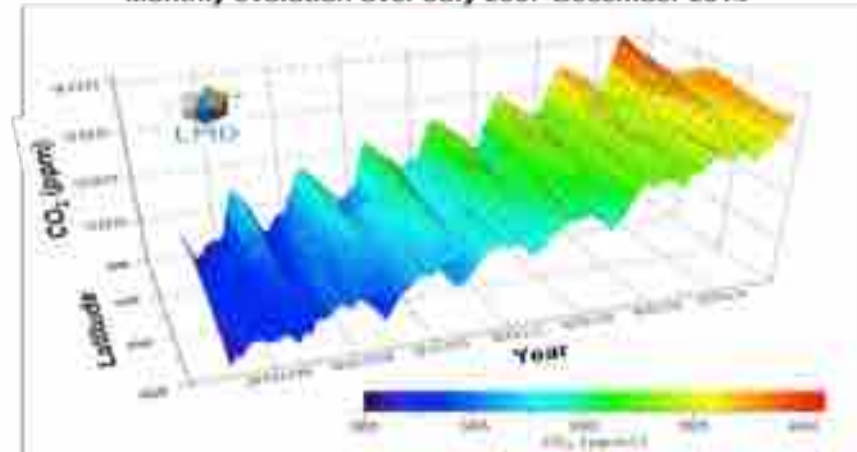


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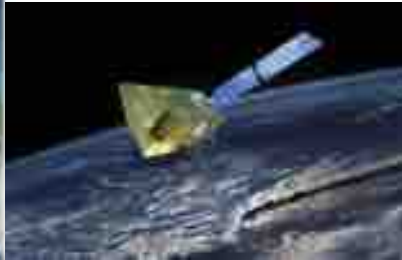


Total column of CO - © Clerbaux et al., 2009

Mid-tropospheric CO₂ from IASI/Metop-A
Monthly evolution over July 2007-December 2014



Greenhouse Gas Monitoring Microcarb & Merlin



© CNES/O. Satler

MERLIN : CH₄ Active measurement Accuracy < 27 ppb Bias < 3,7 ppb

- DIAL Lidar at 1,67 μm
- Horizontal sampling accumulation: 50 km
- To be launched in 2021

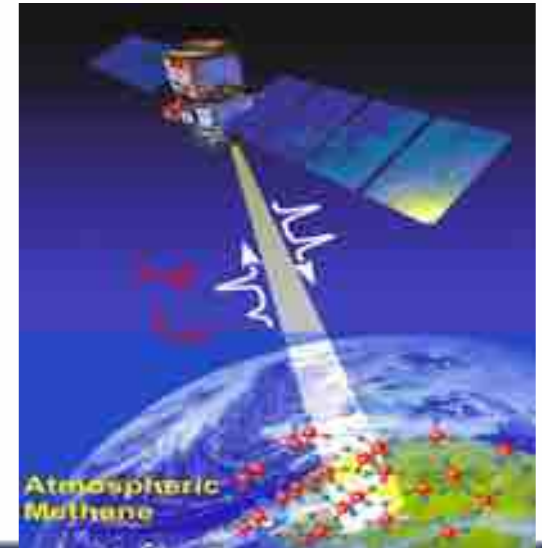


MICROCARB : CO₂ Passive measurement
Accuracy < 1 ppm Bias < 0,1 ppm

- XCO₂ spatial gradients are small (< 10 ppm)
- Error on measurement (regional bias) implies wrong flux computation
- To be launched in 2020



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DISASTER RESPONSE

International Charter Space & Major Disasters

Created by CNES, ESA and CSA, now 16 space agencies.

Coordinated effort to provide timely access to space imagery for disaster

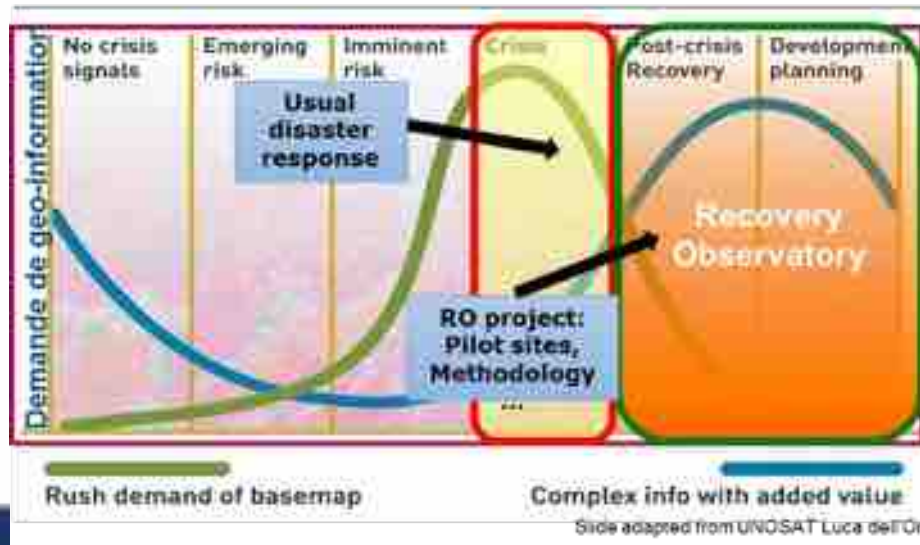
> 520 activations in more than 110 countries since 2000.



Feux de forêt au Chili, janvier 2017

© SERTIT

Recovery Observatory project



IRMA over Saint Martin & Saint Barthelemy

sept 6th, 2017

Pleiades images before (February) /
after (sept 10th)



Ground Motion monitoring

Pilot project towards a national ground motion monitoring service (CLS/TRE-Altamira)

❖ Sentinel-1 SAR Permanent Scatterers analysis

➤ Vertical / E-W motion time series

❖ Variety of applications

➤ Coastal zones instabilities

➤ Tectonics

➤ Urban monitoring

➤ Industrial, construction impact..





TELECOMMUNICATIONS

Data collection

ARGOS

A watchful eye on our planet

ARGOS, the only satellite-based data collection system, can also provide an independent positioning service.

Devoted to environmental study and protection through partnerships with NOAA, NASA, Eumetsat and ISRO, it is operated by CLS (Collecte Localisation Satellites).

The data are used for many applications, including oceanography, wildlife protection, management of fishing activities, and maritime safety and security.

The fourth generation is under development

A new generation instrument, ARGOS 4, will increase the system's capacity fourfold and enable transmitters to be miniaturised, thus enabling the tracking of more animals.

A miniaturized version (ARGOS neo) is compatible with nanosats (ANGELS)

CNES strongly supporting France actions wrt Climate Change

Support to COP 21 – Paris

- ❖ Microcarb decisions

Space agencies common declarations

- ❖ 2015 Mexico : Climate change & Disaster management
- ❖ 2016 New Delhi : GHG monitoring
- ❖ 2016 Marrakesh: Water

Paris Air show diner

- ❖ June 18th, 2017
- ❖ Contributions from: AEM, ASI, UAE, CONIDA, ESA, KARI, LAPAN, Swiss Space office...

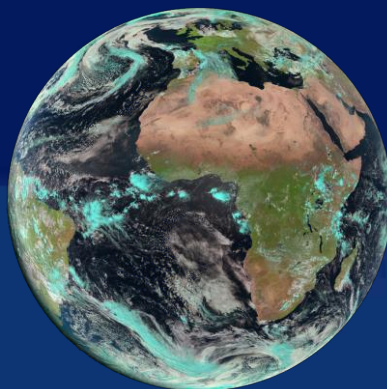
Upcoming:

Climate Summit on Dec 12h in Paris =>

Space agencies dinner on Dec 11th

- ❖ Address the 3 topics of previous declarations
- ❖ Round tables to discuss progress, remaining challenges
- ❖ Work on a Paris Declaration

⇒ **Draft available for comments**
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Thank you for your attention

