CENTRE NATIONAL D'ÉTUDES SPATIALES

Short CNES highlights on Climatology

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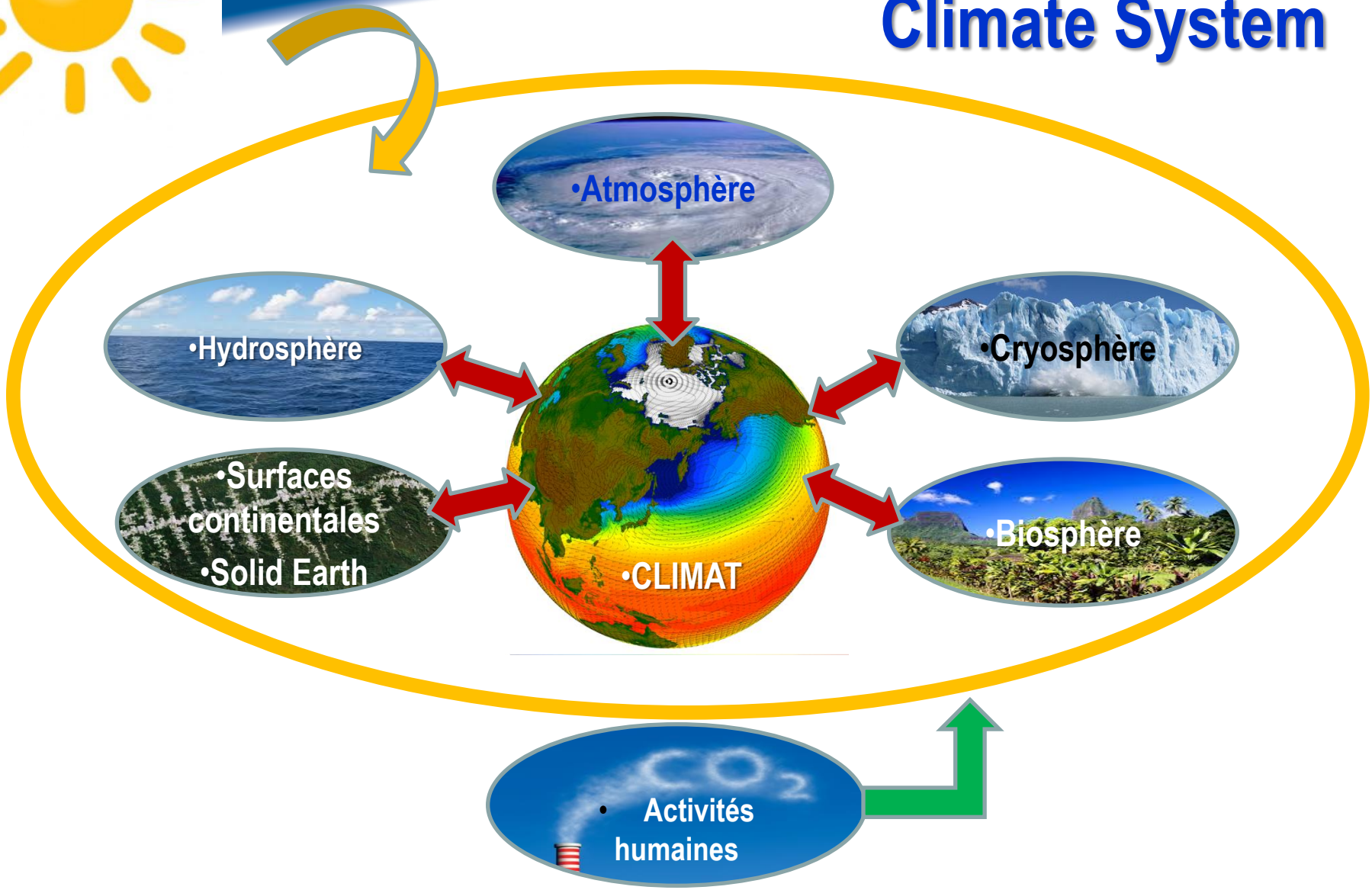
Climate System



•Global Climate Observing System/GCOS, 2011

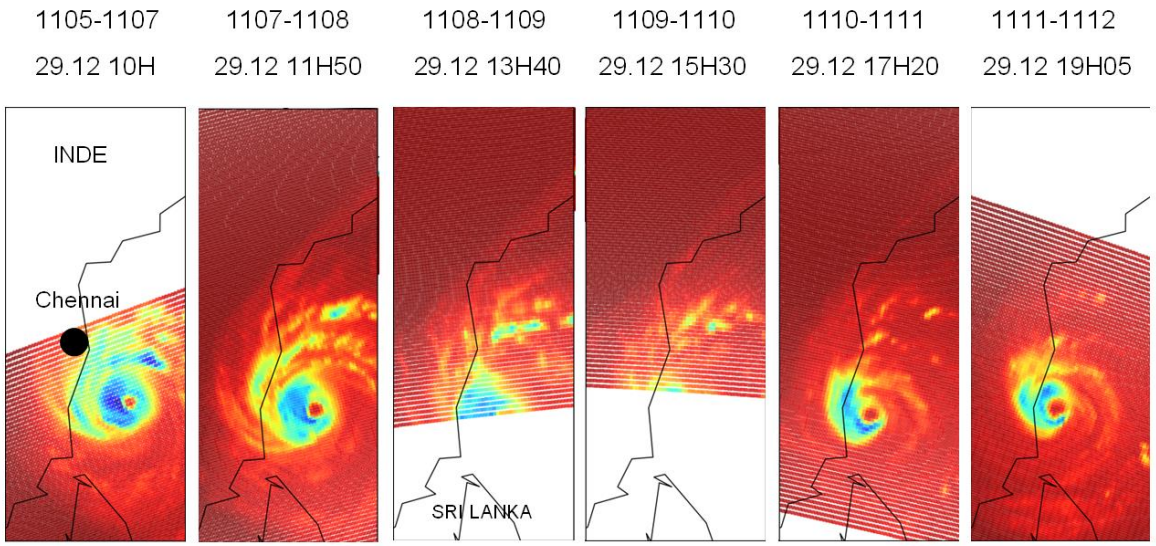
Composante Climatique		Variables Climatiques Essentielles observables par satellite
Atmosphère	Surface Altitude Composition	•Température, précipitation, humidité, pression, flux de surface, vent •Bilan radiatif au sommet de l'atmosphère, température, vapeur d'eau, nuages •CO2, CH4, etc., ozone, aérosols
Océan	Surface Sub surface	•SST, SSS, niveau mer, état de la mer, courants, activité biologique (couleur de la mer), pression partielle CO2 •T, S, courants, éléments traces, carbone, phytoplancton
Surfaces continentales	Débit des rivières, eaux souterraines, humidité des sols, niveau des lacs, manteau neigeux, glaciers, calottes polaires, permafrost	Albédo, occupation des sols et changements, végétation, LAI et autres indices de végétation, biomasse, feux

CNES missions related to climatology

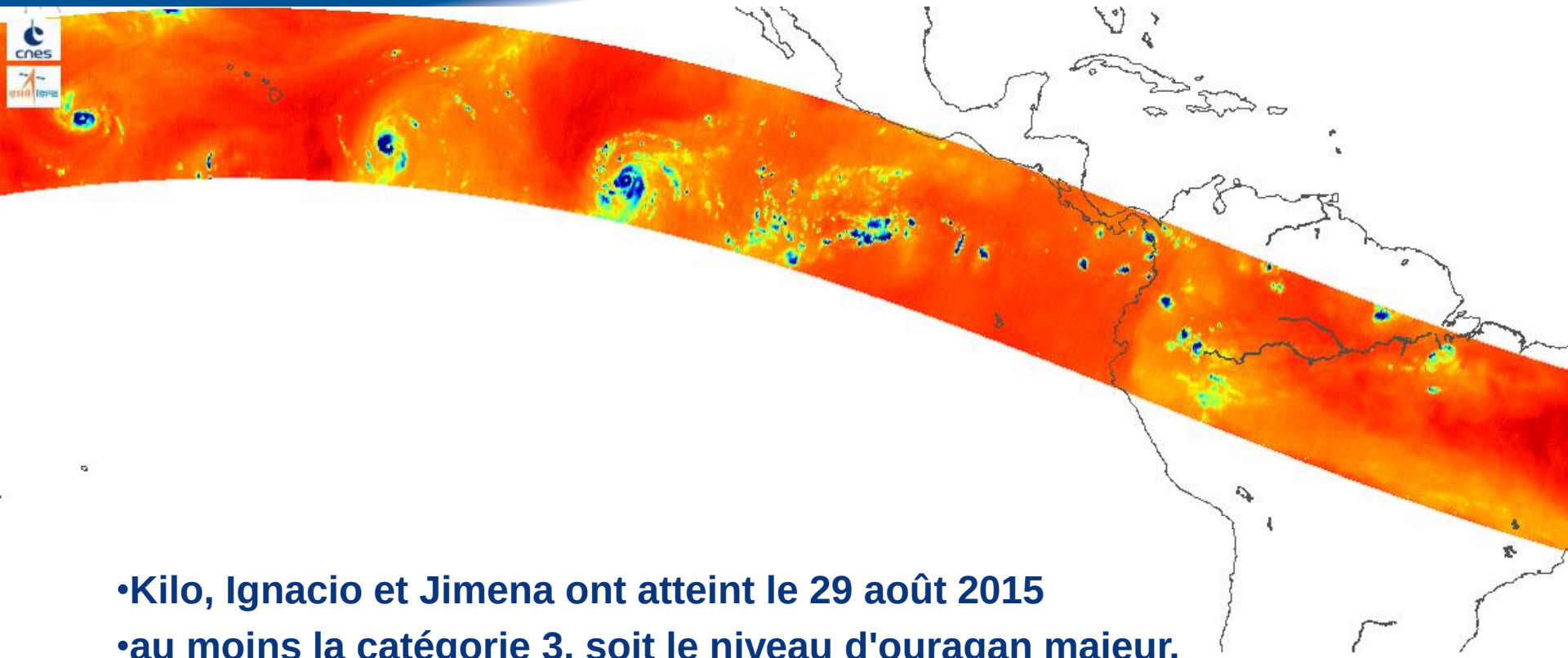
atmosphere

1. Megha-Tropiques (CNES-ISRO/India), launched in October 2011, studies the water and energy cycles in the tropical atmosphere with MW instruments (Saphir, Madras) and a Broadband VIS/IR radiometer (Scarab).

The tropical cyclone Thane as seen by Saphir on 29 December 2011.



•3 cyclones vus par SAPHIR sur Megha Tropiques



•Kilo, Ignacio et Jimena ont atteint le 29 août 2015
•au moins la catégorie 3, soit le niveau d'ouragan majeur.
•Les données de niveau 1 de SAPHIR (radiomètre sondeur micro-onde dévelop
•par le CNES) sont assimilées dans le modèle opérationnel de prévision
•de Météo France depuis le 13 avril 2015

atmosphere (continued)

2. **Calipso** (NASA-CNES, A-Train) launched in April 2006, studies the properties of clouds and aerosols with a lidar (CALIOP, NASA) and an IR imager (IIR, CNES) on a platform provided by CNES. **10 Years Anniversary in June in Paris !!**

3. **Parasol** (A-Train) launched in December 2004, studies the properties of clouds and aerosols with POLDER, a multi-viewing and multi-polarisation imager. End of the mission in December 2013. 3MI on board Metop-SG (2021) will « continue » the measurement.

atmosphere (continued)

4. **IASI and IASI-NG** (CNES-Eumetsat) infrared sounders on Metop then Metop-SG (2021-2040) to measure t°, water vapor, composition of the atmosphere. IASI-NG will succeed to IASI with improved performances.

10 years Anniversary of IASI-1 in October !!

5. **Merlin** (CNES-DLR/Germany) is intended for the measurement of atmospheric methane (CH_4) with a lidar, provided by DLR. CNES will contribute by its new small platform Myriade-E. Planned launch date: 2020.

6. **Microcarb** (CNES) is intended for measuring CO_2 column concentrations with a near-infrared dispersive grating spectrometer.

Planned launch date : 2020

Climate-related space missions : land

1. **VEGETATION** (CNES, European partners) intended to provide land cover with a multi-purpose VIS/IR imagery on SPOT 4/5. SPOT 5 launched on May 2002 . End of Life 2015.

2. **SMOS** (ESA, CNES, CDTI/Spain) provides soil moisture and ocean salinity. Launched on November 2009.

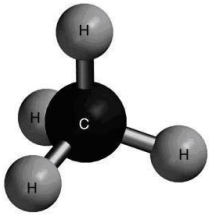
3. **PLEIADES** (CNES) to study the glaciers, land use, vegetation. 2 satellites launched in 2011, 2012.

4. **SWOT** (NASA, CNES) will provide the collection and distribution of high-precision data for the monitoring of water level (sea, lakes, rivers). Planned launch : 2020.

5. **BIOMASS** (ESA) will provide the estimate of the global biomass and the terrestrial component of the carbon cycle. Planned launch : 2021.

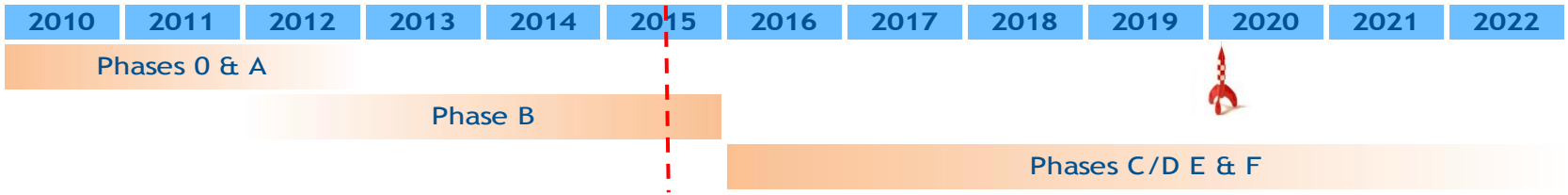
MERLIN

- **MERLIN is a LIDAR satellite dedicated to the observation of the spatial and temporal gradients of atmospheric methane (CH_4) columns**



- **MERLIN is a cooperation between France and Germany space agencies:**
  - **CNES in charge of platform, system, launcher, and part of ground segment**
  - **DLR in charge of payload, and part of ground segment**

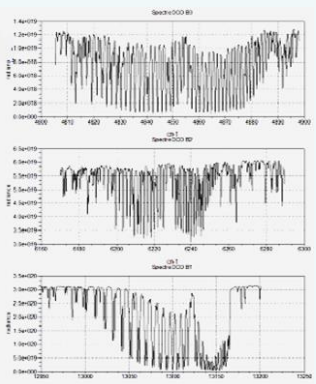
- **Planning:**



•MERLIN shall be the first IPDA lidar in space

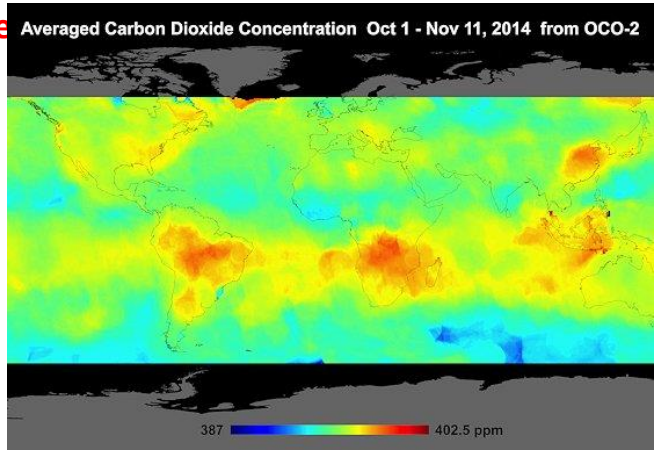
MICROCARB

•Processing, calibration



•Inversion of radiative transfert

•(Rodgers)



•***Level 0*** = Raw data

•***Level 1*** = Calibrated spectra in each band

•***Level 2*** = CO_2 •concentrations

•***level 3***

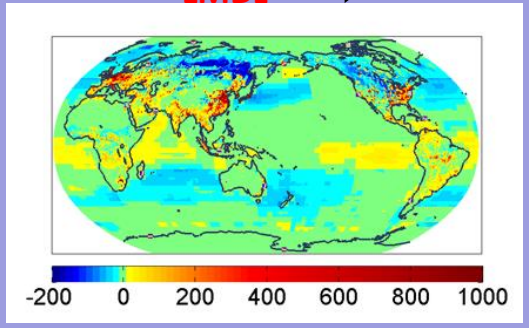
•= monthly average maps XCO_2

•Inversion of Global Circulation (transport model)

•LMDz

•***Level 4***

•= Flux CO_2 sources/sinks (resolution ≤ 500x500 km,



Climate-related space missions : ocean

1. **Jason-2/3** (Eumetsat, NOAA, CNES, NASA) intended to provide high-precision data for the monitoring of sea-level.

2. **Saral** (CNES-ISRO/India), launched on 25 February 2013, embark the Ka-band radar altimeter AltiKa (sea level).

CNES is also involved in Sentinel-3 (2016) and Jason-CS (2018) (for sea level)

3. **CFOSAT** (CNSA/China-CNES), intended to provide sea wave spectrum (SWIM radar instrument from CNES), and sea surface wind (CNSA). Planned launch : 2018.

Other activities related to climatology

CNES Climate Change activities with french scientists also includes:

- **Intercalibration of sensors from several agencies (exemple Infra red sounders like IASI, AIRS etc) and of sensors of a series of satellites (exemple = Jason series)**
- **processing and reprocessing of data activities especially at the end of missions.**
- **inventory and delivery of existing ECV series derived from CNES missions, some ECV data are produced in CNES-CNRS thematic data centers (Théia = Land surfaces, Ocean, Form@Ter = Solid Earth, Atmospheric pole), over ECV are delivered through ESA Climate Change Initiative**
- **Space data = inputs for Climate Service of Copernicus (European Program for Environment and Security)**

Strateole 2

Pré-Concordiasi February 2010

PHASE A - STRATEOLE-2

Situation à février 2016

Stratéole-2

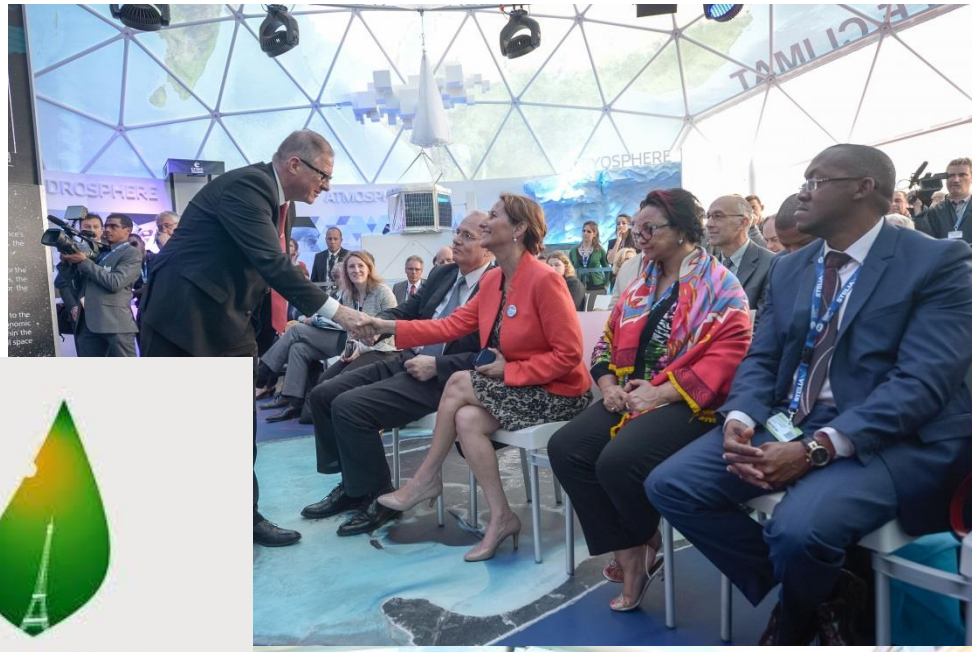
- **Possible contribution with**

- **ESA (Cal-Val ADM Aeolus lancement 2017 et EarthCare lancement 2019)**
- **Eumetsat (IASI 3 lancement 2018 et IASI NG lancement 2021) – Discussions moins avancées qu'avec l'ESA**
- **Université Paris- Saclay, et autres**

Calendrier

- **Campagne de validation (5 vols): Hiver 2018-2019**
- **Première campagne scientifique (20 vols): Hiver 2020-2021**
- **Seconde campagne scientifique (20 vols) : Hiver 2023-2024**

Dôme du Climat au MEDDE



PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11


Thank you for your attention