CNES Earth Science Program Overview

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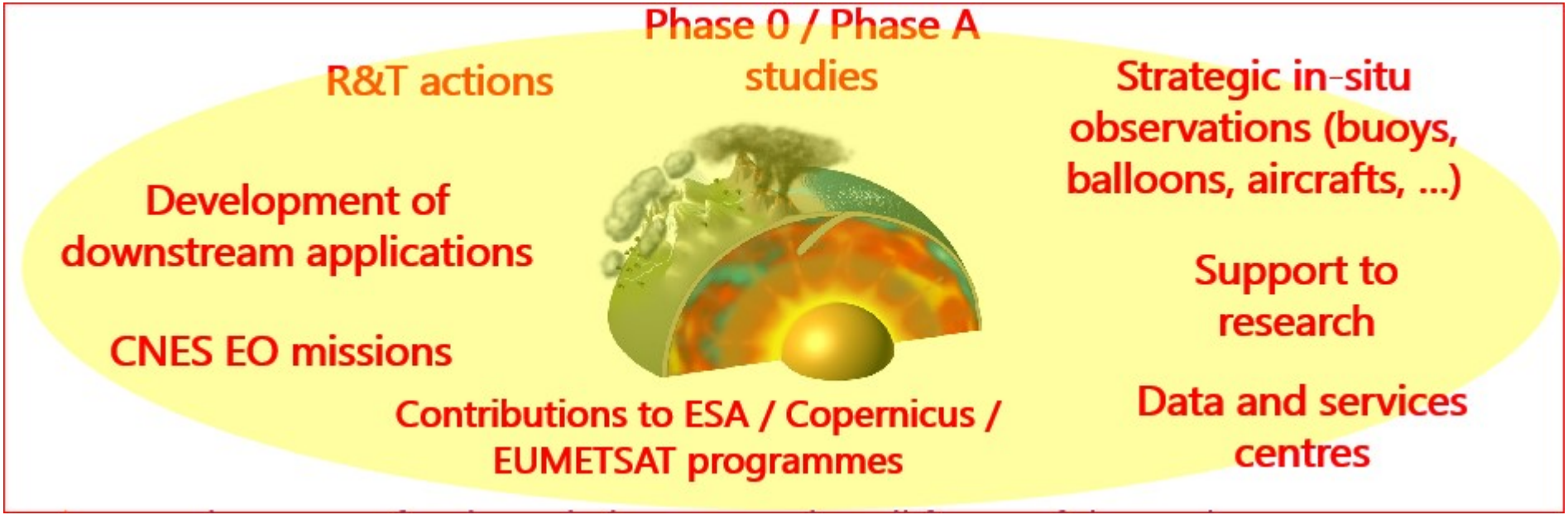
Protecting the Earth by observing it from space

- COP21 and Climate Change
- Agenda 2030 / Sustainable Development Goals
- Sendai; Disasters and Extreme Events

When combined with *in situ* observations and numerical simulations, satellite observations help us understand, monitor and predict the state of the planet so that we can adapt to climate change, locally and globally.

- ***Atmosphere/Weather/Climate***
- ***Oceanography/Hydrology***
- ***Coastal***
- ***Crosphere***
- ***Land surfaces***
- ***Earth/Environment***
- ***Solid Earth/Geodesy/Geomagnetism***
- ***International Charter on Space and Major Disasters***

The CNES EO Programme



- A consistent set of actions aiming at covering all facets of the Earth System
- Collaborations / Partnerships
- Necessary combination of satellite + in-situ + model data
- From upstream (R&T) to downstream (applications)
- Guidance on strategy and level of support provided by scientific committes (CPS / TOSCA)

OBSERVATION

3 recognized areas of excellence

Imaging


SPOT


Helios


Pléiades


Venμs


Trishna


CO3D

Altimetry

Sounding the atmosphere


Parasol


Calipso


IASI


Megha-Tropiques

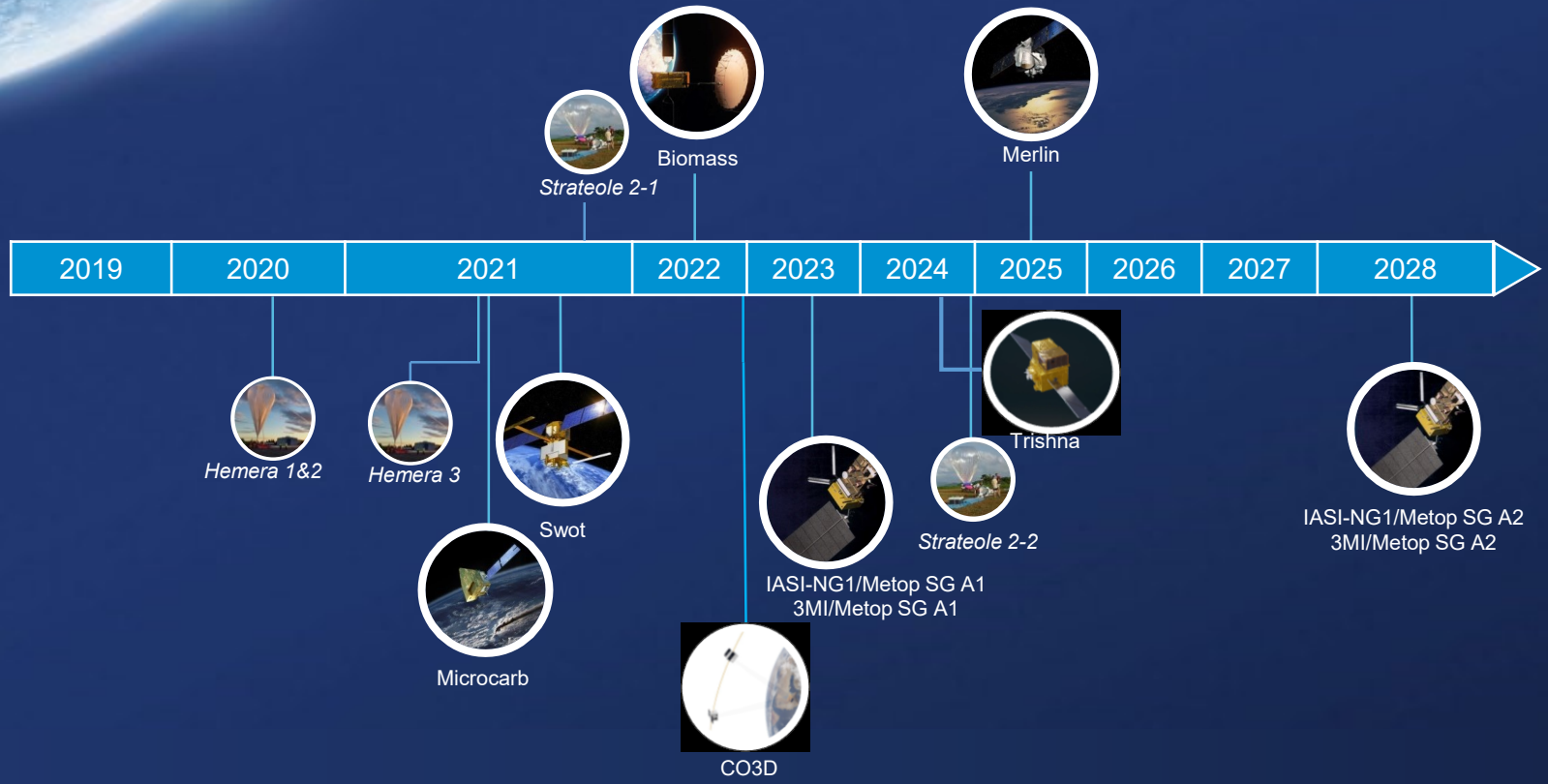

Microcarb


IASI NG


Merlin

OBSERVATION

Programmes being prepared or developed

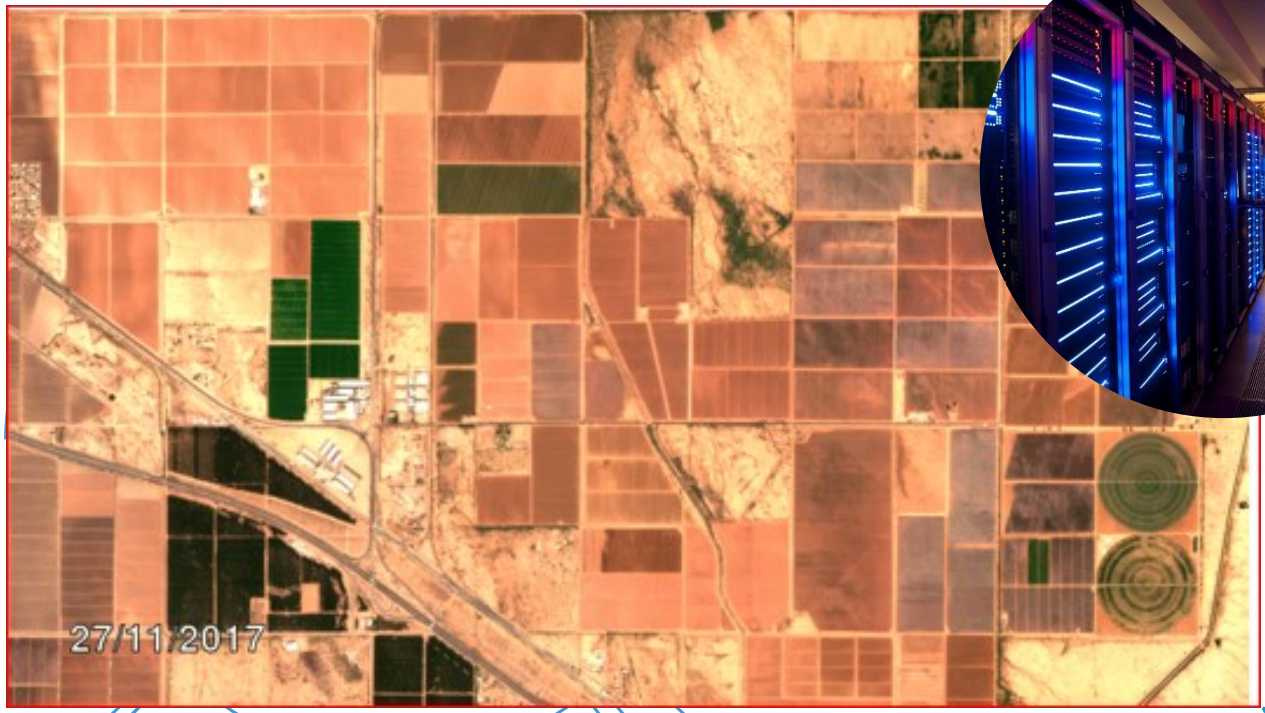


OBSERVATION

Programmes in exploitation

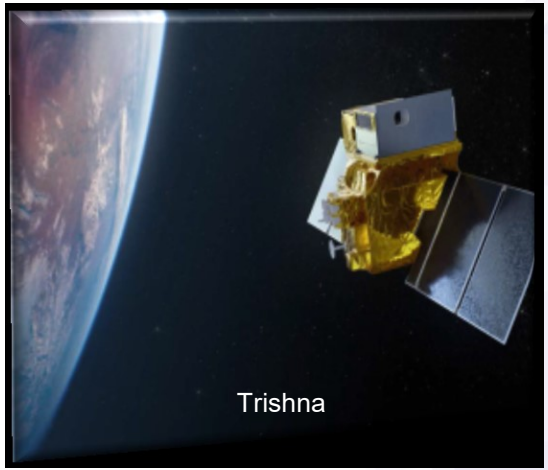
Challenges in Earth Sciences

SCIENCE PROSPECTIVE



- Continuity of data
- New measurements
- Complementarity in-situ - satellite- models
- Increased needs for precision, resolution, revisit time
- Systemic approach (Earth major cycles)

Priority missions for Earth Sciences



TRISHNA

Infrared imaging for monitoring water and vegetative cycles

ACCP: Mescal and C²OMODO

Aerosol and Cloud, Convection and Precipitation observing systems

ULID -> SMOS Next

Feasibility of high-resolution soil moisture measurements

NanoMagSat

Geomagnetic observation,
from the Earth's core to space weather

C³IEL

4D study of convective clouds

BIODIVERSITY

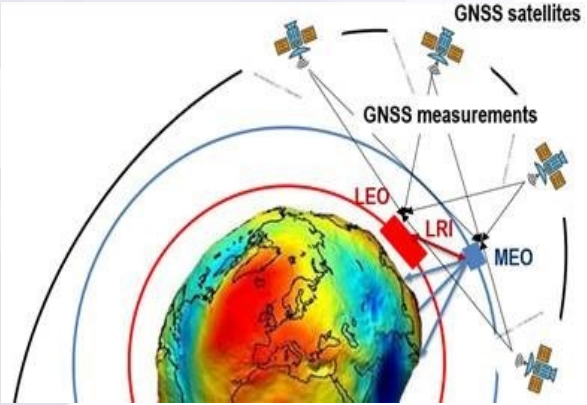
Hyperspectral imaging for studying biodiversity

MARVEL

Climate system monitoring using differential gravimetry

SKIM

Ocean surface currents monitoring



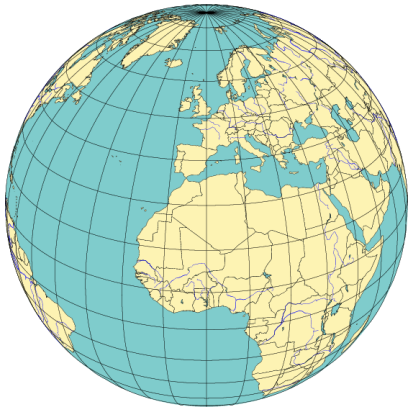
Marvel

COOPERATION – A global ambition and a key Driver

CNES has adopted a global perspective in making cooperation
a key element of its strategy since its inception.

CNES partnerships with other agencies are founded on a
relationship of trust, built at the highest levels over many years

Mock-up of the Eyesat nanosatellite presented by a student from the Janus programme



Cooperation with NASA

- ✦25 years of cooperation in Altimetry Field ->SWOT
- ✦Calipso + A-Train

ACCP (Mescal and/ or C²OMODO)), Mass Change (Marvel)

Cooperation CNES-ISRO

- ✦Megha-Tropiques
- ✦SARAL
- ✦TRISHNA

Cooperation CNES-CNSA

- ✦CFOSAT
- ✦Water Cycle : SMOS Next

Cooperation CNES-ISA

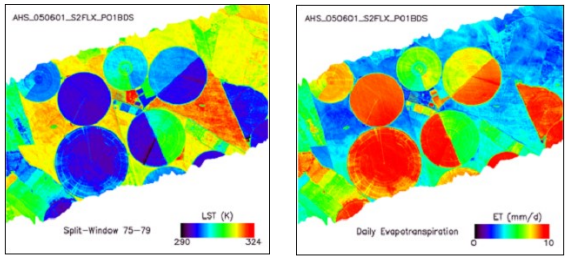
- ✦Venμs
- ✦C³IEL

Cooperation could be sought at academic and industrial

TRISHNA Mission

- TRISHNA : Thermal infraRed Imaging Satellite for High resolution Natural resource Assessment
- CNES ISRO Cooperation since 2011 (Megha-Tropiques, Altika-Saral
- **CNES Board Decision, March 12th, 2020 to proceed with Phase B,C,D,E1**

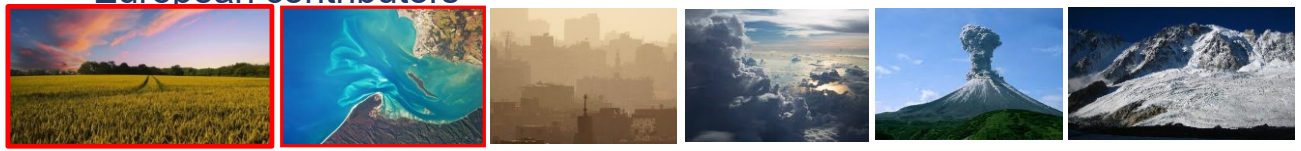
Launch scheduled 2025



Ground surface temperature and daily evapotranspiration

- 2 Primary objectives: **Agriculture & Coastal Hydrolology**
  + Urban, Cryosphere, Atmosphere, Solid Earth
- **Global coverage @ 57 m resolution for continental and coastal areas**, binned at 1 km over open ocean.
- 4 TIR bands **(NeDT 0.2K)**+ 4 VNIR bands + 2 SWIR bands
- **3 Global acquisitions per 8 days period**
- 761km-8day orbit reducing hot spot constraints in intertropical zone
- ± 34° scan angle, 1030km swath, Overpass time : 1 PM ± 15 mn

- Indo-French(*) science mission group, synergies Under development with **ECOSTRESS, SBG**, LSTM science & application teams, + other European contributors



Small Satellites - Missions under study

C3IEL – Cluster For Cloud Evolution Climate And Lightning
Subject area: Meteorology --- Concept: formation flying – swarm

French-Israeli mission (CNES-ISA) under study since 2018.

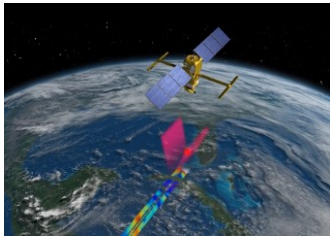
Objective: observe clouds in 3D in order to provide measurements of vertical velocities at the top of convective clouds; of interest for weather and climate models. **Phase A decided and workshare cooperation agreed**

SMOS Next concept

ULID – Unconnected L-Band interferometer Demonstrator
Subject area: Soil moisture and ocean salinity
Concept: formation flying --- swarm demonstrator 3 nanosatellites

Objective: demonstrate the ability for the SMOS follow-on mission to perform interferometric measurements in L-band with unconnected payloads. **Phase A ended**

Small Satellites - Missions under study



SWOT satellite

SMASH – SMall Altimetry Satellite for Hydrology

Subject area: Nadir altimetry for inland hydrology (lakes and rivers)

Concept: constellation – 10 nanoaltimeters in K_a-band

Objective: nadir altimetry mission providing a daily revisit capability

Phase A : on going