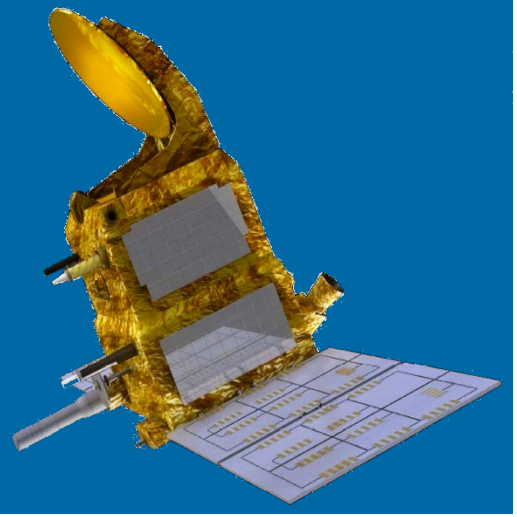
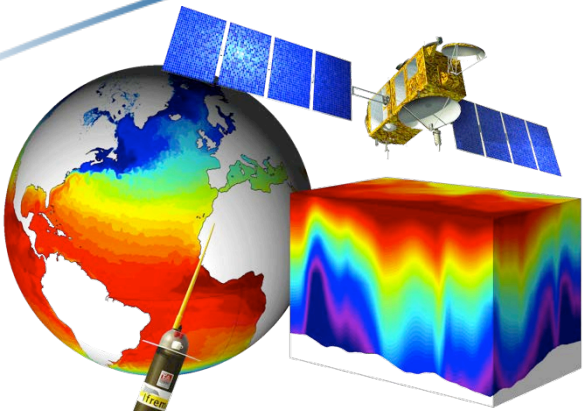
CNES Interest in ocean currents monitoring

Juliette Lambin

March 7th, 2012

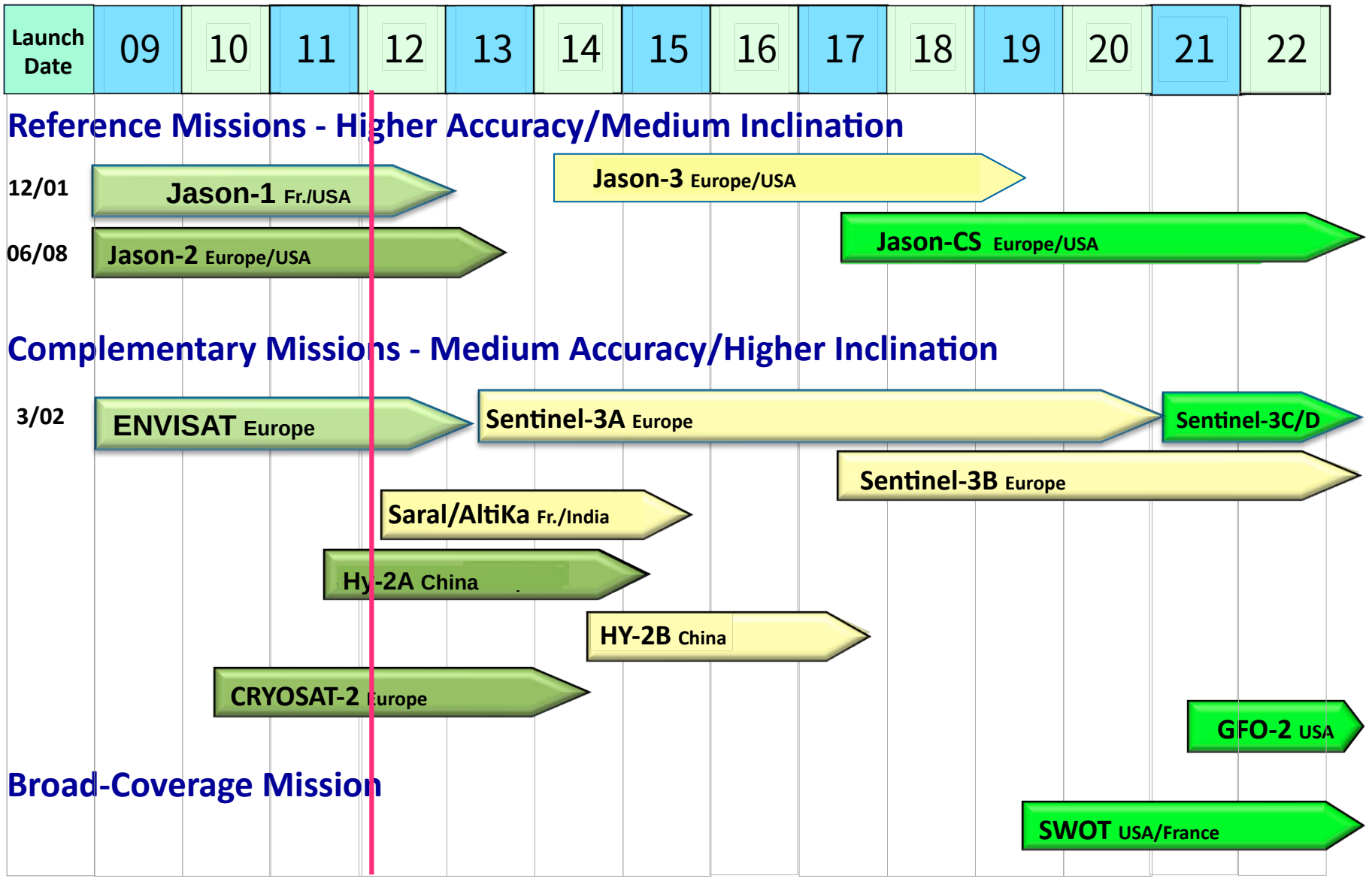


CNES involvement in oceanography

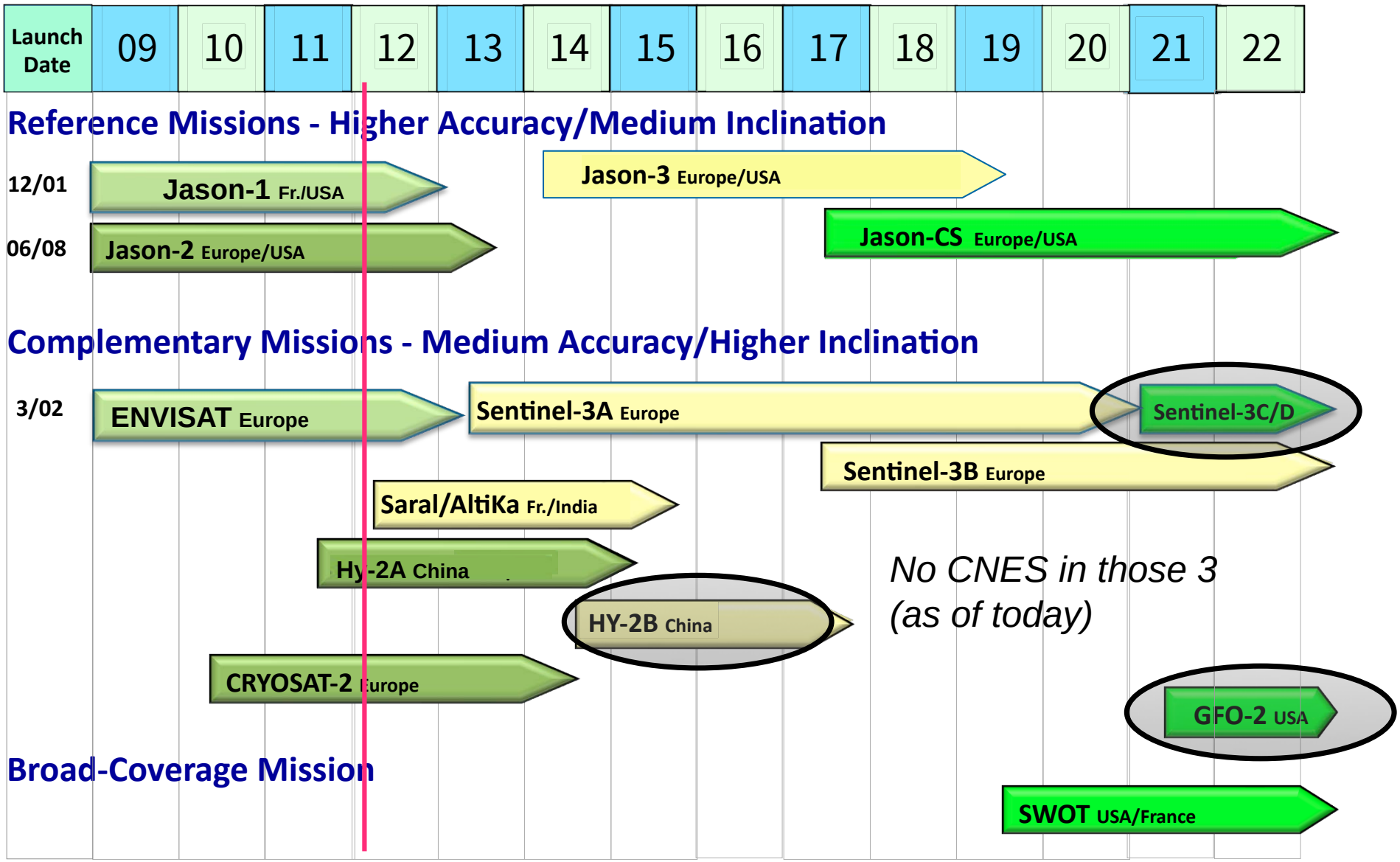


- **Promote the development of operational oceanography**
  - Secure the « reference mission » continuity and performance: TP/J1/J2/J3/J-CS
  - Contribute to the altimetry constellation: ERS/ ENVISAT/SENTINEL-3, Hy-2A
  - Enhance synergies between altimetry missions through AVISO/DUACS
  - Involvment in CORIOLIS, partnership with Mercator…
- **Future of altimetry: new instruments**
  - AltiKa: Ka-band altimetry
  - Contribution/Interest in Delayed Doppler altimetry (Cryosat, Sentinel-3…)
  - SWOT: wide-swath altimetry
- **Explore new measurements of ocean parameters**
  - SMOS: ocean surface salinity
  - CFOSAT: directional wave spectrum
  - Ocean colour

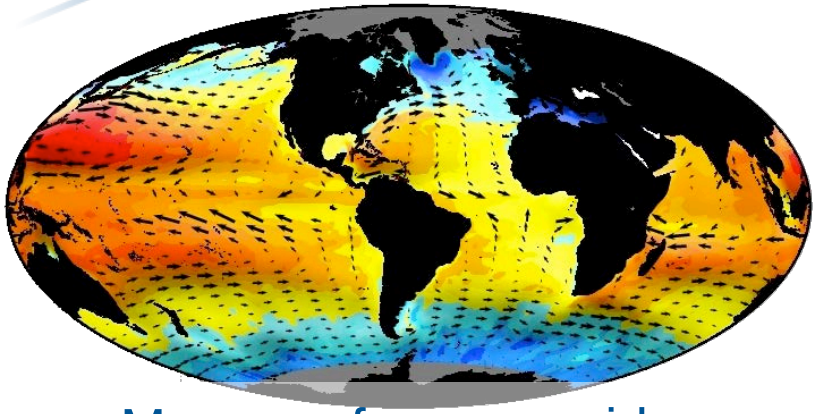
GLOBAL ALTIMETER MISSIONS



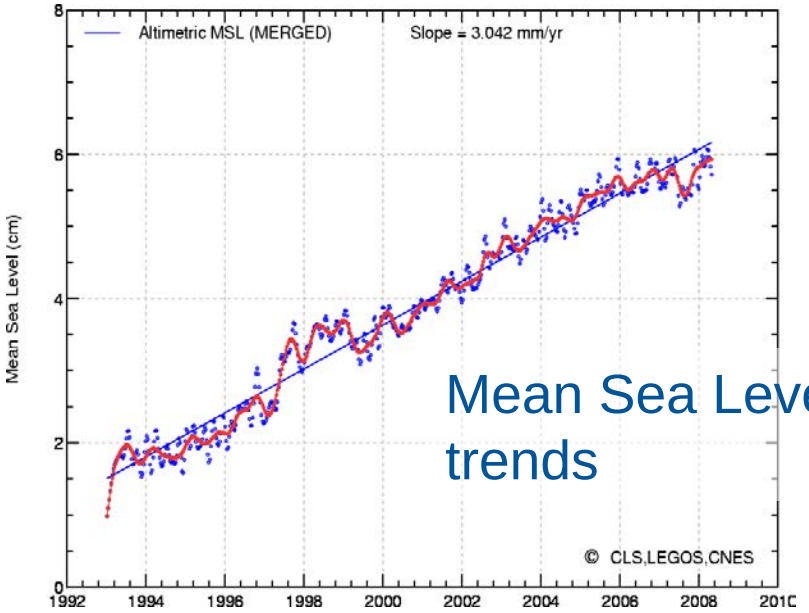
GLOBAL ALTIMETER MISSION: CNES participation



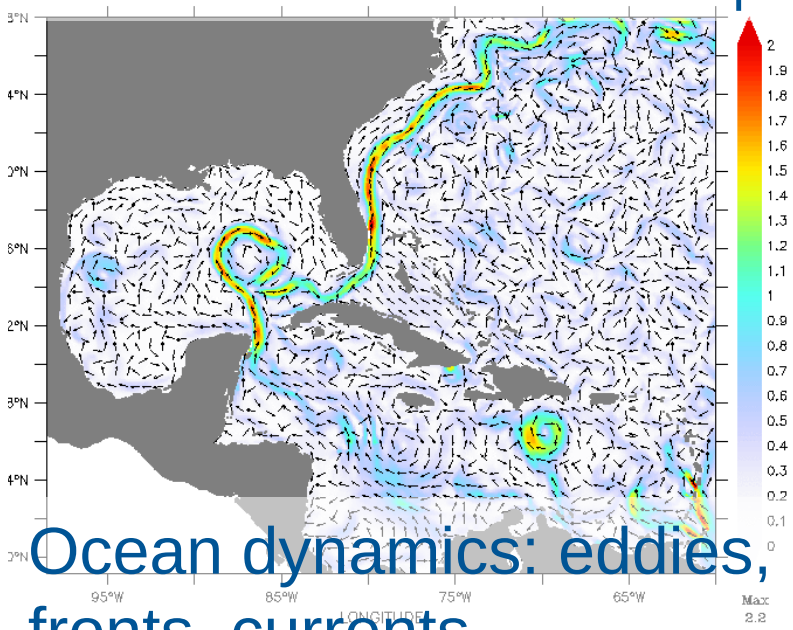
Altimetry: what for?



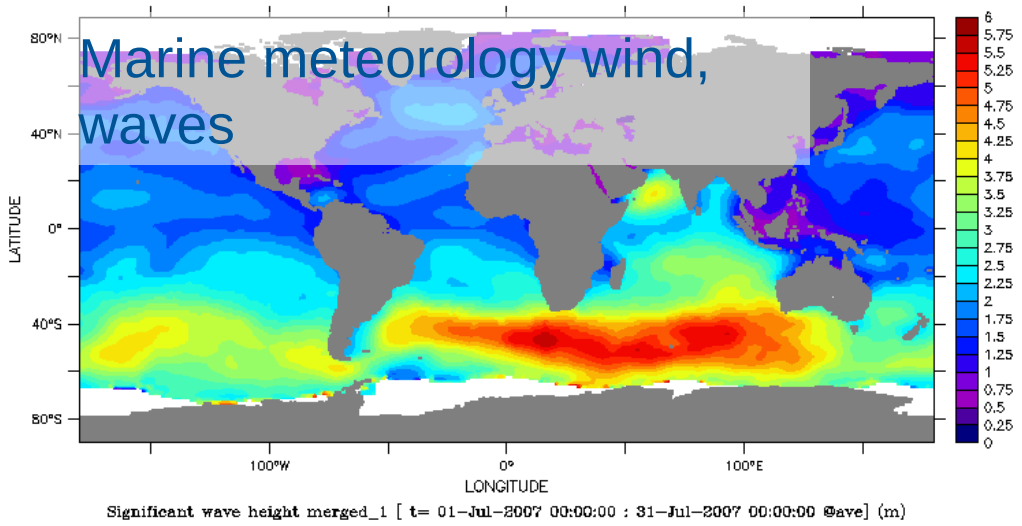
Mean surfaces: geoid, mean dynamic topography



Mean Sea Level trends



Ocean dynamics: eddies, fronts, currents…



Marine meteorology wind, waves

Ocean remote sensing on the ground

- **Multi-mission ground segment in altimetry**
  - **SALP, SSALTO/DUACS, AVISO**
    - Processing
    - Calibration-validation
    - Intercalibration – homogeneization
    - Multi-mission product
    - Distribution, user support
    - Evolutions and reprocessing

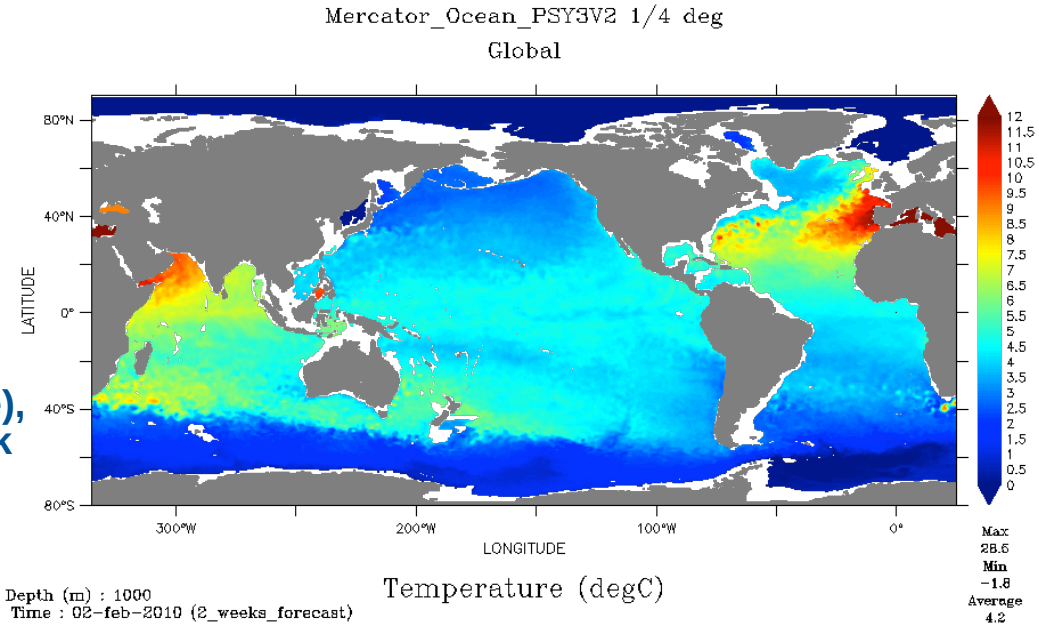
- **Other techniques also**
  - **Contribution to Globwave (Wave products => CFOSAT)**
  - **CATDS (SMOS)**
  - **GIS COOC (Ocean Colour)**

- **Support to science**
  - **OSTST, Dedicated science teams, « TOSCA » program**

Support to Core/Downstream services

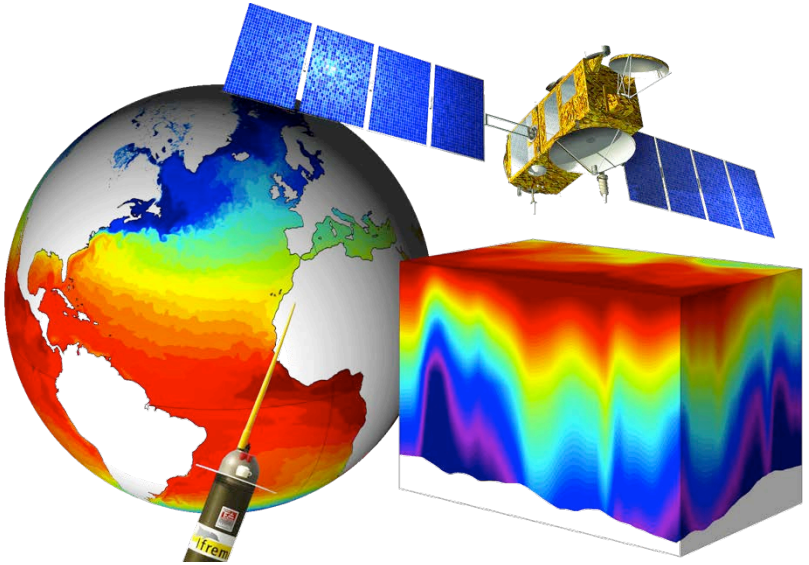
- **Mercator-Océan**
  - Initially a « GIP » (Groupement d'intérêt public) in which CNES was a founding member
  - Ocean data assimilation & forecasting
  - Lead of the MyOcean project: GMES Marine Core Service
  - Since 2010, change of status (Société civile), CNES is no longer a mamber, but framework agreement set in place instead

⇒ **CNES funding now directed to R&D activities, in particular so-called « Green Mercator »**



- **Coriolis : in-situ French contribution to Argo**
  - General contribution to Argo
  - On-going support to Bio-Argo activities

- **GMES Collaborative Ground Segments**
  - On-going coordination with the national partners to see what and how to contribute/ propose
  - 3-axis : Altimetry / Ocean color / Sea State



« Traditional » altimetry innovative concepts

- **« Reference mission » altimetry :**
  - **2001 – present: Jason-1**
    - Poseidon-2 altimeter, DORIS, Proteu platform, ground segment
  - **2008 – present: Jason-2 (~same)**
  - **~2014 Jason-3 (~same)**
  - **~2017 Jason-CS**
    - TBD; so far support to ESA/ EUMETSAT in mission design
- **Other missions:**
  - **2011 Hy-2A**
    - support to DORIS, POD processing, level-3/4 data
  - **~2013 Sentinel-3 A&B**
    - DORIS, technical support to ESA
- **And always:**
  - **SALP / AVISO, CATDS, Globwave, GIS COOC**
  - **Support to Mercator, CORIOLIS, OSTST, GODAE…**

- **AltiKa**
  - **Ka-band altimetry**
- **CFOSAT**
  - **Directional wave spectrum**
- **SWOT**
  - **Wide-swath altimetry**
- **OCAPI**
  - **Ocean color**

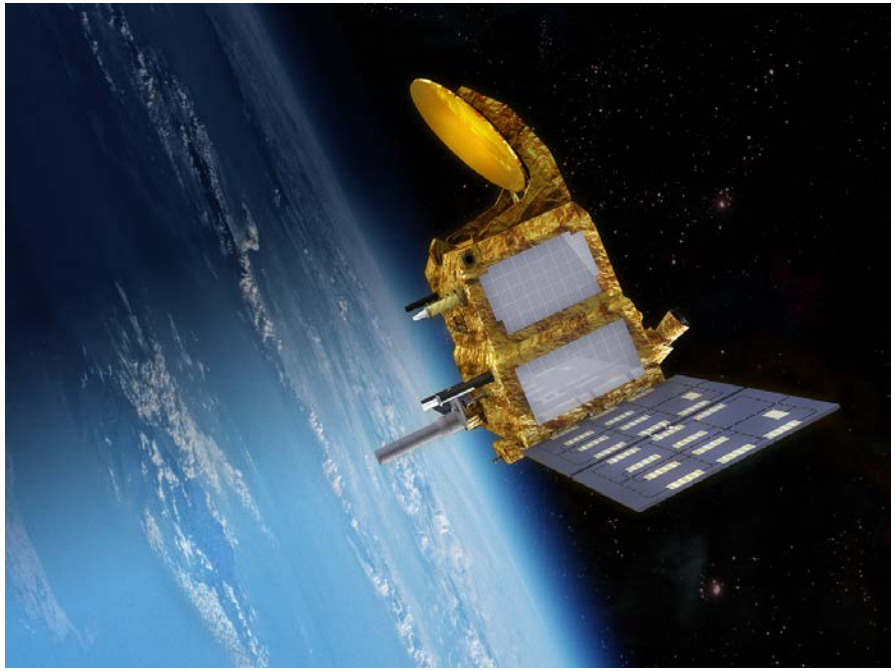
Always strong support in providing quality data, and sustaining science studies and use of ocean remote sensing

What's next?

- **Altimetry is becoming « operational »**
  - **Because some services rely on the avalability, quality, coverage and continuity of altimetry measurements**
  - **An altimetry constellation is needed**
    - Known for quite a while (purple book, OST-VC user requirement document…)
    - Still at the stage of « virtual constellation »
  - **CNES is an « R&D » agency: focus on innovation:**
    - Phase 1: « one-shot » or demonstration missions
    - Phase 2: 1st element of a series (in cooperation with « operationnal agency »)
    - Phase 3: recurring missions: limited involvement…
  - **However**
    - recognizes the importance of correctly transitioning towards operational agencies (phase 2)
    - Innovation is present in series
- **Any innovative concept developped will also be considered in terms of contrubution to the « virtul constellation »**

One slide on… SARAL Satellite for Argos and ALtiKa

- Cooperation with ISRO (India Space Research organization)
- Ka-band nadir altimetry mission
  - Gap filler between ENVISAT & SENTINEL3
  - Same orbit as ENVISAT (35 days, SSO)
  - New Ka-band altimeter, higher precision, compact design, integrated radiometer/altimeter
  - POD: DORIS, LRA
  - Other CNES payload Argos-3 instrument, X-band telemetry
- Status (CNES side)
  - Payload module finished, ready to be shipped to India
  - Ground segment ready
- India side: launched currently planned in (???) 2012
  - PSLV launcher #20 (21?)
  - note that #18 succesfully launched CNES-ISRO Megha-Tropiques mission on Oct 12
- *Data policy : ~ the same as JASON missions*
- *PI: Jacques Verron (CNRS)*



CENTRE NATIONAL D'ÉTUDES SPATIALES

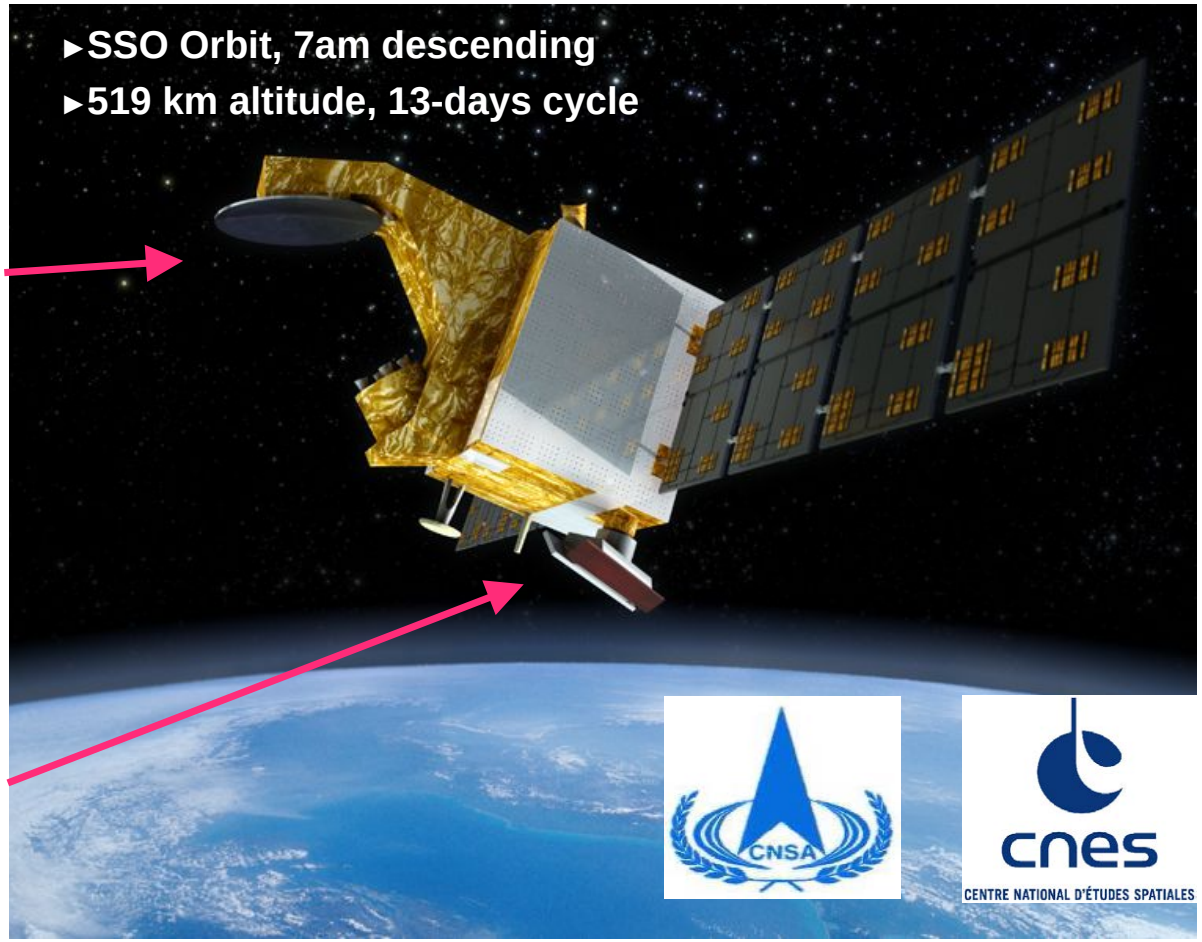
One slide on… SWOT
Surface Water and Ocean Topography

- Hydrology and Oceanography mission
- Baseline payload :
  - Ka-band interferometric altimeter (KaRIn)
  - Traditional altimetry payload
- CNES budget secured in March'11 through General Investment Fund
- NASA/CNES Cooperation scheme approved
- CNES involvement:
  - Participation in KaRIn
  - DORIS, Altimeter
  - Platform
  - Ground segment
- "Phase A" underway at CNES, "pre-phase A" at NASA/JPL
- Next step: Mission Concept Review in 2012
- Launch possible in ~2019

CENTRE NATIONAL D'ÉTUDES SPATIALES

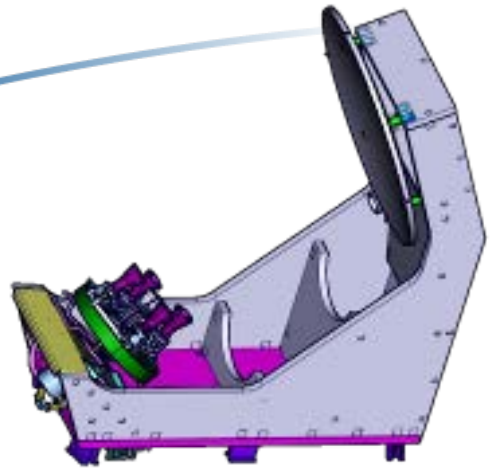
Two slides on… CFOSAT
China-France Oceanography SATellite

- China-France Cooperation
  - Currently in phase C/D
  - Launch date end of 2014
- SWIM, new spaceborne instrument
  - technology innovations (antenna, on-board digital processing)
  - Nadir chanel ~altimeter
- SCAT, new concept of wind scatterometer
  - Ku-band, rotating fan-beam



- Access to 2D wave spectrum with high angular resolution and with global scale
- Joint measurements of winds and waves

SWIM instrument



Surface Waves Investigation and Monitoring

Real aperture radar in Ku-band

- **6 incidence angles: 0°, 2°, 4°, 6°, 8° et 10°**
- **Rotation speed: 5.7 rpm**

Will measure:

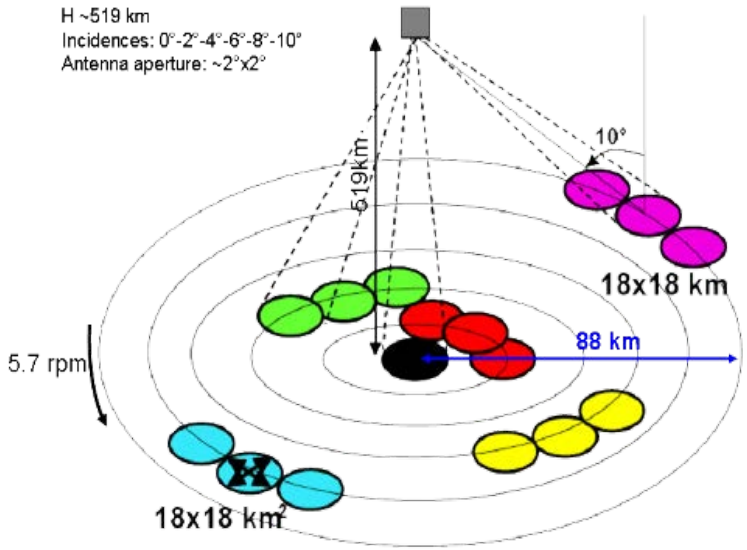
- **Directionnal wave spectrum in the wavelenght range 70-500 m**

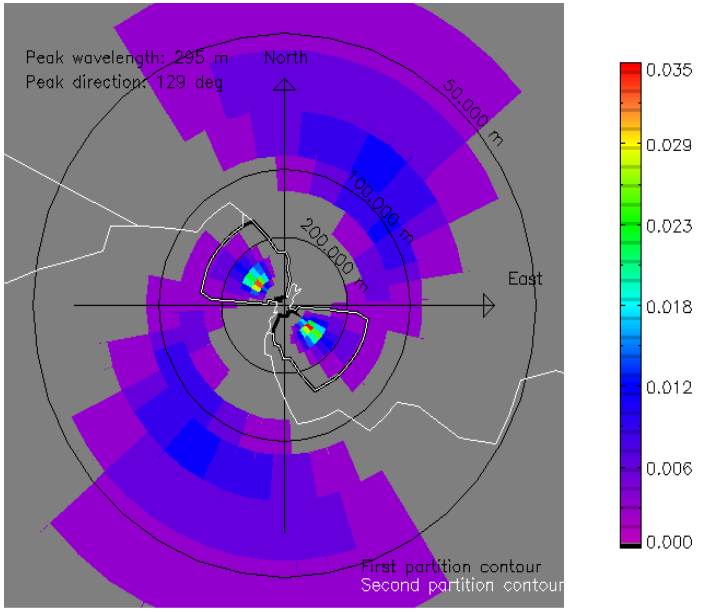
  Accuracy: 10% on wavelength, 15° on direction, 15% on spectral level around the peak

- **SWH and wind speed from nadir**
- **Normalized radar cross-section from 0° to 10°**

  Absolute accuracy of ±1 dB, relative accuracy between incidences ± 0.1 dB

Airborne instrument in 2012 (KUROS)





CNES interest in GlobCurrent

- **Valorisation of CNES missions data in this domain**
  - **Demonstration of capability**
  - **Assessment of the relative pros/cons of different techniques**
  - **Support to scientific community**

- **Constellation sampling and observability studies**
  - **Impact studies for upcoming or present missions**
    - e.g. Cryosat ocean data value in the altimertry constellation
  - **REX from present missions**
  - **Preparation of innovative missions**
    - CFOSAT => waves / currents interactions
    - SWOT => high resolution
  - **Science requirement consolidation for prospective studies**
    - e.g. Phase 0 « constellation of altimetry microsatellites » in preparation

CNES recommendation towards GlobCurrent

- **Do not « re-invent the wheel »**
  - Do not duplicate/redevelop existing tools
  - No reprocessing (below level 2) should be planned without coordination with existing processing centers
  - GMES Space component and core/downstream services

- **Mix of remote sensing techniques is key**
  - Altimetry, SAR, SST, Ocean color…

- **User driven:**
  - Respond to different and maybe incompatible users need
  - But standardization of methods as much as possible

- **Outreach:**
  - encourage users familiar with one technique to consider others, even if not through GlobCurrent products per se.

Thank you