International Ocean Colour Science Meeting 2015

CNES OCEAN PROGRAMS

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San Francisco,

OUTLINE

- CNES OCEAN PROGRAMS OUTLOOK
- OCEAN COLOR: GEO-OCAPI MISSION

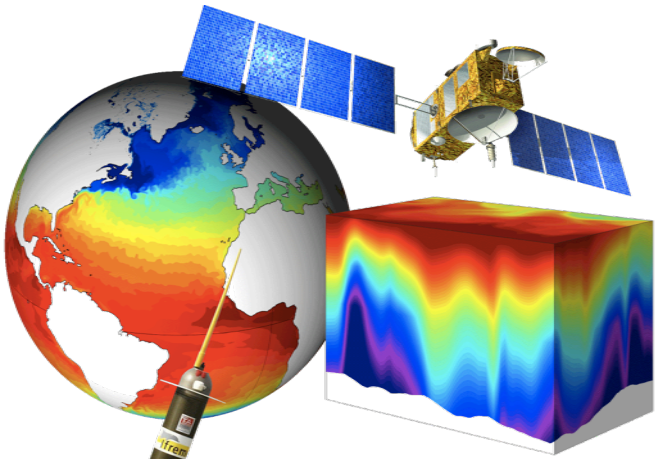
CNES INVOLVEMENT IN OCEAN OBSERVATION

Ocean sciences are one of the major interests of CNES Earth observation programs

- Supporting a strong scientific community through dedicated research funding

- Supporting large scope (spatial + in situ + models) projects and initiatives (e.g. Copernicus Marine Service, Mercator-Ocean, CORIOLIS and bioArgo, Boussole, GIS COOC…

- Supporting R&D (Instrument, mission concepts, data processing…)



CNES SATELLITE MISSIONS

Developed and operated through different frameworks

- European cooperation : ESA/EUMETSAT/UE
- Multilateral cooperation : US, China, India, …

Strong involvement in altimetry, significant involvement in other ocean variable measurement

Altimetry : Jason-1/2/3/CS, SARAL/AltiKa, SWOT, Sentinel-3, Hy-2A

Salinity : SMOS

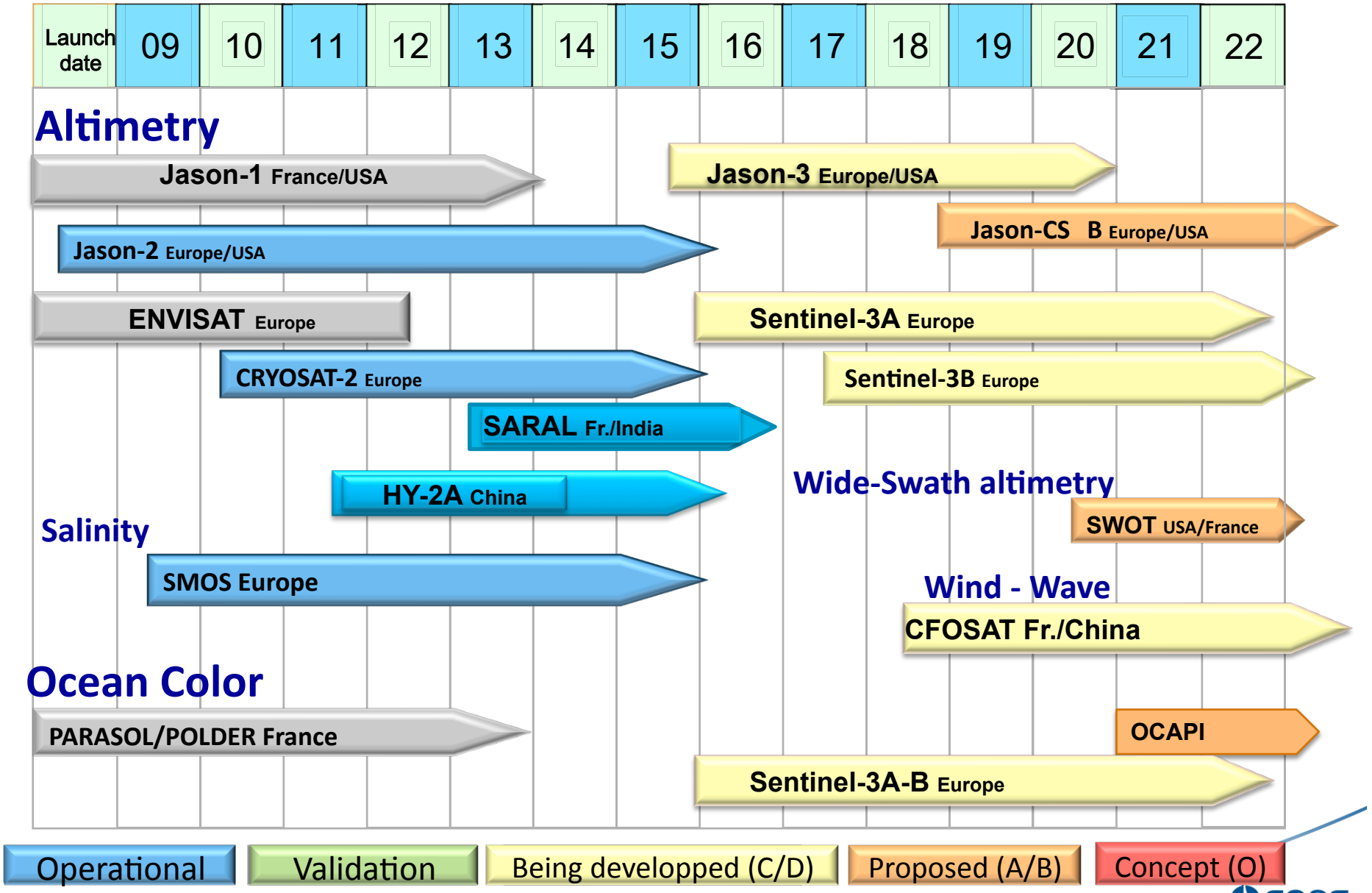
Sea State, wind/waves : CFOSAT,

ocean color: PARASOL, Sentinel-3, GEOCAPI

Interest in development of synergies between missions

➔Mutual benefits between Altimetry, Ocean Color, Sea State

Ocean missions @ CNES (various levels of contributions)



CNES ACTIVITIES IN THE FRAME OF COPERNICUS PROGRAM SENTINEL-3

Involvement at all levels:

Space component

CNES contributions to development of Sentinel-3:

- System support for the altimetry payload and ground system
- DORIS, orbitography processing
- Ground segment prototyping
- Calval and value added products

Core Services

- Partner with Marine Service team leaded by Mercator-Ocean
- R&D support (future mission assimilation preparation)

Science support

- In situ validation campaign + BOUSSOLE, BIOARGO for bio-optics
- GISS COOC: group around Ocean Color
- Algorithms, Data analysis

  ➔ Ocean Color, altimetry, SST + Sentinel 1 (Ice, Sea state)

STATUS ON GEO-OCAPI MISSION

Phase 0 successfully conducted

⇒ GEO OCAPI « Ocean Color Advanced Permanent Imager »
from geostationary orbit
Inherits from GOCI and OLCI (Sentinel 3) instruments

Decision to conduct a Phase A following science prospective seminar recommendation (La Rochelle 2014)

- Conclusion of phase 0: accommodation as “hosted payload” on telecommunication satellites
- Target of Phase A : support a proposal to ESA Earth Explorer 9 Announcement of opportunity
- First meeting on June 10: Tuning of science mission requirements to fit EE9 and hosted payload constraints
- International cooperation needed:
  - At European level to support the proposal, develop and conduct the mission
  - At international level for coordination and synergies with similar initiatives

➔ “Virtual constellation” approach for global coverage

GEO-OCAPI : PHASE 0 MISSION REQUIREMENTS (1/3)

Band	λ (nm)	$\triangle\lambda$ (nm)	L_{min}	L_{ref}	L_{max}	$L_{max,\ ocean}$	SNR at 250 m[1] & L_{ref}	Use
			W m^{-2} sr^{-1} μm^{-1}					
1	395	10	12	65	580	180	400	Chl-CDOM separation
2	412	20	12	70	550	190	400	CDOM, possibly atmospheric correction above "black waters"
3	442	20	12	65	650	185	400	Chlorophyll, TSM, CDOM
4	470	20	11	60	650	175	400	Specific anomalies of the reflectance spectrum
5	490	20	10	50	665	165	400	Chlorophyll, TSM, CDOM, diffuse attenuation coefficient, Secchi transparency
6	510	20	8	45	620	155	400	Chlorophyll, TSM, CDOM, detection of blue-absorbing dust-like aerosols
7	560	20	6	30	580	132	300	Chlorophyll, TSM, turbidity index, Secchi transparency
8	590	20	5	25	550	120	300	Spectral slope b_{bp}, maximum R in Case-2 waters
9	620	20	4	20	550	95	300	Chlorophyll, TSM
10	660	20	3	15	500	86	300	Chlorophyll, TSM, Chl fluorescence (baseline)
11	681	7.5	3	15	500	82	200	Chl fluorescence (peak)
12	709	10	3	13	450	75	200	Chlorophyll, TSM, Secchi transparency, Chl fluorescence (baseline)
13	750	15	3	11	450	65	150	Atmospheric corrections
14	754	7.5	2	10	400	65	150	Reference for O_2 A-band
15	761	2.5	2	6	400	63	30	O_2 A-Band (aerosol scale height, clouds)
16	779	15	2	9	380	60	150	Atmospheric corrections
17	865	35	1	6	300	45	150	Atmospheric corrections
18	1020	40	1	4	220	45	150	Atmospheric corrections (turbid waters), cirrus clouds

⇒Between12 and 18 spectral bands.

⇒*Signal-to-Noise Ratio* < 400

⇒ Spectral resolution from 10 to 40 nm *(depending of the spectral domain and uses)*

GEO-OCAPI : PHASE 0 MISSION REQUIREMENTS (2/3)

Ground Spatial Resolution

- 500 meters and larger for Open Ocean (Case-1 waters)
- 100-250m meters for Coastal Ocean (Case-2 waters)

Coverage

- Global on the visibility disk
- Swath of 100 km x 100 km

Revisit frequency: the main design driver

- from ½ to 1 hour (diurnal)
- Daily composite (mosaïc) after clouds/glitter correction

Challenges

- Image quality
- Radiometry and geometry quality

CONCLUSIONS

GeoOCAPI shall provide next Ocean Color generation complementing low orbit observation with :

- Very high temporal resolution :
  - thanks to his GEO position, the disk is revisited every hour and Near Real Time observation is possible
- High spatial resolution of 100/500 m, 12-18 spectral channel, a swath of 100 km compatible with LEO data (MODIS, SENTINEL 3/OLCI, …);
- Technological miniaturization which allows easy accomodation as hosted payload (or mini-satellite)
- Lifetime anticipated : 10 years

GeoOCAPI phase A agenda: from May 2015 to mid-2016.

Phases B/C/D/E1 should be decided for a launch in 2020/2021.

This program strongly depends on the development of critical technologies (like specific detectors) and international cooperation.

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