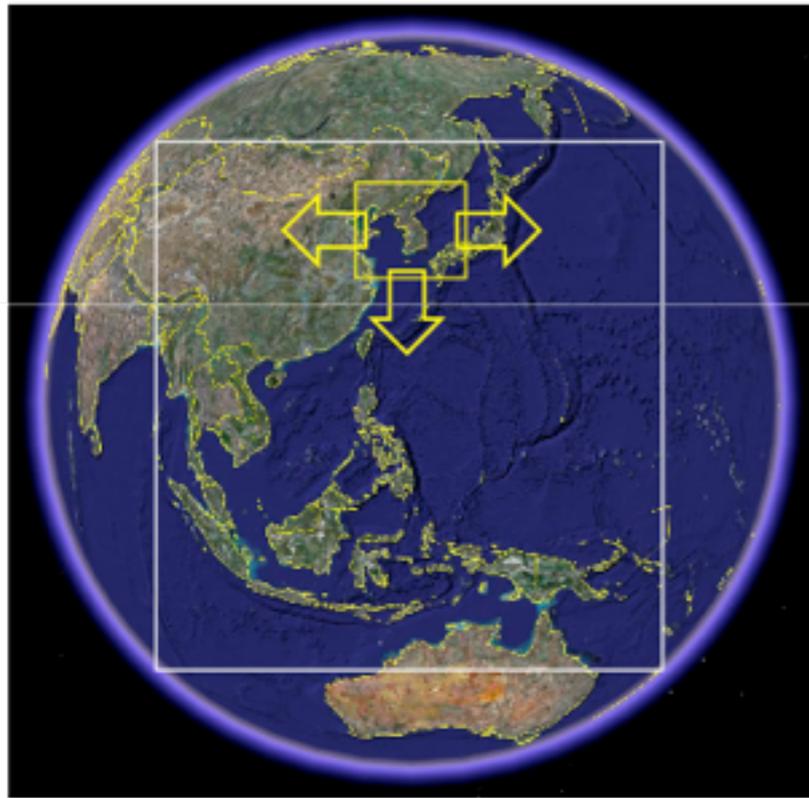


Objectives

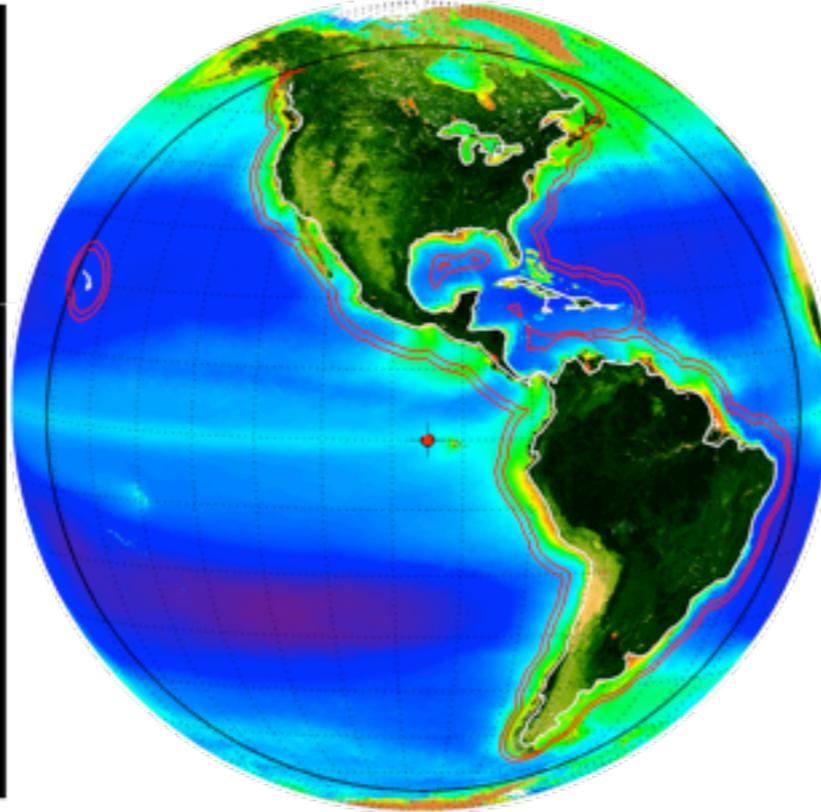
- Updates on Geo ocean color mission plans
- Share experience and results on geo ocean color studies
- Discuss coordination for “global” constellation of geo ocean color missions
 - Establish minimum requirements
 - Harmonization of global vs coastal coverage
 - Consistency in products produced
- Unique geo products
- Consider plans for joint activities
 - analyses to prepare future geo missions
 - field campaigns

“Global” Geo Ocean Color Constellation

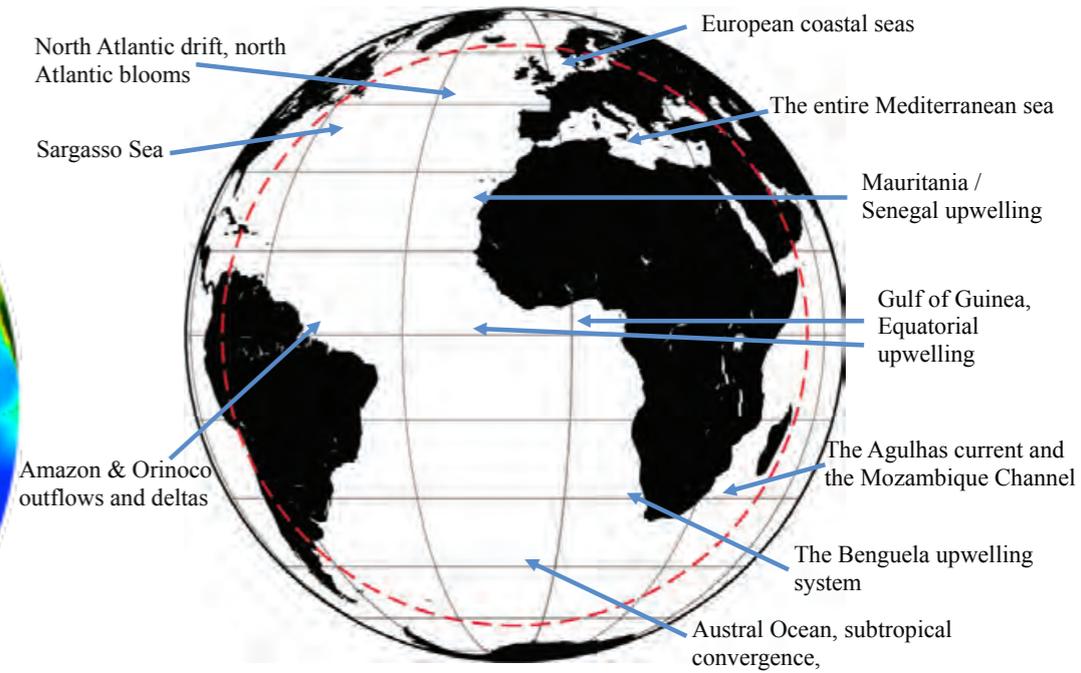
GOCI-II: 2018



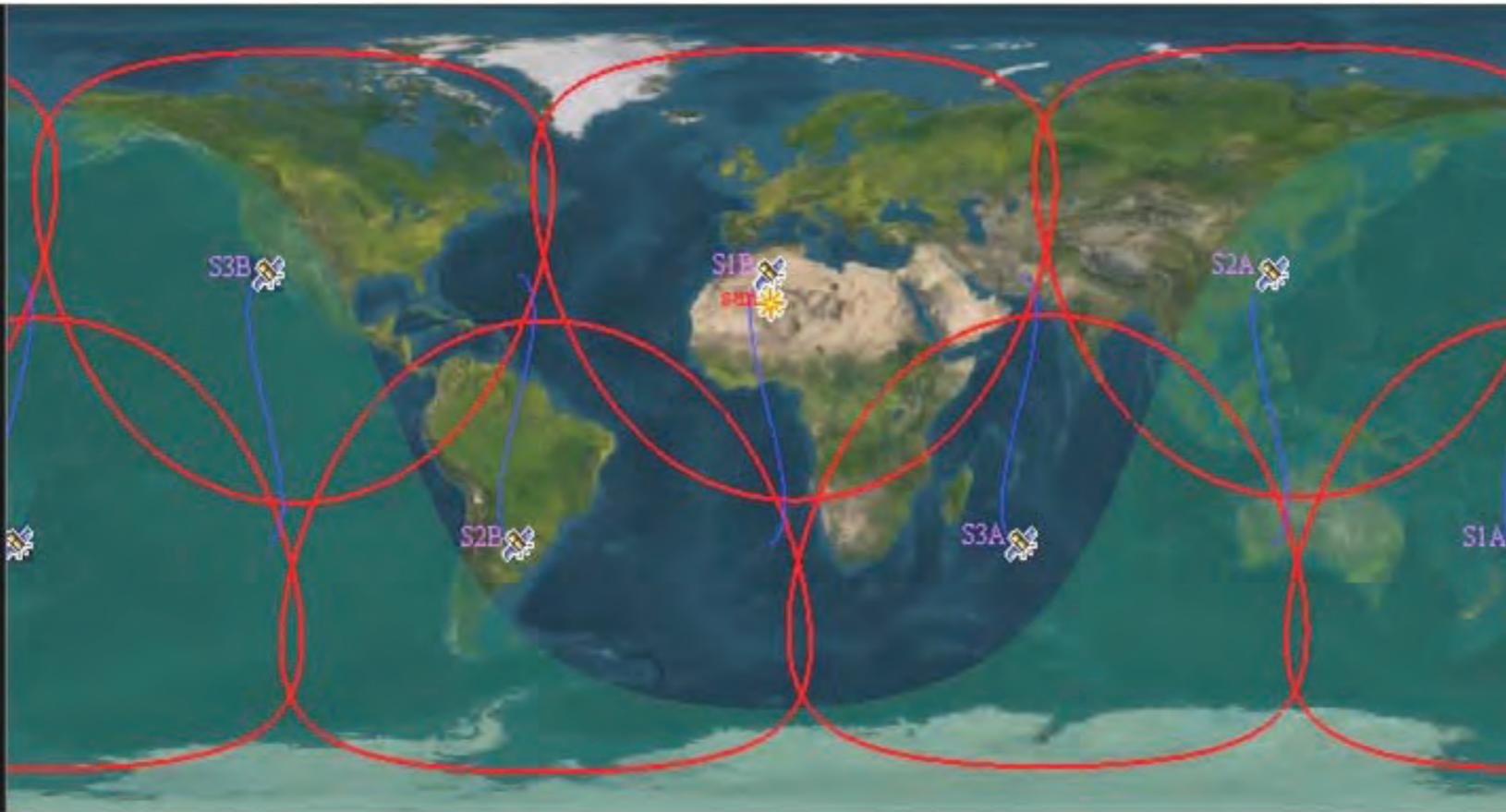
GEO-CAPE: ?



OCAPI: ?

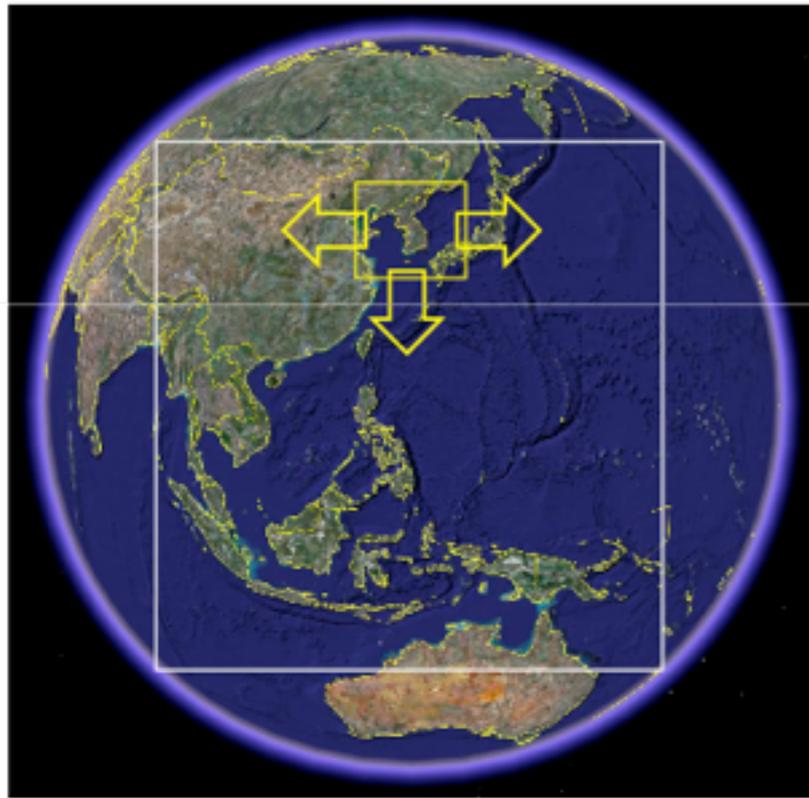


OLCI, S-GLI, PACE-OES, etc.

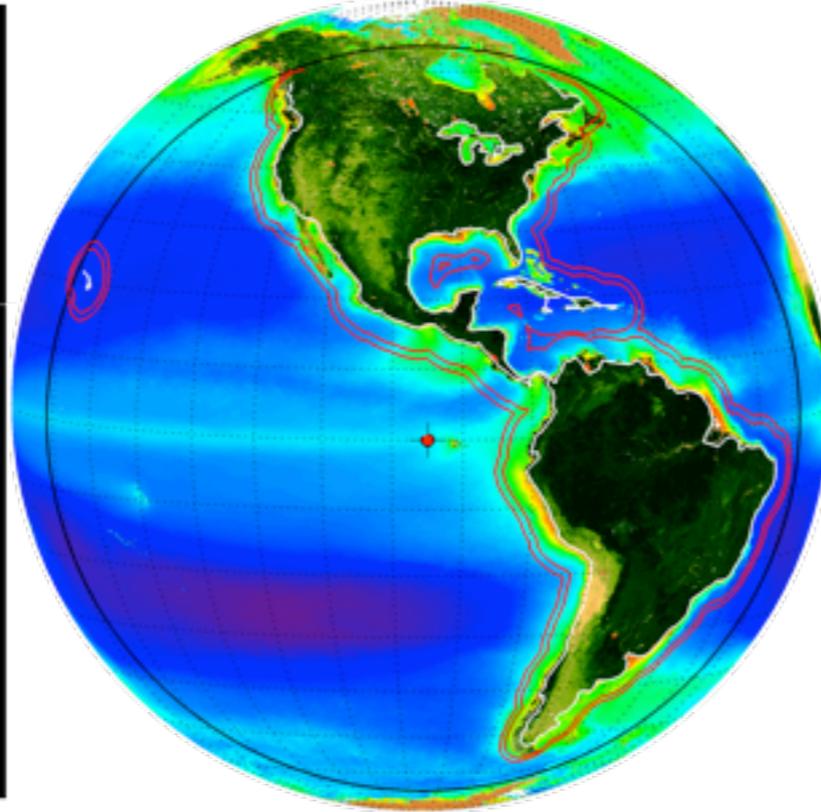


“Global” Geo Ocean Color Constellation

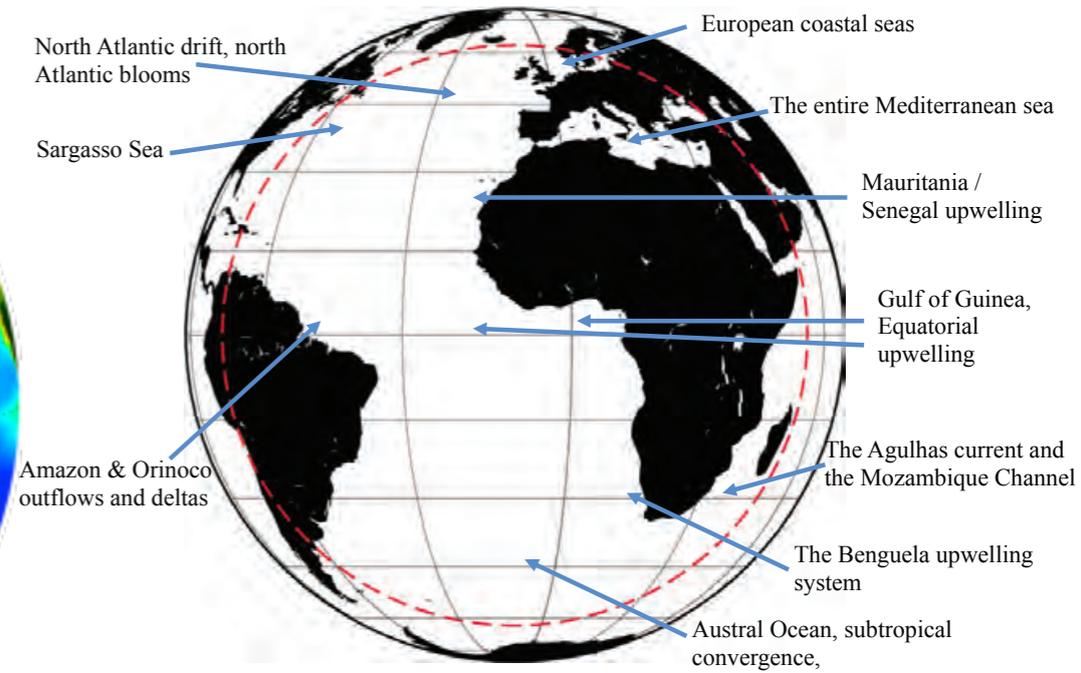
GOCI-II: 2018



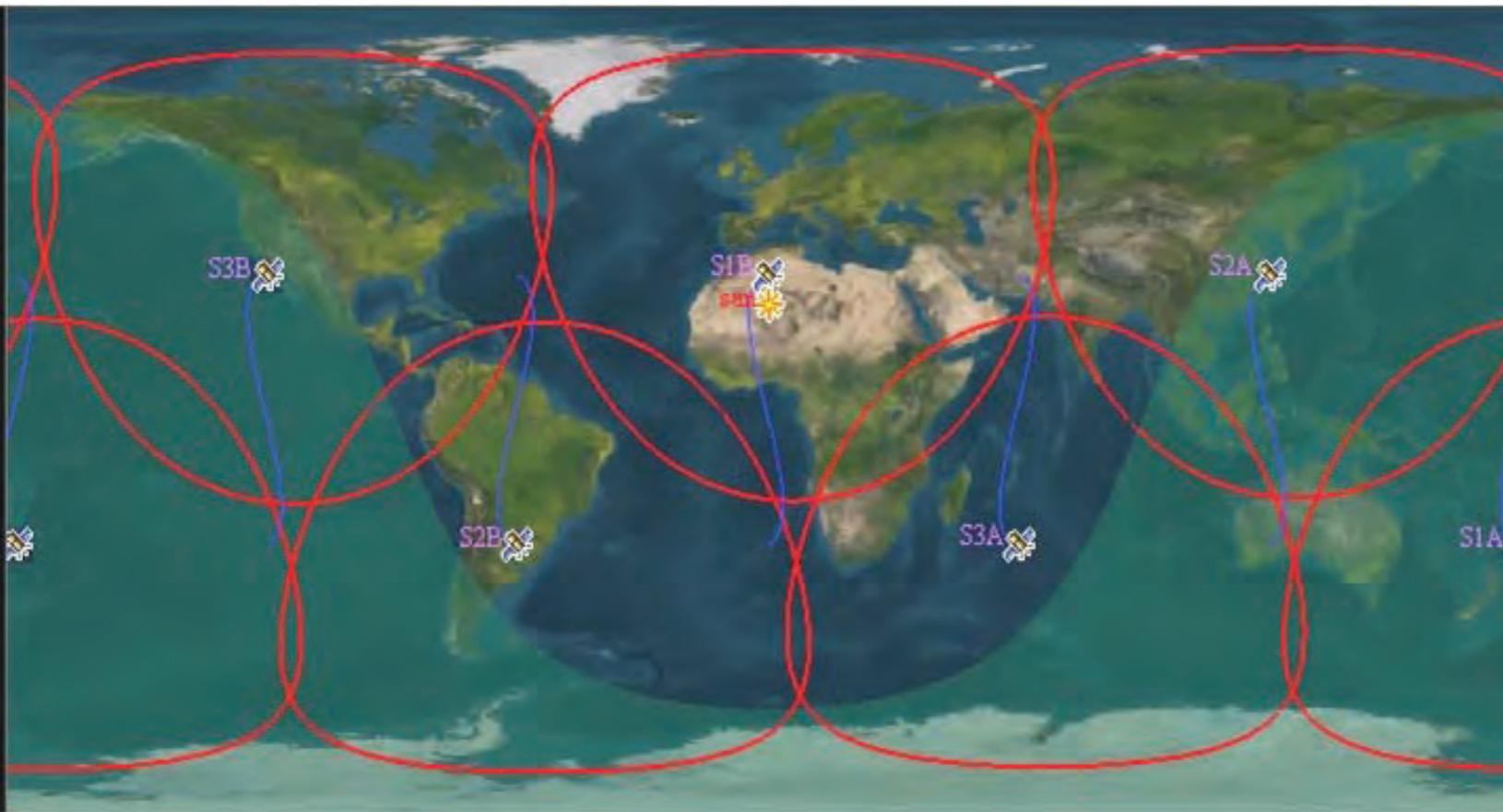
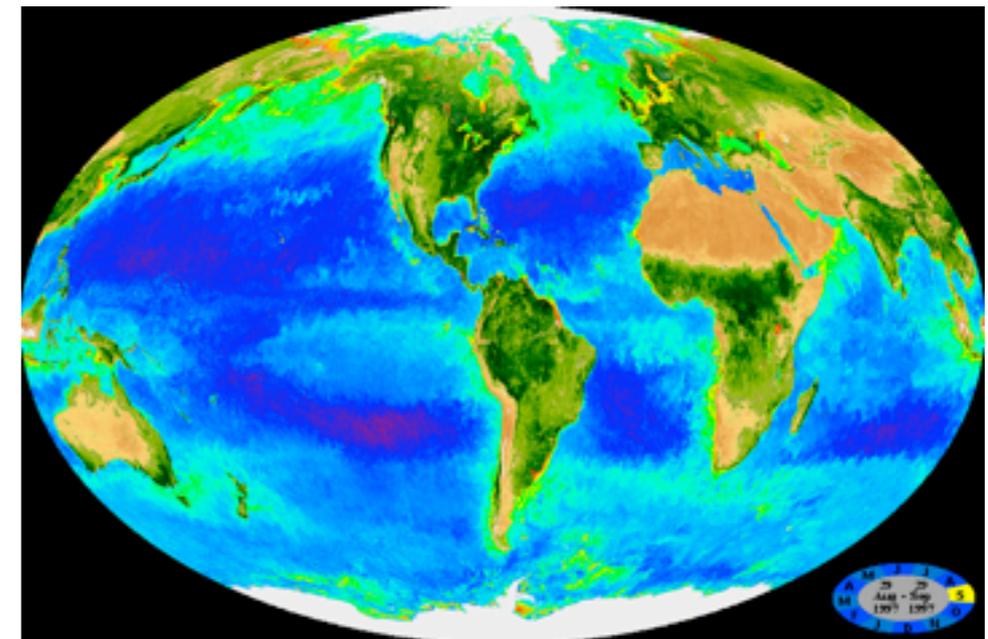
GEO-CAPE: ?



OCAPI: ?



OLCI, S-GLI, PACE-OES, etc.



Recommended Geo OC Constellation sensor requirements

Band	λ (nm)	$\Delta\lambda$ (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
19	1240	20	0.2	0.88	158	5	65	Atmospheric corrections (turbid waters)
20	1640	40	0.08	0.29	82	2	45	Atmospheric corrections (turbid waters)

Band	Heritage	Band Center (nm)	Band width (nm)
1	GOCI-II	380	20
2	GOCI-B1	412	20
3	GOCI-B2	443	20
4	GOCI-B3	490	20
5	GOCI-II	510 nm	20
6	GOCI-B4	555	20
7	GOCI-II	625	20
8	GOCI-B5	660	10
9	GOCI-B6	681	10
10	GOCI-B7	745	20
11	GOCI-II	765	20
12	GOCI-B8	865	40
13 to 15	GOCI-II	709 nm	40 nm

Source: IOCCG #12

Recommended Geo OC Constellation sensor requirements

Parameter	Goal	Breakthrough	Threshold	Comments
Orbit	Geosynchronous (inclination depending on mission goals)		Geo-stationary	
Type of Coverage	Complete Earth disk (oceans, coastal zones, land)	Complete Earth disk (oceans, coastal zones)	Selected areas of interest	
Revisit	30 min	1 hour	avg. 1 h	
Accessibility to specific revisit areas	15 min		none	
Resolution (Nadir GSD)	100 m	250 m	500 m	Aggregation might be acceptable for some bands
Imager bands	20 (See Table 3.1)	16	10	
Temporal co-registration for one scene	< 1 minute			For acquisition of a given point in all bands

Harmonization of geo OC products & coverage

- Concur on file and data formats?
 - Follow IOCS splinter recommendations
- Concur on a set of “standard” products and algorithms?
 - Is this best done within individual processing groups? i.e., OBPG, KOSC, EUMETSAT, ...
 - consistent atmospheric correction approaches or capability to implement multiple approaches within various agency processing streams
- What products should we consider to be “standard”
 - chl-a, K_d490 , PAR, a_{CDOM} , a_{ph} , a_d , b_{bp} , POC, etc,
- “quasi” global coverage at set time of morning or afternoon
 - in conjunction with LEO sensor data for multiple retrievals each day.
- Other issues

Backup

Ocean Color & Related Products

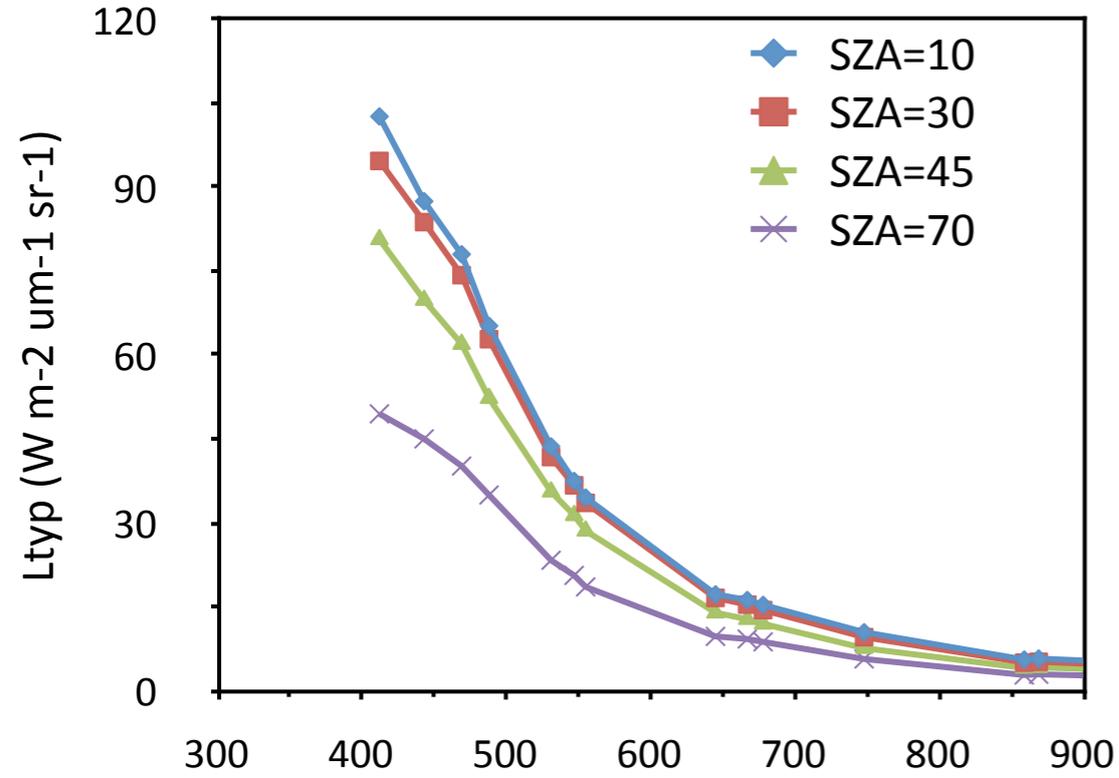
Mission Critical Products (drive requirements; heritage algorithms)

- **Spectral remote sensing reflectances - R_{rs}**
- Chlorophyll-a, Primary Productivity
- Particulate Organic Carbon, Dissolved Organic Carbon, Particulate Inorganic Carbon (coccolithophore blooms)
- Total Suspended Matter
- Absorption coefficients of Colored Dissolved Organic Matter, Particles & Phytoplankton; Particle backscatter coefficient
- Water clarity ($k_d[490nm]$; euphotic depth)
- Photosynthetically Available Radiation
- Fluorescence Line Height, Phytoplankton Carbon
- Functional/taxonomic group distributions
- Harmful Algal Bloom detection & magnitude
- *Aerosols, NO_2 & other products for atmospheric corrections*

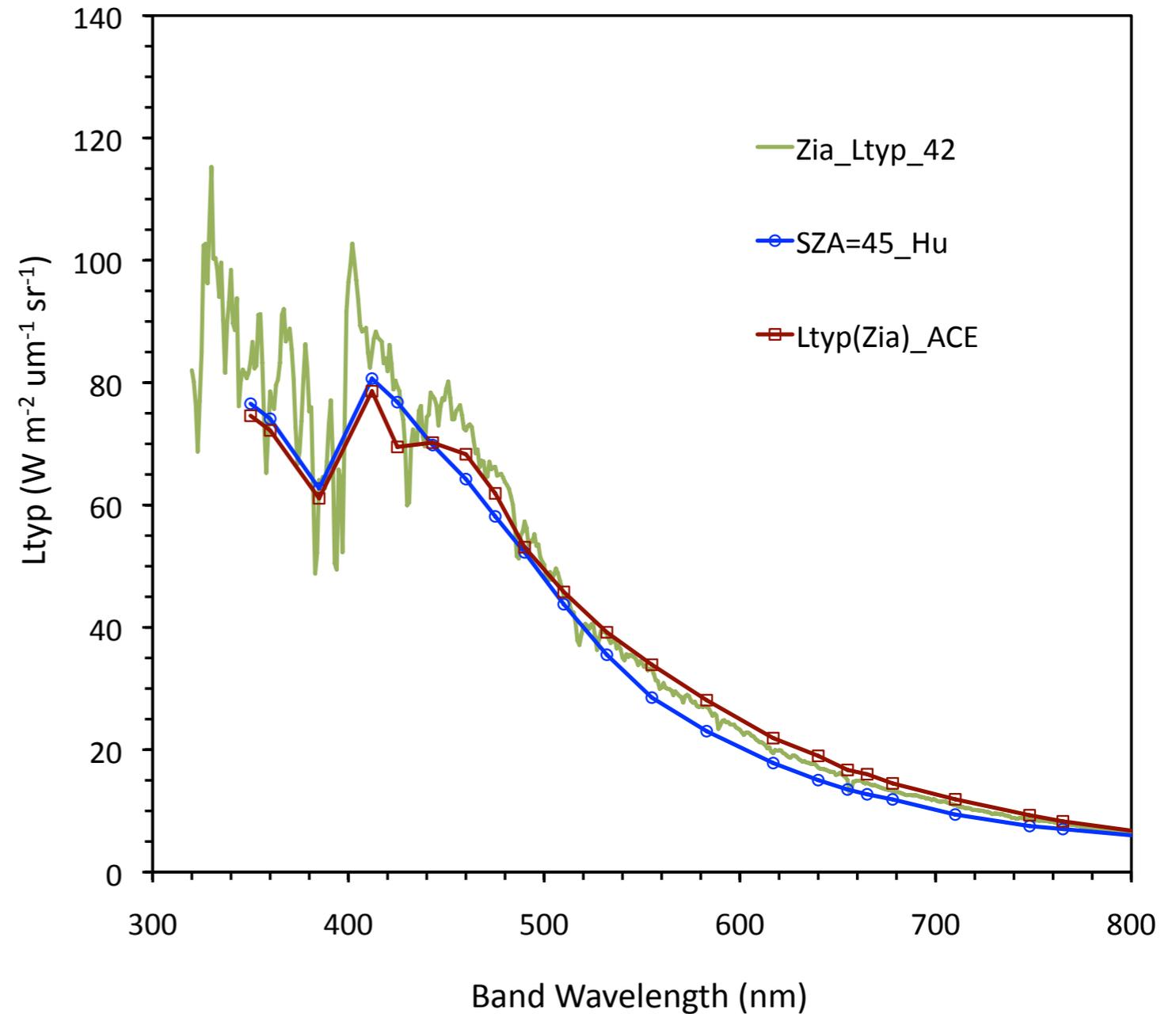
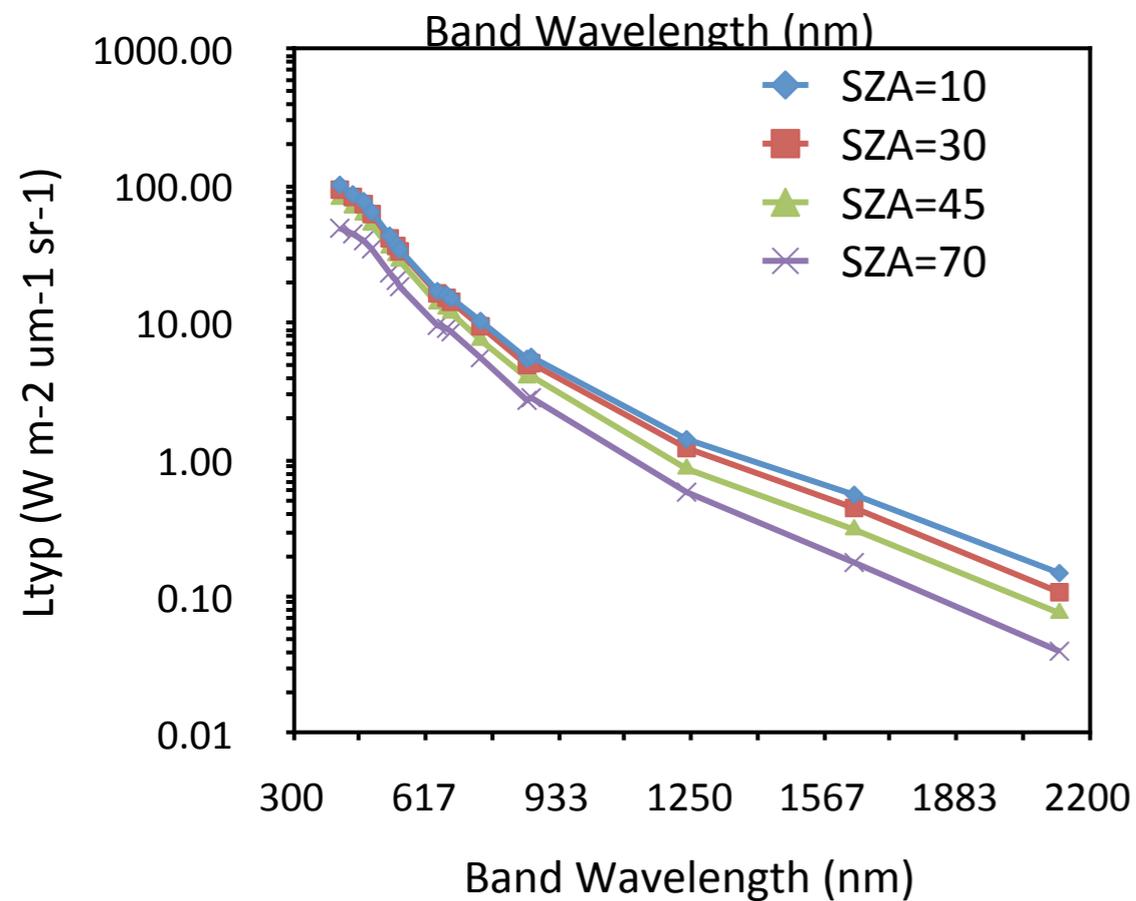
Highly Desirable Products (experimental products)

- Particle size distributions & composition, other plant pigments, phytoplankton physiological properties, vertical migration detection
- Net Community Production, Export Production, Respiration, Photooxidation
- Air Sea CO_2 fluxes, $pCO_2(aq)$
- Terrigenous Dissolved Organic Carbon
- Petroleum detection and thickness

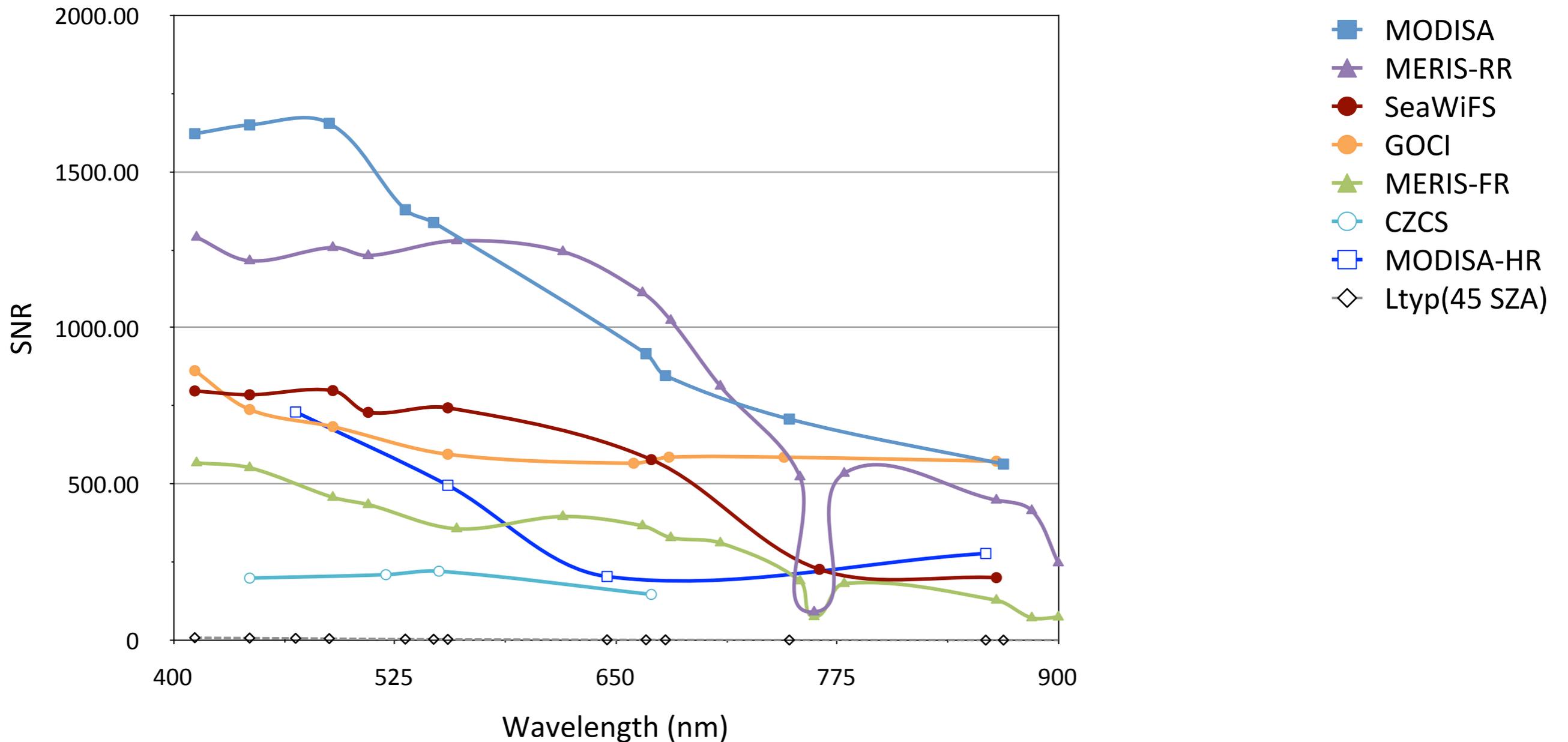
Sensitivity - Ltyp



GEO-CAPE SNR requirements based on Ltyp at 70° SZA



SNR of Heritage Sensors Scaled to Identical L_{typ} values



Coastal Applications & Societal Benefits

- Detection and tracking of hazards (HABs, oil spills, etc.)
- Post-storm Assessments (e.g., flood detection)
- Water Quality / Ecosystem Health
- Water clarity forecasting
- Link data to models and decision-support tools and processes (e.g., predict hypoxic regions, fisheries management, ocean acidification)
- Sediment transport (navigation)
- Assessment of climate variability and change

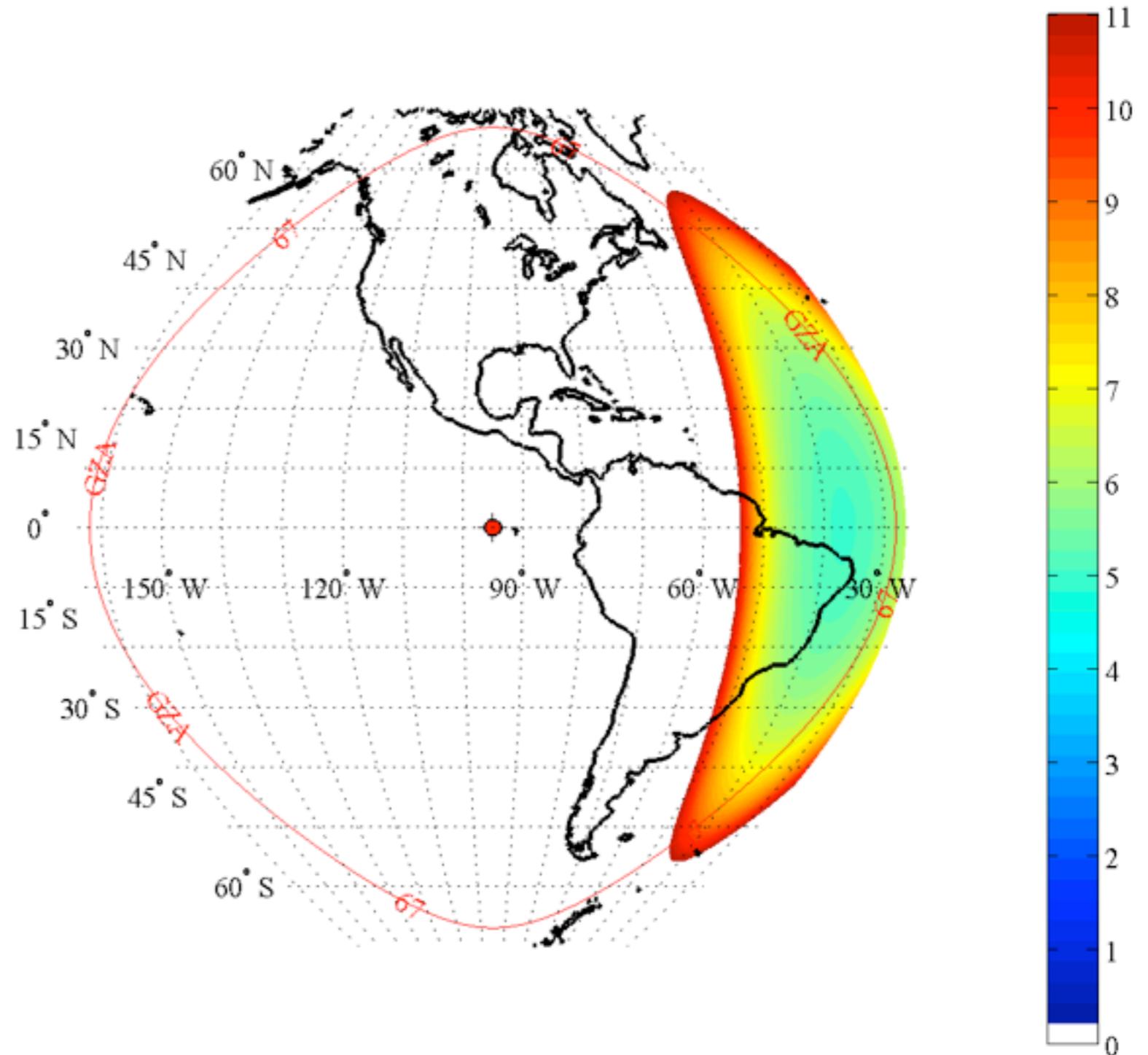
Deepwater Horizon Oil Spill
April 2010



Air Mass Fraction at Equinox for 95°W

Air Mass Fraction @ ST: 21-Sep-2011 04:00:00

- ~16 hours of scan time available each day from ~30°W to ~155°W.
- Scan Atlantic coastal & deep ocean waters in early morning
- Scan Pacific coastal & deep ocean waters in late afternoon



Air Mass Fraction at Equinox for 95°W

- ~16 hours of scan time available each day from ~30°W to ~155°W.
- Scan Atlantic coastal & deep ocean waters in early morning
- Scan Pacific coastal & deep ocean waters in late afternoon

Minimum Geo ocean color sensor requirements

	GOCI-II	GOCI
Temporal resolution	1 hour intervals 8 times/day during daylight hours	1 hour intervals 8 times/day during daylight hours
Spatial resolution	< 250 m in local area mode 1,000 m in full disk mode	500 m
Spatial coverage	2,500 km in local area mode 12,500 km in full disk mode	2,500 km in local area mode
Spectral resolution	10 to ~40 nm	10 to ~40 nm
Spectral bands	15 bands (1 UV, 9 visible, 2 NIR and 3 SWIR)	8 bands (6 visible, 2 NIR)
SNR	1,500	1,000