Report
Benefits and Challenges of Geostationary Ocean Colour Remote Sensing - Science and Applications

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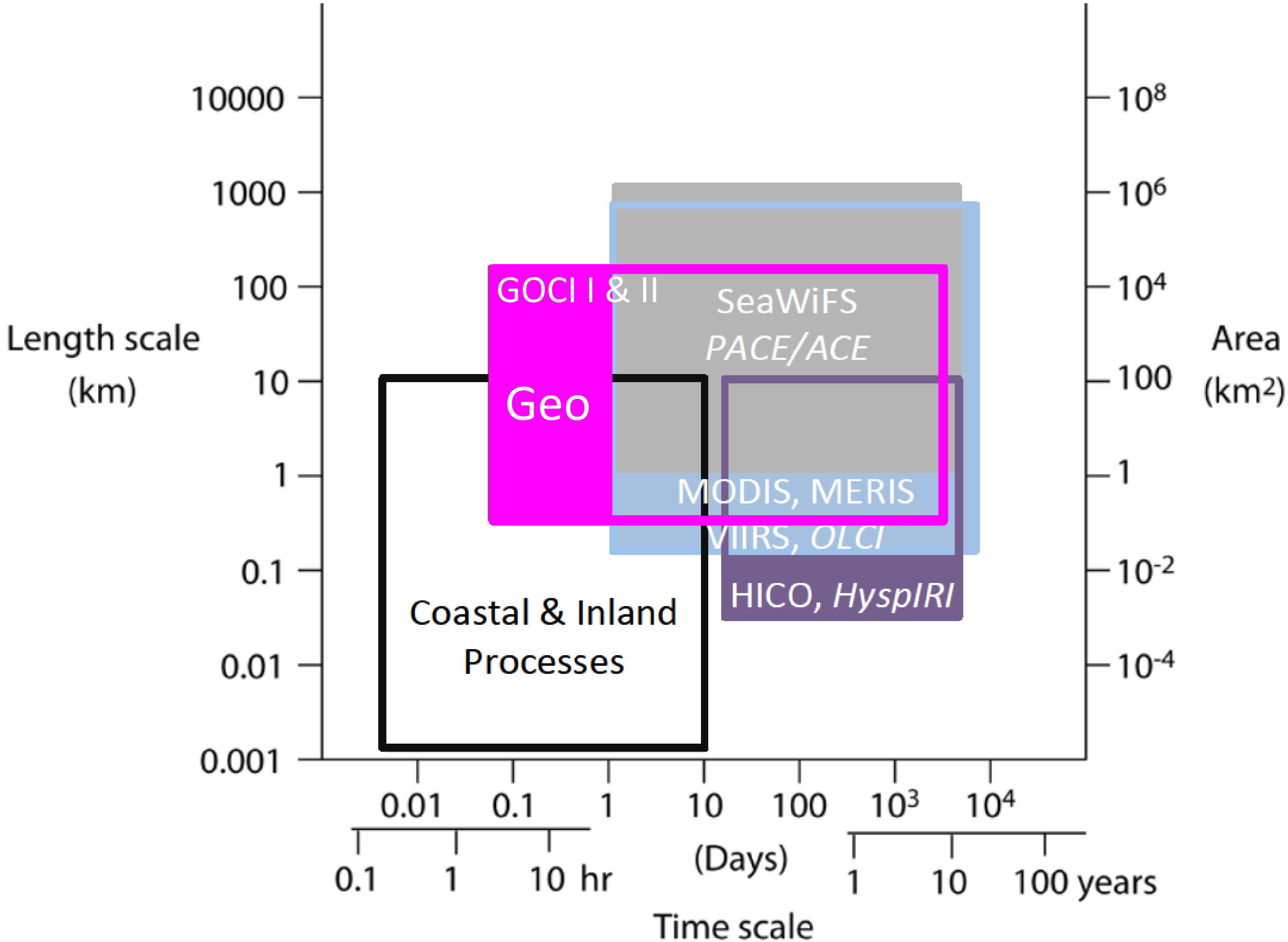
Time & Space Scales of OC Relevant Missions



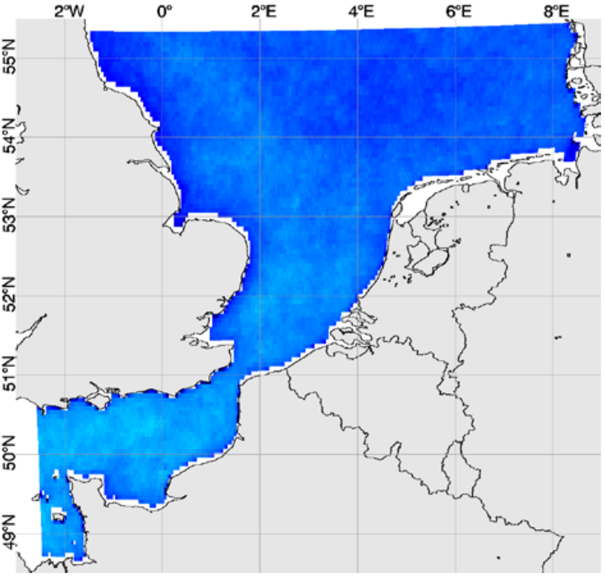
from Mouw et al. 2015, Remote Sens. Environ

Advantages of Geo

- Temporal (sub-hourly)
  - Rate processes
  - Passive tracer (track hazards, quantify flow fields)
- Spatial coverage (clouds move during the day)
  - LEO: 1 cloud-free ~120 days per year (North Sea)
  - Geo: ≥1 cloud-free for ~240 days per year
  - Geo: 4 of 6 diurnal images for ~120 days per year
- Integrate longer to build-up SNR at low SZA and higher view angles

The advantages of GEO observations (North Sea) a) scattered clouds, b) tidal variability)

#days with
12:30 image OK



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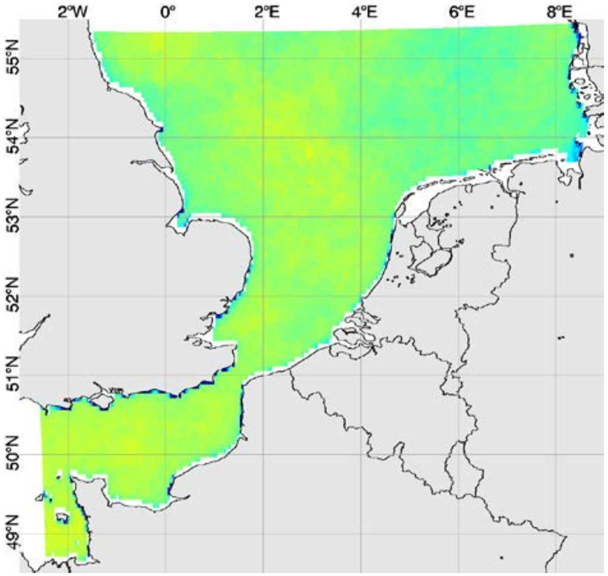
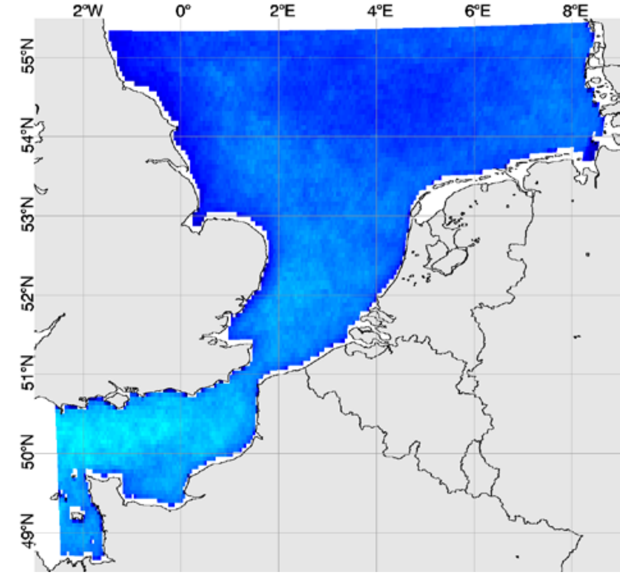
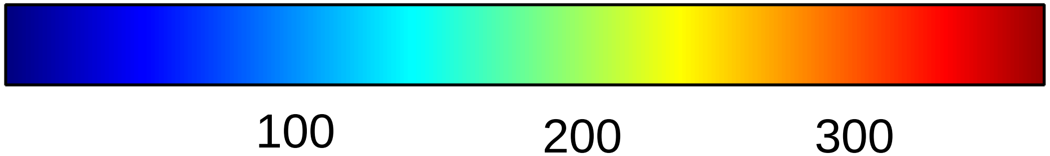


#days with
≥4/6 images (10-15:00)



#days in 2008



[Ruddick et al, 2014]

Challenges of Geo Ocean Colour - 1

- Atmospheric correction
  - Spherical shell model vs plane parallel model
  - Correction for trace gases (NO_2 and ozone - diurnal variability)
  - Correction for absorbing aerosols
    - Need for SSA and aerosol layer height
  - Heritage vs spectral matching approaches
- BRDF correction
  - sun-sensor geometry varies throughout day & seasons
- High sun and viewing zenith angles
  - Strong sky/sun reflection at high VZA or SZA (air-sea interface)
  - Marine BRDF
  - Lower signal at high SZA and view angles

Directions (from Zia Ahmad)

- Perform sensitivity studies to examine the accuracy of retrievals at large sensor and solar zenith angles.

- Optimize OBPG aerosol models for coastal regions.

- Develop methods to detect different types of absorbing aerosols.

    - mineral dust
    - Black Carbon
    - Industrial pollution (Brown Carbon)
    - Continental aerosols

- Explore the possibility of using transport models like GOCART to identify and correct for different types of aerosols.

- Follow PACE Science Team for atmospheric correction algorithm

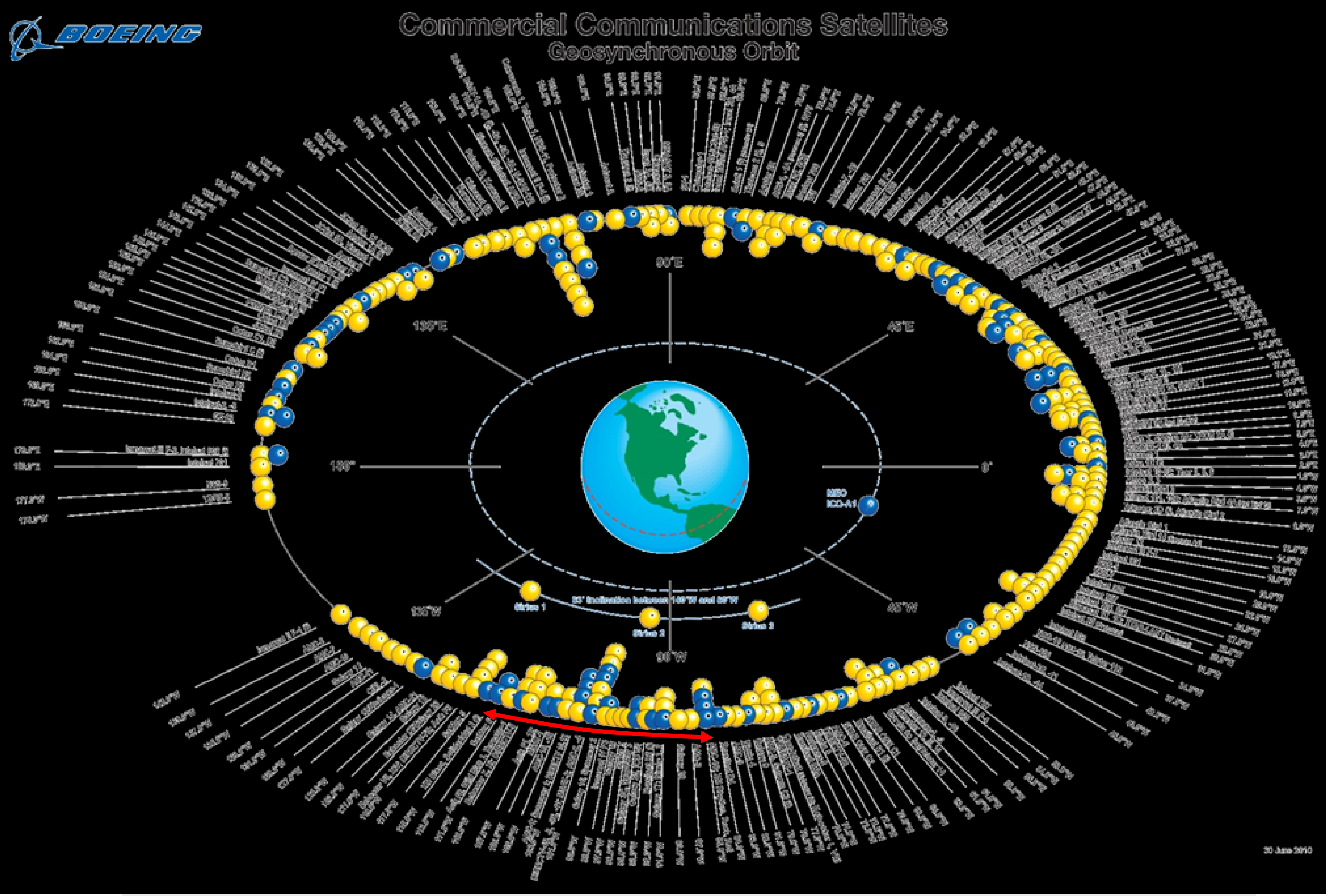
Challenges of Geo

- Wave shadowing
- Must determine Rrs and algorithm uncertainties necessary to quantify diurnal changes
- Achieving opposing instrument requirements
  - temporal, spatial coverage, spatial and spectral resolution, SNR
- Instrument issues
  - GOCI: straylight, ghosting, solar calibration
  - Pixel-level spectral response functions
  - lunar calibration
  - pointing stability
- Cost
  - Hosted payloads on commercial satellites
  - Modest cost instrument concepts possible
    - Filter radiometers (GOCI), wide FOV spectrometers, and multi-slit spectrometers.

Promoting Geo Ocean Colour Missions

- Emphasize measurements that relate issues to coastal managers (socio-economic)
  - Fisheries, water quality (beach closures, human health), invasive species (ballast water), etc.
- Track hazards such as HABS and oil spills
- Map and follow the evolution of phytoplankton blooms
- Ecosystem health
- Improving models for forecasting
- Convolve geo missions as part of a global observation system (with LEO sensors).

Geostationary Orbit Opportunities

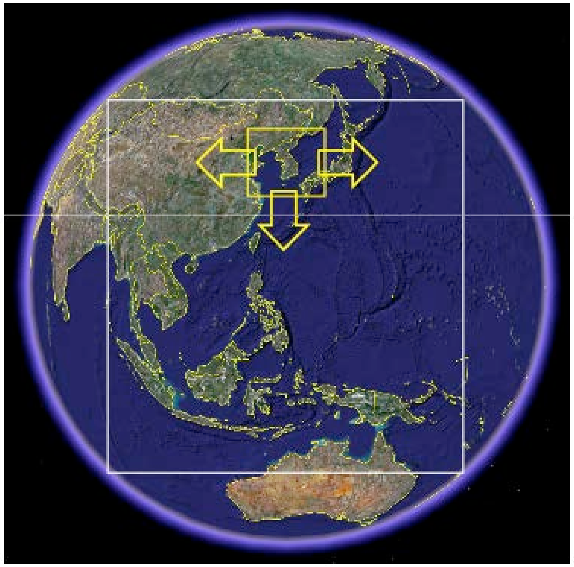


New IOCCG Working Group on Geo?

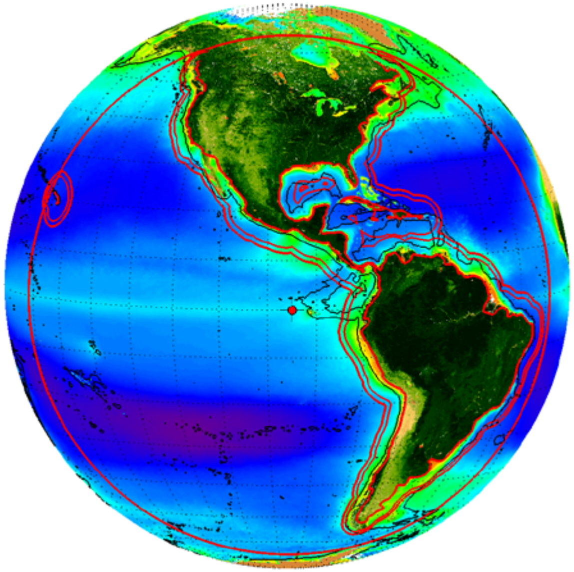
- Share information and ideas to promote a "quasi-global" geo ocean colour constellation
- Compilations of field measurements and simulated geo-relevant datasets
- Coordination on field campaigns to resolve challenges (e.g., GOCI validation cruise, KORUS-OC)
- Foster international collaboration on geo applications with GOCI-I (and II) and other geo sensors (meteorological sats.)

Towards Quasi-Global Geo Constellation

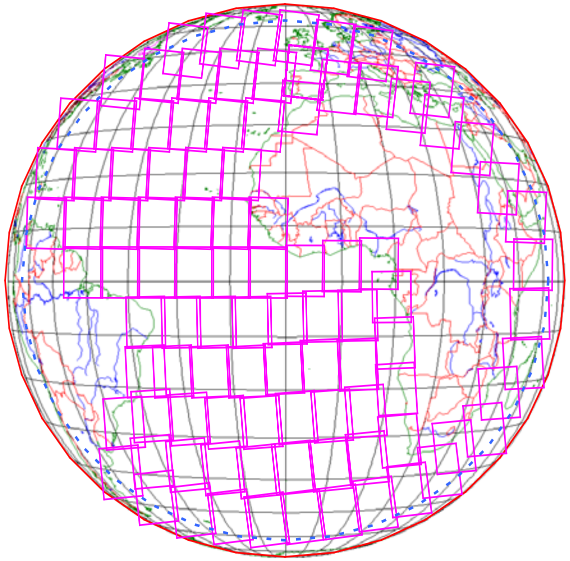
- Plans for Geo ocean color missions: Korea (follow-on), Europe, India, U.S., etc.
- Synergies with LEO: temporal resolution globally, enhance global spatial coverage, improve global productivity measurements, on-orbit cross-calibration, joint cal/val activities, etc.



GOCI-II 2019



GEO-CAPE



Geo-OCAPI