Ocean Carbon From Space 2022 Workshop

Challenges, Gaps and Opportunities common to all sessions

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Challenges

- Limitations of algorithm retrieval and validation in coastal/shelf sea environments/optically complex waters
- Understanding uncertainty budget including propagation from satellite and in-situ observations to L3/L4 products
- Using coupled physical/BGC/Carbonate ecosystem models combined with Satellite/in-situ data to better study the ocean biological pump
- Linking surface satellite measurements to vertical distribution. High frequency and high spatial resolution satellite observations coupled with in-situ underwater measurements for time and place matching
- Better understand the different sensing depths between remote sensing and in-situ data
- Capturing the high spatial and temporal variability, in particular in coastal areas
- Capturing diurnal or sub-diurnal processes with temporal resolution of current sensors
- Better understand differences between models and observations
- Bridging spatial and temporal scales between satellite data, in-situ observations and models
- Improve Predictability
- Reduce the (Ocean) Carbon Community Carbon footprint

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Gaps

- Lack of high quality in-situ measurements for validating and improving satellite products (coastal, at depth, high latitudes, under-ice, seasonal gaps, in extreme events, higher spatial and temporal resolution)
- Lack of good reporting of protocols used in measuring the in-situ data in current data repositories
- Need for standardisation of methods (but not only!)
- Lack of pixel-by-pixel uncertainty in satellite products / Flagging
- Need for long-term consistency of satellite records and derived biogeochemical data products
- Need for better connecting biology and physics
  - Lack of integrative and systematic observations in both physical and biogeochemical parameters
  - Need for improved upper-ocean dynamics/high resolution coastal circulation models
- Improve connection between different scientific communities (physical/chemical/biological/ecological/..) through Multi-institutional transdisciplinary research collaborations
- Need for higher spatial and temporal resolution products
- Need for higher spectral resolution of satellite measurements
- Need for better atmospheric corrections in nearshore/coastal waters
- Need for consistent Open Ocean – Coastal – Land products
- Need for enhanced observation-based model development/ Data assimilation /Nesting approaches

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Opportunities

- Upcoming sensors with improved spectral range/resolutions (UV, hyperspectral) and temporal resolutions (geostationary): PACE (2023) and GLIMR (2027), EnMAP (DESIS, PRISMA), ESA Fluorescence Explorer (FLEX, 2023), S-4 UV/Visible/Near-infrared Geostationary over European waters (2022), S-5 (2024), S2-Next Generation, Copernicus Hyperspectral Imaging Mission for the Environment (CHIME, 2030),
- Lidars (Aeolus, ESA EE EarthCare (2023))
- Upcoming Wide-Swath altimetry SWOT (2022)
- New in-situ platforms (Ferrybox, coastal Argo floats,…)
- Further exploit synergies between sensors (in-situ, satellites), multi-platform approach
- Exploitation of existing satellites to further understand the interactions between the different components of the Earth System
- Exploit recent/upcoming higher resolution Earth system models with improved representation of ecosystems
- Use existing capability to demonstrate capability/prepare exploitation of future missions (GOCI, GOCI II, PRISMA,…)
- Intercalibration/intercomparison exercises with goal of establishing standard measuring protocols for key parameters
- Further leverage on AI/ML methods (But: limitation of the validity of such approach in a changing climate / for representing extreme events)
- Use of models to perform Observing System Simulation Experiments (OSSE), to evaluate the impact of undersampled observing systems on obtained results, or evaluate the value of new observing systems / design optimal sampling strategies

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