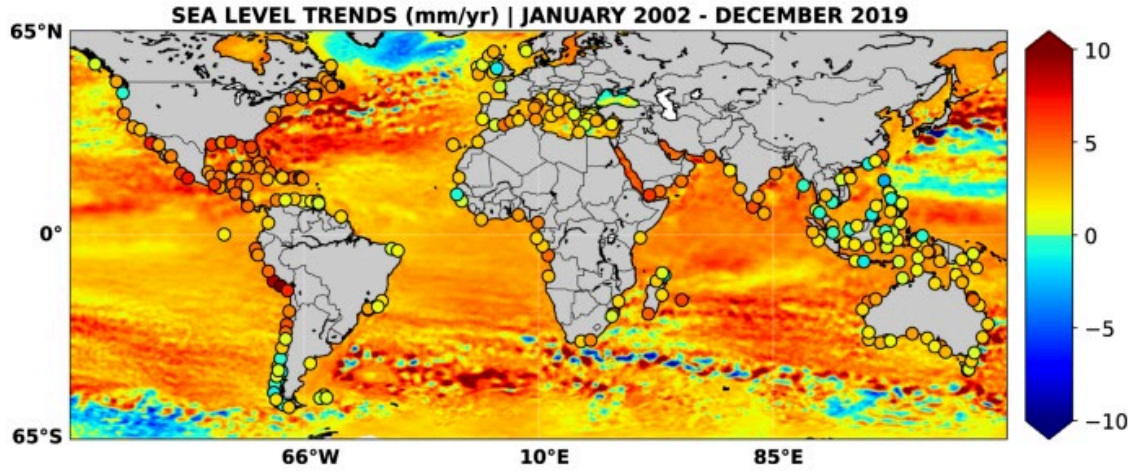
CSQ-5 Summary

Question	Knowledge Advancement Objectives	Observables	Measurement Requirements	Tools & Models	Policies / Benefits
What processes drive changes in sea level in the coastal ocean?	A) Reduce uncertainties in observing, modelling and forecasting of water levels in coastal, estuarine and inland water bodies B) Characterise the relative contributions to coastal sea level changes by steric and other physical processes C) Understand the processes that drive land-ocean water exchanges and their associated impacts on marine and land-side coastal environments (e.g. salt intrusion)	- sea surface height - directional wave spectra including integral wave parameters (wave height, period, direction) - 2D total surface current vectors - 2D surface winds vectors - salinity - inland water levels - river flow, river discharge - soil moisture - precipitation - coastal bathymetry - surface air pressure - vertical land movement	Fine-resolution (1 km) Frequent revisit (daily, sub-daily) to observe fast-changing ocean processes (e.g. tides) and extreme events (storm surges, extreme waves, rainfall) 2D mapping High-resolution coastal wind data (1km or finer) Improved coastal bathymetry for water depths > 30m (not optical) New surface air pressure measurements	Coastal circulation models Hydrological models Storm surge and flood forecasting systems Coastal morpho-dynamics and coastal erosion models	Operational coastal and inland flood forecasting systems Climate projections of coastal sea level change

CSQ-5 Narrative

Sea Level Rise (SLR) is a critical manifestation of climate change with severe impacts on coastal environments, human activities and infrastructure. Coastal threats associated with SLR include coastline changes, coastal erosion, sediment transport and bathymetry shifts, subsidence, coastal flooding, salt intrusion (aquifers) and loss of coastal habitats and biodiversity. Woodworth et al. (2019) point out the many physical phenomena that can contribute to SLR in coastal regions, including ocean surface waves (Melet et al., 2018), river discharge (Durand et al., 2019) and ocean dynamics (Hughes et al., 2019). International tide gauge networks provide long-term high-quality coastal sea level records at a small number of globally distributed coastal locations. Satellite altimeters measure sea level continuously since early 1990s and provide estimates of SLR on global and regional scales. Recent progress with new sensor technology (Cryosat-2) and coastal processing have led to improved altimeter data quality within 10km of land, bringing the prospect of global EO-based sea level records close to land. Cazenave et al. (2022) report that coastal SL trends within 3.5 km of land are broadly consistent with observed trends further offshore, but that significant – sometimes large - discrepancies remain in many coastal sites worldwide. Comprehensive EO observations of the 2D dynamics of the coastal zone are needed to understand the driving processes of coastal SLR in different regions, their relative contributions and space-time composition. The goal is to reduce uncertainty in spaceborne coastal SLR estimates to improve the representation of these processes in models and forecasts, and - combined with improved water level estimates over estuaries, rivers, lakes and reservoirs – to evaluate their interactions and impacts on land-side hydrology.

Fig. 5: Coastal and regional sea level trends (mm/yr) over the 18-yr time span.



Coastal trends at virtual stations closer than 3.5 km from the coast are indicated by the black circles. The background map shows regional sea level trends from the C3S data set.

From Cazenave et al. (2022)

Observations and Geophysical parameters required: Key data needs are coastal observations of water level, surface winds, ocean waves (height, period, direction), ocean currents and river flow and discharge. High-resolution 2D imaging would deliver greater understanding of coastal processes by revealing spatial structure in the across- and along-shore directions, and facilitate interpretation with land-side hydrological data.

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