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The CMEMS In Situ TAC multi-year and multi-variate products to monitor and understand the ocean variability

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The CMEMS In Situ TAC (INSTAC) integrates *in situ* observations from various platforms, (e.g. profiling floats, gliders, drifters, saildrones, research vessels, ferryboxes, fixed stations, tides gauges, sea mammals, high-frequency radar), providing physical and biogeochemical ocean data at local, regional and global scales, with an increasing data integration from the polar and coastal regions.

The INSTAC quality-controlled data in both delayed mode and near-real time are contributing to support the operational oceanography (e.g. model forecasting, analysis and reanalysis, satellite calibration, downstream services) and to monitor the 4-dimensional ocean at various spatial and temporal scales. The INSTAC multi-year products provide an essential information on the ocean state, variability and changes and allow addressing long-term variations (climate) analysis as well as detecting remarkable events. Hence, the INSTAC group has contributed substantially to the elaboration of the annual CMEMS Ocean State Report (OSR, *Von Schuckmann et al.*, 2016, 2018, 2019, 2020, 2021).

A general overview of the INSTAC contributions to the CMEMS OSR is presented, highlighting its capacity to describe, analyze and understand the ocean state and variability of both physical and biogeochemical components from the sea surface to the deep ocean, from the coastal to open sea waters, from tropical to polar regions, from semi-enclosed seas to the global ocean, from short-term to long-term temporal scales. The INSTAC team contributes to the CMEMS Ocean Monitoring Indicators reporting, investigates the ocean circulation variability, analyses the impact of climate change on marine ecosystem and ocean circulation, and develops operational applications and services.

Maintaining the current observational network, integrating new platforms, enhancing the spatial and temporal resolutions, improving methodologies and developing new metrics (e.g. quality control, data assimilation), developing new products, INSTAC will continue to serve the overall need to understand and predict the ocean state and variability, in line with the present and future scientific, societal and environmental challenges.