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# SENTINEL-6: HIGH ACCURACY ALTIMETRY CONTINUITY FOR HIGH VALUE SOCIETAL APPLICATIONS

## Abstract

Sentinel-6 is a multi-satellite program operated as a four-party international collaboration among the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), the European Space Agency (ESA), and European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT). The second satellite of this program, Sentinel-6B (S6B), is targeted to launch in late 2025. With a 7.5 year design lifetime, the S6B will extend an uninterrupted, multi-decadal ocean topography measurement set established by prior missions to beyond 40 years: TOPEX-Poseidon (1992), followed by Jason-1 (2001), OSTM/Jason-2 (2008), Jason-3 (2016), and Sentinel-6 Michael Freilich (S6MF, 2020). The data returned from this series is critical to advancing our understanding of ocean climatology: global sea level rise time series; seasonal, annual, and decadal variabilities; coastal variability and its impact on ecosystems; ocean weather-operational oceanography; and surface wave forecasting and evaluation. In addition, the data are of increasing value towards important operational and societal applications: Ocean dynamics for Navigation, Marine ship routing (wave, winds, currents), Coastal flooding, Inland water management, and Fishery Management.

The S6 satellites include an ESA-contributed payload consisting of precise orbit determination (POD) instrumentation via GNSS and DORIS receivers plus a dual-frequency (C and Ku band) synthetic aperture radar altimeter (Poseidon-4) for high-resolution range measurements. The NASA/JPL-provided payload includes the Advanced Microwave Radiometer for Climate (AMR-C) with an on-board absolute Calibration Subsystem for improved wet-path delay measurement stability and additional millimeter-wave radiometer channels for improved spatial resolution near coastal zones. NASA also provides a Laser Retroflector Array for POD validation and a Global Navigation Satellite System for Radio Occultation instrument that contributes near-real time temperature and humidity profiles for use by numerical weather modeling applications.

Recognizing the importance of this long-term, uninterrupted data record, the space agencies are engaged in planning future missions to ensure continuity. A third Sentinel-6 (‘S6C’) is envisioned with a targeted launch in 2030. Some measurements enhancements are under investigation for S6C including the addition of a digital spectrometer that could allow detailed measurement of the 22-GHz water spectral signature.

Continuation of this important measurement set is essential to the understanding of ocean circulation (and its effects on climate) as well as supporting operational and societal applications. Sentinel-6B (and possibly S-6C) will contribute to our ability to continue these important observations for at least the next 10+ years, which is vital to the understanding of long-term climate trends and the impacts on societies.