OSID & IESS

Thu. Nov 12, 2026 2:00 PM - 3:30 PM JST | Thu. Nov 12, 2026 5:00 AM - 6:30 AM UTC | Room D (Icho) (3F)

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Chair: Alessandro Oggioni, Matthias Obst

2:00 PM - 2:15 PM JST | 5:00 AM - 5:15 AM UTC

[.s6T5WKf-01] The Coastal Zone Digital Twin: A Federated Bridge Between Land, Coast, and the Digital Twin of the Ocean

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Coastal zones sit at the dynamic intersection of riverine, oceanic, atmospheric, and human systems, where flooding, erosion, and water quality degradation increasingly pose urgent risks to communities and economies. NASA’s Coastal Zone Digital Twin (CZDT) is an extensible, AI accelerated Earth System Digital Twin designed to provide an integrated, real time understanding of these complex land to sea interactions. By maintaining a continuously updated digital replica of coastal and adjacent ocean environments—harmonizing satellite, airborne, and in-situ observations with high fidelity models—CZDT directly addresses fundamental questions that drive coastal resilience: What's happening now? What will happen next? What if conditions or decisions change?

As a component of emerging digital twins of the ocean, CZDT advances multi source data fusion, hybrid modeling, and federated interoperability across agency and partner systems. Remote sensing data from ocean focused missions provide Essential Variables such as sea surface height, shoreline position, turbidity, chlorophyll, and temperature, feeding a living digital replica capable of representing both terrestrial and marine processes driving coastal change. Surrogate models accelerate forecasting of storm surge, compound flooding, estuarine water quality, and sediment transport, enabling rapid, interactive scenario exploration for emergency management, environmental stewardship, and infrastructure planning.

New agentic capabilities strengthen both science and usability. A data wrangling agent automates onboarding of new Essential Variables; retrieving, ingesting, and normalizing ocean and coastal datasets into the replica, while a natural language, LLM based interaction layer assembles CZDT subsystems on demand, allowing users to pose complex what-if questions without navigating rigid pipelines. Standards based interfaces, provenance tracking, and uncertainty quantification ensure scientifically defensible outputs that can be federated with other regional or global ocean digital twins.

Together, these innovations position CZDT as a foundational component in the broader digital twin ecosystem—linking land, coast, and ocean processes—and enabling richer, more actionable insight into the evolving coastal Earth system.

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