AI, Automation & Optimization

Thu. Nov 12, 2026 2:00 PM - 3:30 PM JST | Thu. Nov 12, 2026 5:00 AM - 6:30 AM UTC | Room C (201) (2F)

Oral C2 AI, Automation and Agent Platform

Chair: Patrick Heimbach, Fernando Mendez

2:15 PM - 2:30 PM JST | 5:15 AM - 5:30 AM UTC

[GdsyDt6e-02] SURF AI Assistant: Multi-Agent AI for On-Demand Coastal Digital Twin Configuration and Scientific Workflows

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Developing and operating Digital Twins of the Ocean (DTOs) requires expert knowledge across multiple stages, including experiment design, dataset selection, numerical model configuration, workflow validation, simulation, and scientific assessment. Although large language models offer new opportunities for AI-assisted scientific workflows, configuring operational coastal ocean models remains a domain-specific task requiring specialised expertise, traceability, and rigorous validation.

We present the SURF AI Assistant, a domain-specialised multi-agent framework integrated into the Structured and Unstructured grid Relocatable Ocean platform for Forecasting (SURF). SURF enables on-demand, high-resolution coastal Digital Twins through relocatable downscaling workflows based on the NEMO structured-grid and SHYFEM unstructured-grid ocean models. It supports the modelling lifecycle from data acquisition and preprocessing to simulation, validation and analysis, serving applications including coastal forecasting, oil-spill response, search and rescue, navigation, and maritime decision support.

The SURF AI Assistant orchestrates specialised agents representing expertise in atmospheric forcing, bathymetry, open-boundary conditions, numerical configuration, workflow validation, documentation, and scientific best practices. It combines retrieval-augmented generation with structured configuration schemas and deterministic validation rules, grounding recommendations in curated SURF documentation and operational knowledge. Through natural-language interaction, users define experiments, generate and iteratively refine configurations, and analyse uploaded observational and model datasets. Specialised agents extract metadata and selected physical properties on the fly to derive data-informed modelling parameters and recommend domain settings, forcing choices, boundary treatments, and validation criteria. Human experts retain control over all modelling decisions.

By embedding domain-specific AI within an operational coastal modelling platform, the SURF AI Assistant demonstrates a practical human–AI approach to reducing configuration complexity while improving reproducibility, transparency, and interoperability, lowering the barrier to trustworthy coastal Digital Twins for research, forecasting, and coastal management.

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