- **Leads:** Breanna Vanderplow and Lucila Bloemendaal, NOAA
- **Session Description and Materials:**

  This session will cover advances in operational oceanographic models and model development tools. The presentations and discussions aim to share approaches, best practices, and lessons learned from operational model developments, focusing on AI, cloud computing, and novel evaluation and visualization tools. The session will also feature a cross-cutting presentation on NOAA's Project EAGLE, a demonstration environment that enables testing of AI weather models against existing NOAA weather models.

- **Presentations/Discussion/Notes:**

  NOS Surge and Tide Operational Forecast System (STOFS) - 2026 Upgrade - Greg Seroka (OCS)

  - Greg Seroka provided an overview of the 2026 upgrade to NOAA's Surge and Tide Operational Forecast System (STOFS).
  - STOFS supports a range of end users, including National Weather Service forecast offices, NOAA's National Water Center and Environmental Modeling Center, mariners, pilots, and NOAA Precision Marine Navigation efforts.
  - The STOFS-2D Global upgrade includes two major enhancements: gridded bias correction and substantial mesh improvements in watersheds and coastal areas.
  - Gridded bias correction will be applied to both station and gridded outputs, allowing downstream systems such as the National Water Model (NWM) and National Water Prediction Service (NWPS) to use bias-corrected products.
  - Hindcast evaluations for 2018 and 2024 showed reduced error and improved performance across U.S. stations.
  - STOFS-3D Atlantic includes dynamic adjustment of open boundary conditions.
  - STOFS-3D Pacific is based on SCHISM and is driven by GFS and HRRR forcing, with resolution as fine as 50 meters in selected locations.
  - Precision Marine Navigation products use STOFS-2D for S-104 water level products and STOFS-3D for S-111 surface current products.
  - Future development priorities include continued mesh improvements, hydrologic integration, improved ocean features, and expanded skill assessments.

  NOAA EAGLE Project Review - Sergey Frolov (OAR/PSL)

  - Sergey Frolov presented NOAA's Experimental AI Global and Local Ensemble (EAGLE) project.
  - EAGLE serves as NOAA's research-to-operations pipeline for AI weather models and provides a uniform platform for AI model development, testing, and verification.

- The project aims to accelerate evaluation and deployment of AI forecasting systems while maintaining rigorous verification standards.
- EAGLE leverages NOAA's existing forecast verification infrastructure and provides a centralized location for model information, evaluation results, and visualizations.
- Current development efforts include Nested-EAGLE, HRRRCast, and 3D ocean prediction capabilities.
- Planned future work includes migration to the Anemoi framework, expanded AI model verification against observations, and incorporation of additional AI systems.
- Discussion highlighted NOAA's available GPU resources, open-source development approach, and the relationship between EAGLE and broader Unified Forecast System (UFS) activities.

Leveraging Neural Operators for Continuous Bias Correction of Water Level Forecast Guidance - Saeed Moghimi (OCS)

- Saeed Moghimi presented NeurOCAST, an approach that uses neural operators to continuously correct biases in water level forecasts.
- Neural operators were described as extending traditional neural networks by learning mappings between function spaces rather than finite-dimensional inputs and outputs.
- The approach predicts forecast errors and applies corrections to improve operational guidance.
- A case study used data from 2021–2023 for training and more than three million observations from 2024 for testing.
- Results demonstrated improved performance across both training and previously unseen stations.
- Improvements were strongest under routine conditions, while extreme events remain more challenging and may require additional training data or methodological improvements.
- Operational implementation pathways include continual retraining and transition from hourly to higher-frequency forecast products.
- Key outcomes included improved lead-time reliability and strong spatial and temporal generalization.

The NOS Coastal Cloud Sandbox: A Prototype for Operational Modeling in the Cloud - Michael Lalime (IOOS)

- Michael Lalime presented the NOS Coastal Cloud Sandbox and its role in supporting collaborative cloud-based operational modeling.
- The Sandbox is intended to reduce barriers between NOAA and external partners while accelerating research-to-operations activities.

- Okta authentication enables external users to access NOAA modeling resources hosted on AWS.
- Recent efforts have focused on improving data management practices and controlling cloud costs through storage optimization and automated resource management.
- Example applications included LiveOcean, the National Water Model retrospective, and AI-focused workflows using Amazon SageMaker.
- The Sandbox is supporting development of regional forecast systems including ECOFS, NECOFS, and SECOFS.
- Reported benefits include cost savings, easier collaboration, scalable computing resources, and reduced infrastructure maintenance requirements.
- Future plans include expanded training opportunities, improved documentation, enhanced data access through NODD, and identification of a long-term organizational home for the Sandbox.

EDS Skill Assessment Tool - Cheryl Morse (TetraTech)

- Cheryl Morse presented the Environmental Data Server (EDS) Skill Assessment Tool developed for the U.S. Coast Guard.
- The tool supports evaluation of ocean forecast model performance for search and rescue operations.
- Skill assessment is based on comparisons between observed trajectories and model-simulated trajectories.
- Data sources include Self-Locating Datum Marker Buoys (SLDMBs), Argo floats, and moored buoys.
- Results are stored in a long-term database that has been operating continuously since 2014.
- Coast Guard users can evaluate model performance for specific areas and time periods through a web-based portal.
- Skill scores are calculated and visualized through maps, tables, and trajectory comparisons.
- The system allows users to compare model performance over both short-term events and longer time periods.

NOS Shared Cyberinfrastructure and Skill Assessment (SCI/SA) System - Lucila Houttuijn Bloemendaal and Team (CO-OPS)

- Lucila Houttuijn Bloemendaal presented the NOS Shared Cyberinfrastructure and Skill Assessment System.
- The effort is developing a Python-based replacement for legacy skill assessment tools along with a web-based GIS application for visualization and evaluation.

- The system supports routine assessment of NOS Operational Forecast Systems using both real-time and archived model outputs.
- Variables supported include water level, temperature, salinity, currents, and ice concentration.
- Current development supports ROMS, FVCOM, SCHISM, and ADCIRC-based systems.
- One-dimensional assessments provide station-level comparisons, error statistics, skill metrics, and datum conversions.
- Two-dimensional assessments support side-by-side comparisons of model output and observations, including SST, SSH, currents, and ice products.
- Great Lakes ice skill assessment capabilities have recently been added.
- Additional features include improved customizability, direct access to NODD-hosted model data, and expanded automated testing.
- Prototype completion is targeted for the end of 2026.

Discussion

- Participants discussed treatment of observational uncertainty within skill assessment systems.
- Questions were raised regarding use of HF Radar data within skill assessment workflows.
- Discussion covered interpretation of negative skill scores and regional differences in skill assessment results.
- Participants discussed assessment of STOFS-3D currents and future uncertainty requirements associated with S-111 products.
- Additional discussion focused on AI-based bias correction approaches and potential applications to additional regions.
- Participants discussed future model bakeoff activities and the importance of ensuring Regional Association observations are available and discoverable for evaluation efforts.
- Questions were raised regarding users of S-111 products and methods for understanding downstream use of operational oceanographic products.
- Participants noted opportunities for Regional Associations to work with Pilots Associations and NOAA Navigation Managers to better understand product usage and communicate the value of observing data.

4. **Key Links:**
   - **https://epic.noaa.gov/ai/eagle-overview/**
   - **https://coastalsandbox.ioos.us/**
   - **https://github.com/NOAA-CO-OPS/Next-Gen-NOS-OFS-Skill-Assessment**
   - **https://www.weather.gov/media/notification/pdf_2026/scn26-51_STOFS.v3.1.pdf**
   - **https://chl.crc.nd.edu/**