COSS-TT Brest June 2025 – Theme 5 (AI/ML) – ORAL SESSION

1. *AI in the Digital Twins of the Ocean: Opportunities and Challenges* -- **Ronan Fablet**, IMT Atlantique, Brest, France *(keynote)*

2. *Equation discovery for climate impact: symbolic regression to emulate climate impact indicators for unseen scenarios* -- **Erwan Le Roux** , IMT Atlantique, Brest, **et al.,** France

3. *Observational data-driven model to understand onset and decline of marine heatwaves in the Mediterranean* -- **Amélie Simon, Etienne Pauthenet**, LOPS, Brest, France

4. *Developing data-driven ocean models for the Norwegian coast and fjords using graph neural networks* -- **Ina Kullmann**, met.no, **et al.,** Oslo, Norway

5. *A deep learning approach for coastal downscaling: the northern Adriatic Sea case-study* -- **Federica Adobbati,** OGS, **et al.,** Trieste, Italy

6. *Statistical spatial wave downscaling in a regional sea from the global ERA5 dataset* -- **Bing Yuan,** Helmholtz Zentrum Hereon, Geesthacht, Germany

7. **Discussion**, incl. first results of the COSS-TT AI/ML survey

- 57: *Advancing Bathymetric Reconstruction and Forecasting Using Deep Learning* -- **Irem Yildiz,** Helmholtz Zentrum Hereon, Germany

- 65: *Applying Machine Learning to Predict Typhoon-Induced Storm Surges in Vietnam* -- **Lars R. Hole**, met.no, Norway

- Other AI/ML-related

Survey on the use of AI/ML in the COSS-TT

- AI/ML now becoming part of the toolbox of the coastal modelling/forecasting community, on several aspects: retrieval from data, super-resolution and downscaling, forecasting, emulators, etc.

- Categorize the different uses of the AI in the Task Team

- The COSS-TT Systems Information Table (SIT) (https://oceanpredict.org/science/task-team-activities/coastal-ocean-and-shelf-seas/#section-sit) does not list the uses of AI in the COSS-TT systems

- Prepare the linkage with the AI-TT within OceanPredict

- Prepare the COSS components of Digital Twins

- Survey was run among TT members

Q1 - Please list in a few words/lines the **current or planned uses** of AI/ML in your regional and coastal systems represented in the COSS-TT.

Q2 - For each numbered use, please indicate **to which system, or model, or application, this use is attached** (please indicate if it is already listed in the SIT).

Q3 - For each use, indicate the **development status**: current, under development, planned, envisaged.

Q4 - For each use, briefly indicate **what motivates or has motivated** the use of an AI/ML technique.

Q5 - For each current or under development use, briefly indicate the **obstacles and difficulties** encountered.

- 13 respondents on 29 COSS-TT members = 44.8% response rate

- Assume the 16 who did not respond have no current AI/ML activities or plans

- Examples in COSS:
  - Construct fields of bgc variables (Herzfeld), of pCO2 (Veitch), of SSS (Zavialov)
  - Generate pseudo-obs of ML-generated total alkalinity (Edwards)
  - Downscale currents (Paquin), downscale climate change scenarios (Sotillo)
  - Predict currents (Choi), coastal forcings (Sotillo), storm surges (Hole), wave parameters (Federico), Chlorophyll-A (Gan)
  - Generate emulators of port-scale systems (project, Dunphy)

- Need to continue survey – run new questions
  - Training?
  - What would be expected from the COSS-TT?
  - Other suggestions?