

EGU26-18999, updated on 13 Jun 2026

<https://doi.org/10.5194/egusphere-egu26-18999>

EGU General Assembly 2026

© Author(s) 2026. This work is distributed under the Creative Commons Attribution 4.0 License.



Machine learning sea-surface temperature forecasting based on empirical orthogonal functions

Takeshi Enomoto¹, Aki Saito², and Saori Nakashita¹

¹Kyoto University, Disaster Prevention Research Institute, Uji, Kyoto, Japan (enomoto.takeshi.3n@kyoto-u.ac.jp)

²Kyoto University, Graduate School of Science

Data-driven forecasting of the atmosphere and ocean is evolving rapidly. Recent reports on machine learning weather prediction (MLWP) demonstrate that these models rival or even outperform traditional numerical weather prediction (NWP) from leading operational centres. While the inference is faster than physics-based models, MLWP typically requires Graphical Processing Units (GPUs) or Tensor Processing Units (TPUs) with significant memory, and the computational requirements for training remain enormous.

Certain applications prioritize efficiency, such as sea-surface temperature (SST) prediction on research vessels with limited communication bandwidth. We address this problem by proposing a light-weight alternative to convolutional neural networks (CNNs) or vision transformers (ViTs). To this end, we utilize gradient boosting, specifically XGBoost, which is highly efficient for tabular data. To incorporate spatial patterns, we conduct the Singular Value Decomposition (SVD) to derive Empirical Orthogonal Functions (EOFs). We train the model on the four years of 0.1° SST data based on Himawari over the Western Pacific (120°E–150°E, 20°N–50°N). Preliminary 5-day forecasts show a median error improvement to -0.082 K from 0.10 K and a reduction in standard deviation to 0.68 K from 0.74 K compared to the persistence baseline.

Acknowledgements: This work was supported by JSPS KAKENHI 24H02226.