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Climatological Ocean Surface Wave Projections using Deep Learning

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We present a numerically cheap machine-learning model which accurately emulates the performances of the surface wave model *Simulating Waves Near Shore* (SWAN) in the Adriatic basin (north-east Mediterranean Sea).

A ResNet50 inspired deep network architecture with customized spatio-temporal attention layers was used, the network being trained on a 1970-1997 dataset of time-dependent features based on wind fields retrieved from the COSMO-CLM regional climate model (The authors acknowledge Dr. Edoardo Bucchignani (Meteorology Laboratory, Centro Italiano Ricerche Aerospaziali -CIRA-, Capua, Italy), for providing the COSMO-CLM wind fields). SWAN surface wave model outputs for the period of 1970-1997 are used as labels. The period 1998-2000 is used to cross-validate that the network very accurately reproduces SWAN surface wave features (i.e. significant wave height, mean wave period, mean wave direction) at several locations in the Adriatic basin.

After successful cross validation, a series of projections of ocean surface wave properties based on climate model projections for the end of 21st century (under RCP 8.5 scenario) are performed, and shifts in the emulated wave field properties are discussed.