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Using deep learning to improve the spatial resolution of the ocean model

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For the ocean models, the increase of spatial resolution is a matter of significant importance and thorough research. Computational resources limit our capabilities of the increase in model resolution. This constraint is especially true for the traditional dynamical models, for which an increase of a factor of two in the horizontal resolution results in simulation times increased approximately tenfold. One of the potential methods to relax this limitation is to use Artificial Intelligence methods, such as Neural Networks (NN). In this research, NN is applied to ocean circulation modelling. More specifically, NN is used on data output from the dynamical model to increase the spatial resolution of the model output. The main dataset being used is Sea Surface Temperature data in 0.05- and 0.02-degree horizontal resolutions for Irish Sea.

Several NN architectures were applied to address the task. Generative Adversarial Networks (GAN), Convolutional Neural Networks (CNN) and Multi-level Wavelet CNN. They are used in other areas of knowledge in problems related to the increase of resolution. The work will contrast and compare the efficiency of and present a provisional assessment of the efficiency of each of the methods.