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Neural Network Approaches for Sea Surface Height Predictability Using Sea Surface Temperature

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Abstract : Sea Surface Height Anomaly (SLA) is a signature of the sub-mesoscale dynamics of the upper ocean. Sea Surface Temperature (SST) is driven by these dynamics and can be used to improve the spatial interpolation of SLA fields. In this study, we focused on the temporal evolution of SLA fields. We explored the capacity of deep learning (DL) methods to predict short-term SLA fields using SST fields. We used simulated daily SLA and SST data from the Mercator Global Analysis and Forecasting System, with a resolution of (1/12)◦ in the North Atlantic Ocean (26.5-44.42◦N, -64.25–41.83◦E), covering the period from 1993 to 2019. Using a slightly modified image-to-image convolutional DL architecture, we demonstrated that SST is a relevant variable for controlling the SLA prediction. With a learning process inspired by the teaching-forcing method, we managed to improve the SLA forecast at five days by using the SST fields as additional information. We obtained predictions of a 12 cm (20 cm) error of SLA evolution for scales smaller than mesoscales and at time scales of 5 days (20 days), respectively. Moreover, the information provided by the SST allows us to limit the SLA error to 16 cm at 20 days when learning the trajectory.

Keywords : deep-learning, altimetry, sea surface temperature, forecast
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