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Tidal Forcing Derived from Satellite and Tide Gauges Information: Neural Network Approach

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Tidal elevation is one of the essential inputs for ocean modeling. For modeling small regions near the coast, information at tidal stations may be sufficient to derive tide fluctuations at model domain boundaries. However, when modeling large regions covering coastal areas and deep oceans, data from tidal stations may not be adequate because tidal stations are usually located near the shore and not in deep oceans. Therefore, global ocean tide models have been developed to give tide information at arbitrary locations. The global ocean tide model selected in this study is LeFevre's FES2004 (Finite Element Solution 2004). FES2004 provides the global hydrodynamic tide solutions based on the tidal barotropic equations on a global finite element grid. It also assimilates tide gauge and satellite altimetry data from the Topex/Poseidon satellite to further enhance the model's accuracy. This study observes that in an open sea where there are no or relatively few obstacles (e.g. islands) tide fluctuations obtained from FES2004 compares well with those obtained from TotalTide, a popular and well-established tide prediction software from the UK Hydrographic Office. However, in areas where obstacles are significant, the comparison is very poor. (TotalTide predictions are derived from historical data from tide stations.) This study proposes a scheme that extracts the best available information to provide tide fluctuations at locations required by ocean models. A data driven technique such as Neural Networks is applied at locations where, for example, data from both FES2004 and TotalTide are combined to optimal effect.