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Assimilation of AVHRR water temperature observations into a coastal hydrodynamic model

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Coastal hydrodynamic model state predictions are driven by open sea boundary conditions, riverine inputs, and atmospheric forcing. Therefore uncertainties in the model physics, model parameters, initial conditions, as well as in forcing data often lead to large errors in water temperature prediction. While satellite observations give good spatial coverage at an instant in time, they do not give direct information about deeper layers, unobserved areas (either outside the satellite swath or obscured by cloud), or the evolution with time. Therefore a data assimilation approach is used to combine the full temporal and spatial strengths of modelling with the direct observations. To demonstrate this an Ensemble Square Root Filter assimilation scheme has been developed for the Model for Estuaries and Coastal Oceans (MECO). Here model predictions are constrained with remotely sensed estimates of near-surface bulk temperature (top 1m) using Advanced Very High Resolution Radiometer (AVHRR) thermal IR data. The Ensemble Square Root Filter uses a Monte Carlo technique to estimate model covariances and optimally combine the model prediction and the satellite observation using their respective uncertainty. Using Port Phillip Bay, Australia as an example, this paper presents a series of numerical experiments that demonstrate an improvement in water temperature prediction at insitu measurement points when AVHRR data are assimilated as compared to no assimilation.

Keywords: Sequential Data Assimilation; Ensemble Square Root Filter; AVHRR; Hydrodynamic Modelling; Port Phillip Bay.