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Data assimilation for bathymetry in the nonlinear shallow water equations

The shallow water equations (SWE) are a widely used model for the propagation of surface waves in oceans, lakes and rivers. Common applications include modelling the propagation of tsunami waves, storm surges and flooding. We consider the problem of determining under which conditions a space-time variational data assimilation approach based on observations of the free surface is able to reconstruct the bathymetry to a given accuracy (e.g. sufficient for modelling wave propagation). We then use density-based global sensitivity analysis (GSA) to assess the sensitivity of the surface wave and reconstruction error to model parameters and second order adjoint analysis (SOA) to analyze the sensitivity of the surface wave error, given the reconstructed bathymetry, to perturbations in the observations.

This is joint work with Bartek Protas (McMaster University) and Ramsha Khan (University of Stockholm)