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A Bayesian hierarchical model for surface winds in the Mediterranean Sea: Generation of ensemble initial conditions for ocean forecasting

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Bayesian Hierarchical Models (BHM), of increasing physical sophistication, were developed to generate Surface Vector Wind (SVW) distributions for the Mediterranean Sea Ocean Forecast model (i.e. MFS). Data stage distributions (i.e. likelihoods) during the analysis period (14 days) are constructed from QuikSCAT scatterometer winds and surface wind analyses from ECMWF. During the forecast period (10 days) the data stage distribution is constructed using only forecast winds from ECMWF. A sequence of physical models are tested in the process model stage (i.e. priors), including geostrophy and the linearized planetary boundary layer equations. Realizations are selected from a 1000 member posterior distribution, estimated via Gibbs sampling, and used to generate 10 ocean initial conditions via the MFS Reduced Order Optimal Interpolation sequential data assimilation method. Spread in the initial condition ocean state ensemble reflects uncertainty. Uncertainty concentrates in ocean synoptic scale eddies of the Mediterranean, that are in fact the most uncertain features of the general cicrulation. Particular attention is focused on the case of initial condition spread in the Gulf of Lion gyre during a deep water formation event in February 2005.