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Interpretation of tropical cyclone targeting guidance

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Targeted observing guidance maps for 78 tropical cyclone cases from the 2004 Atlantic Hurricane season are interpreted in light of atmospheric dynamics and the specific design of the different methods. The targeted observing products considered here include two ensemble transform Kalman filter (ETKF) products based on NCEP and ECMWF ensembles and two total-energy singular vectors (TESVs) products computed by ECMWF and the Naval Research Laboratory, using their respective global models. The TESV techniques consider "dynamics only", ignoring the expected differences in the analysis error covariances at target time. ETKF techniques consider both the estimated analysis error covariance at target time and the dynamic growth of perturbations, but are constrained by the finite size and specific characteristics of the ensemble used. Not surprisingly, systematic differences between the techniques are readily apparent. When the targets are remote from the storm, the TESVs usually indicate targets northwest of the storm, often associated with an upstream trough, while the ETKF targets are far more likely to occur northeast of the storm, over the Northern North Atlantic. While the ETKF techniques often produce targets that are significantly different than those based purely on 48-h ensemble spread, they are nonetheless constrained by ensemble characteristics, specifically the estimate of analysis error covariance produced by the 48-h ensemble, which often has maximum variance over the northern North Atlantic. Unlike the ETKF techniques, the "dynamics only" TESV method is not designed to consider spatial differences in the likely analysis errors (e.g., relatively small over land and large over oceans). Consideration of likely analysis errors in the SV calculation may result in a shift of the target areas towards less-well-

observed regions. The importance of considering estimated analysis error variance in these calculations will be examined by calculating SV targets with initial-time metrics based on estimated analysis error variances. In addition to contrasting the general characteristics of the different methods, specific case studies will be examined in detail to elucidate the connection between the target guidance and atmospheric dynamics.