and eigenvalues. This is in part due to the orthogonality constraint, but is also a reflection of the coupled multiscale, multivariate and nonhomogeneous nature of the real ocean variability. Once the evolving dominant eigendecomposition has been estimated and studied as in this presentation, subsequent analyses should thus be very informative. For example, additional tools could disentangle the processes from the estimated subspaces (e.g., Fourier, wavelets, factor or cluster analysis). Another direction consists in studying the time-space evolution of diagnostic quantities, e.g., energy, vorticity or enstrophy principal components. The four-dimensional estimation and dominant decomposition of statistical properties other than the fields and covariances should also be a fruitful sign of research.

These few technological and scientific advances are linked to practical data and model feedbacks. First, the dominant error covariance eigendecomposition and error variance fields are useful to estimate data requirements for a specific experiment. From the present study, the importance of the deep MLIW variability and error patterns suggests that, for accurate three-dimensional estimations, both salinity and temperature should be measured in the Sicily Strait, at least down to about 500 m. The need of current data in the Ionian slope region was emphasized, especially for the external component (e.g., moorings, ADCPs, AUVs). For some regions, periods and features, the dominant uncertainties were also observed to be associated with specific state variables, for example: T for the IBV, S for a MLIW path or T (S) with total velocities for the temperature (salinity) Ionian slope front. In general, the error growth was logically tempered downstream of the sampling locations. It was also found that the impacts of observations were determined by the most uncertain variations of the five features identified. For example, the data impacts had tight horizontal scales across the Ionian slope, in accord with the most uncertain local fluctuations of the corresponding subbasin-scale fronts. Hence, evolving these dominant variations or predictability errors appears most valuable for adaptive sampling design. The present approach in fact allows to forecast data optimals, i.e., the most desired and least expensive future observational strategy (sensor and platform types, sampling pattern) within the available observational networks. Such a scheme, combined with practical and meteorological constraints, was used subjectively during the March 98 Rapid Response in the Gulf of Cadiz for the adaptive design of AXBT flight patterns (Robinson et al., 1998c). With the implementation of real-time optimal control and optimization algorithms, computed data optimals give the ESSE scheme the observations it needs most, hence ideally improve the ocean estimate. Secondly, the focus on the largest errors has been very helpful to refine the dynamical and measurement models employed in the real-time experiment. The open boundary conditions, coastal and bottom friction parameterizations, Shapiro filter and error models have for example been improved. Such feedbacks are important and during the more recent Rapid Response 97 in the Ionian Sea (Robinson et al., 1998c), additional model improvements were achieved.

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