hence represents a coupling between mesoscale internal to large-scale external processes over the ABV/MCC with subbasin-scale external patterns above the Ionian slope. Of course, the coupled patterns shown on Fig. 11 are not imperatively physically feasible at all times. The covariance loses the sign of perturbations and the SVD imposes orthogonality constraints. Even though there is significant energy within the vectors shown, in real ocean perturbations, the couplings could cancel out at a given time by vector combinations. Other decompositions are then needed for further analysis.

To conclude, the present decomposition scheme (Section A.1) is valuable for estimating and studying the physical content of the initial variability/error covariance conditions. The results are in strong relation with the processes accounting for the main dynamical variations occurring in the Strait of Sicily during August-September 1996. Several phenomena are explained, in accord with the full PE model, horizontal mesoscale correlations and vertical EOFs of the data residuals. To agree with the data misfits around Sept. 15, the error standard deviations are estimated to be a quarter of these of the variability ($\gamma = 0.25$ in Section A.1, Eq. (A15)). For the tracers, the initial errors are horizontally uniform in the domain of interest: in the surface, the T (S) error standard deviation is 0.45°C (0.055 PSU). The corresponding initial velocity errors, obtained by PE adjustments, are largest in the Ionian slope region where the maximum gradient of the ψ error standard deviation is 1 Sv, across-slope, and the maximum surface, $\hat{u}$, $\hat{u}$ error standard deviations are 12 cm^{-1}.

3.2. Estimation with predictions of the fields and dominant error covariances

The initial field (Fig. 5) and ES (Figs. 9–11) conditions are now available. The estimation and study for the subsequent ten days can be started. Section 3.2.1 describes the results of the Sept. 15–18 forecast of the fields and ES, and of the assimilation on Sep. 18. After this, the fields and dominant error covariances are forecast to Sept. 22. The data for that day are assimilated, and new field and error forecasts issued for Sept. 24. Section 3.2.2 presents selected results from this period. All along, the estimated fields are evaluated by intercomparisons with the OI fields, clear SST images and in situ data.

3.2.1. September 15–18, 1996

3.2.1.1. Field forecast and analysis. Fig. 12 shows the surface T forecast for Sept. 18 (Panel a), the satellite SST analysis at 12:10 GMT on Sept. 17 (Panel b), and the data-forecast melded estimates of the OI scheme (Panel c) and present scheme (Panel d), both for Sept. 18. The forecast is in accord with the SST analysis for the overall shapes of the AIS front and of the main features identified in Section 3.1 (i.e., the ABV, MCC, IBV and SMV). However, at most depths, the root mean square (RMS) errors of the forecast at data-points are above the computed RMS errors of the data (Section 2.4.1). The assimilations (Panels c–d) improve this forecast. At each level, the RMS of the data residuals of the OI and present analyses are within the computed data error: Panels (c–d) are valid estimates. Nonetheless, the two assimilation schemes extrapolate the a priori data residuals differently. As shown by the northwestward velocity vectors along the