2.4.1.3. ESSE forecast parameters. The forecast of the state and ES characteristics is here based on a Monte Carlo ensemble approach (Section A.4). Several choices of state and ES estimates are possible. In this study, the state forecast is the central nonlinear forecast. The ES forecast is obtained as follows. An ensemble of perturbed states is created such that, at the infinite ensemble limit, the sample covariance matrix from the a posteriori the $\hat{\psi}_{k+1}(+)$ tends to the a posteriori error subspace covariance matrix. The signs of the perturbations are constrained by data to avoid states of adequate variance, but of possibly too unrealistic physics. Model errors are assumed null and the PE stochastic forcing (Lermusiaux, 1997) set to zero. While batches of forecasts are computed in parallel, a similarity coefficient measures the added value of new integrations to assess the convergence of the ES forecast. When the coefficient is large enough, parallel iterations are stopped. The size of the ES hence evolves with time, in accord with data and dynamics.

2.4.2. Optimal interpolation scheme

The OI consists of a two-scale OA of the new data, followed by a blending of the forecast and OA fields. It is a robust scheme, with successes in several regions of the world's ocean (Lozano et al., 1996; Robinson et al., 1996). Presently, the profiles (Fig. 4b–c) are first gridded in a two-scale (subbasin-scale, mesoscale) minimum error variance estimation. These analyses are carried out using the parameters of Table 2. Gridded velocities are obtained assuming geostrophic balance with the analyzed density field, for a level of no motion at 180 m. The analyzed tracers and internal flow are then blended with the forecasts. [1] The weights in the blending are such that where the error variance of the gridded data is one, the forecast weight is null, and inversely (Robinson, 1996). With this OI, the external flow adapts to the new data after the blending, by dynamical adjustments.

3. Data-driven fields and covariances

The present nonlinear estimation starts on Sept. 15 and ends on Sept. 24, using the parameters of Section 2. The initialization of the ES which leads to an interesting decomposition of the summer variability is described in Section 3.1. The subsequent ten days of field and dominant error covariance estimates are studied and evaluated in Section 3.2.

3.1. Error subspace initial conditions

For the limited number of comprehensive modeling efforts in the Strait of Sicily, simple principles are used to initialize the ES on Sept. 15. As for the initial fields $\hat{\psi}_0$ (Section 2.3), the main information consists of the initial data (Section 2.1) and PE model (Section 2.2). The largest uncertainties of $\hat{\psi}_0$ are hypothesized to be generic mesoscale PE variability (features of about 15–100 km horizontal-scale or

[1] In future studies, the OA transport could perhaps be assimilated if its values in data regions were PE adjusted, in a fashion similar to that discussed in Section 2.3.