Since this is a first endeavor with real data, some time is spend illustrating the estimation methodology. The scientific and technological results are discussed and studied along the way, as they are obtained. The advances made and the corresponding opportunities are summarized at the end. The presentation is intended to show that analyzing the evolution of the dominant decomposition of covariance matrices is very valuable for many reasons, ranging from the elucidation and modeling of real ocean processes to the efficient and objective design of observational strategies.

The organization of this paper is as follows. Section 1.1 briefly overviews the regional features and scales of variability. Section 2 deals with the estimation parameters. Section 3 describes and analyzes the results of the ten days of nonlinear estimation. The initialization of the error subspace is presented in Section 3.1. Several features associated with the dominant variability in the Strait during RR96 are identified. The estimation with predictions of the fields and dominant error covariances is studied in Section 3.2. The predictability error eigenvectors obtained are shown to be valuable for organizing and describing the variations of variability in the region. For quantitative and qualitative evaluations, intercomparisons with OI fields, clear SST images and available in situ data are carried out. Section 4 consists of a summary and conclusions. The Appendix defines the notation frequently used and overviews the machinery of the ESSE scheme employed.

1.1. Descriptive overview of the regional features and scales of variability

The Strait of Sicily (Fig. 2) separates the Western from the Eastern Mediterranean basins. The topography is complex, with the large and shallow Tunisian and Sicilian shelves (above 200 m) surrounding a narrow, double-sill trench (400 m) south of Malta Island, and a deeper basin (up to 1000 m) south of the Adventure Bank, between the Pantelleria and Malta Islands. Past the Ionian shelfbreak, the slope is steep, almost oriented north–south along 16E. This region is referred to as the Ionian slope.

A recent description of the general surface-intensified circulation in the Eastern Mediterranean and Strait of Sicily is given in Robinson et al. (1991). In the Sicily Channel, the fresh modified Atlantic water (MAW, in 1996, $\sim$37–37.8 PSU and $\sim$16–24°C) inflows in the surface layer ($\sim$0–150 m) from west to east, mainly by advection within the AIS. It was found during RR96 that within the Strait in summer conditions, the meanders of the AIS are mainly associated with surface thermal structures. As shown on Fig. 3, the free jet enters the Strait southward, along the western side of Sicily. It flows past Pantelleria on the north, bears northwestward around the Adventure Bank Vortex (ABV), then turns back southeastward in the Maltese Channel Crest (MCC), to go around the Ionian Shelf Break Vortex (IBV). These three features were subjectively identified during RR96 and named by Robinson et al. (1998b). Past the IBV, the AIS flows off the shelf into the upper western Ionian Sea, possibly bifurcating and breaking off into several streams. Interestingly, the present real-time study objectively confirms all of these independent findings. Another result is that two other features associated with the dominant variability are identified.

The main complement to the surface MAW exchange is the deep outflow, from east to west, of the salty modified Levantine intermediate water (MLIW). The MLIW (in