



Sampling strategy assessment for temperature and salinity observations in the Mediterranean Forecasting System

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Sampling strategies involving the collection of temperature and salinity profiles in the Mediterranean Sea are studied and compared. This task is accomplished by means of Observing System Simulation Experiments techniques that allow to assess the usefulness of observations by quantifying their impact on the performance of a Mediterranean GCM. Twin experiments (composed of control, free and assimilation runs) are performed using different data distributions and in different seasonal configurations. Temperature and salinity profiles are inserted into the GCM via bivariate data assimilation, by means of a reduced-order multivariate optimal interpolation scheme.

The convergence of the assimilation run towards the control run is assessed by means of standard deviations of differences between the two runs. The convergence of the free run towards the control run is used for reference, since it shows the ability of the model to converge towards the control run without data assimilation. The data impact is quantified by the error reduction achieved in the assimilation run relative to the free run.

The sampling strategies studied here consist of combinations of synthetic XBT and CTD profiles located along Volunteer Observing Ship (VOS) tracks and CTD profiles from MedARGO floats. The profiles distributions are based upon idealized and real data samplings adopted in the framework of the Mediterranean Forecasting System.

The VOS track impact generally depends on the spatial coverage provided by the observations, i.e. the track length. However, the most effective VOS tracks, as well as float trajectories, are those which sample areas with complex dynamics, particularly

those characterized by fronts between water masses, such as the western Mediterranean and the northeastern Ionian Sea. Floats can enhance the spatial coverage relative to VOS. The combination of VOS and floats data enable a relative error reduction up to 20-30%, depending on the season and the region.