Abstract View

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Dynamical Interpolation and Forecast of the Evolution of Mesoscale Features off Northern California

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ABSTRACT

The series of cruises off Northern California comprising OPTOMA11, during two months in summer 1984, were specifically designed as an ocean prediction experiment. In addition to a regional survey from Cape Mendocino to Monterey, six surveys were made of a $(150\ \text{km})^2$ domain offshore of Pt. Arena/Pt. Arena/Pt. Reyes. During the initial phase (over about ten days) of OPTOMA11, an intense (speeds up to 50 cm s^{-1}, relative to 450 m) jet/cyclone system propagated offshore at about 5 km day^{-1}. The subsequent evolution (over about 40 days) of the streamfunction field was governed by the meandering of the jet and the associated changes in the intensity of the anticyclonic region to the north of the jet and the cyclonic region to the south. From quasi-geostrophic (QG) model hindcast experiments using the streamfunction data, wind stress curl was an important forcing mechanism in the later phase of the experiment. Forecast in a domain extending over the continental slope were in agreement with objective analyses (OA) in the upper water column when the local topographic slope was used in the model. Asynopticity in initialization data (in this case, data acquired over eight days) did not seriously degree forecasts, although forecasts which used synoptic estimates (via a time-dependent objective analysis) of initial and boundary data were more accurate. The repetition in sampling allowed estimation of a space-time covariance function which was used for statistical forecasts. Quasi-geostrophic dynamical forecasts, generated using statistically forecast boundary data, evolved consistent with the OA in the interior of the forecast domain (rms difference 56% after 16 days). Assimilation of truly synoptic data, in the interior of the forecast domain as well as on the boundaries, improved the forecast so that it gave a better estimate of the streamfunction field than the OA (rms difference from the best field estimate was 20% after 16 days). Energetics analyses, based on-best estimates of the streamfunction and vorticity fields obtained by dynamical interpolation, indicate that the cyclonic region to the south of the jet grew

due to baroclinic instability. The inclusion of wind stress curl forcing was essential to the interpretation of the energetics.

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