Mass transports in the Earth's system principally manifest in variations of the fundamental geodetic observables Earth rotation, Earth deformation and gravity field. Although, the oceans significantly contribute to large scale mass transports the underlying physical processes are still poorly understood due to sparse observational data of the ocean's interior. To overcome this gap, we use a data assimilation approach based on Ensemble-Kalman filtering in combination with an ocean global circulation model. We fitted a dynamical three-dimensional ocean model state to observed two-dimensional mass distribution anomalies derived from GRACE and observed variations of the Earth's rotation vector. Before assimilation the non oceanic components were removed from the observations. By subsequent analysis of the resulting ocean model state knowledge about the ocean's interior could be inferred. Due to the complementarity of gravity and Earth rotation data the approach allows the distinction between ocean angular momentum which is generated by a changing mass distribution or by changes in the ocean currents. Comparisons between assimilated and non-assimilated model simulations reveal errors in model-forcing and internal parameterization. Components of the observations that could not be reproduced with respect to the estimated error budgets give information about possible inconsistencies and hint to the true order of error budgets. In addition, this allows a consistency check of the assimilated data sets and hint to the true order of error budgets. Consequently we tested the geodetic observations of the different physical properties for their dynamical consistency in the context of the utilized model.