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Time series of eddy amplitude from an automated eddy identification and tracking analysis of the nearly two-decade merged satellite altimeter record of global sea-surface height (SSH) are analyzed. It is found that the resulting amplitude life cycles of nonlinear mesoscale eddies, a major component of low-frequency ocean physical variability, have a characteristic structure that differs fundamentally from that which would be expected on the basis of classical interpretations of ocean eddy evolution in terms of mean-flow instability followed by frictional, radiative or barotropic decay, or of vortex merger dynamics in quasigeostrophic turbulent cascades. Further, it is found that these life cycles can be accurately modeled in terms of the large-amplitude excursions of a stochastic process. The ensemble mean and standard deviation time series of normalized eddy amplitude have several striking and unexpected characteristics, including time-reversal symmetry and approximate self-similarity. The basic qualitative and quantitative statistical properties of these series can be remarkably well reproduced with an extremely simple stochastic model, in which the SSH increments between successive time points are random numbers, and the eddy life cycles are represented by excursions exceeding a given threshold. The stochastic model is found also to predict accurately the empirical autocorrelation structure of the underlying observed SSH field itself, when the autocorrelations are computed along long planetary (Rossby) wave characteristics.
OSTS session
Science Results from Satellite Altimetry