Abstract View

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Coherence Maps for Wind-Forced Quasigeostrophic Flows*

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ABSTRACT

Coherence maps are a useful tool to study the oceanic response to atmospheric forcing. For a specific frequency band these maps display the coherence between the oceanic current (or pressure) at a single mooring location and the atmospheric forcing field at other locations as a function of separation. This paper calculates such coherence maps from a simple linear quasigeostrophic model forced by a statistically stationary and homogeneous wind field. The calculated coherence maps show values less than one. Such values are not due to the presence of noise but are a consequence of the ocean being forced at many locations. The maps also show characteristic patterns with maxima either at the mooring location or away from it. The locations of the maxima do not indicate the locations of the forcing but instead reflect the scales of the atmospheric forcing spectrum and of the Green's function of the potential vorticity equation. Coherence maps can be used to estimate the Green's function in a multiple regression analysis. The presence of noise or nonlinearities in the system can be inferred from the multiple coherence, which is a number. Emphasis is on understanding the information content of coherence maps, not on reproducing observed maps. The results can be generalized to other systems where response and forcing are related by a Green's function.