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A new method to infer sea-surface temperature anomaly dynamics from stochastic fluctuations

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This presentation introduces a new method for quantifying the transport of stochastically forced sea surface temperature (SST) anomalies. Previous studies have inferred the travel time, and hence the advective speed, of surface currents by observing significant time-lagged correlations in SST timeseries from remote locations. The disadvantage of this approach is that the time-lag of peak SST correlation does not necessarily align with the advective time in flows where SST anomalies are advected by a current, diffused by eddies, and relaxed to atmospheric temperatures. Instead, the time-lagged correlation function should be interpreted using the Green's function that captures complete transport information. Using this insight we have designed an algorithm that provides individual estimates of the advective, diffusive, and relaxation fields responsible for transporting a stochastically forced tracer field. The algorithm works by producing a least squares estimate of the transport operator acting on the anomaly field. The operator is then decomposed into its advective, diffusive, and relaxation components using arguments based on symmetry and divergence. The algorithm has been tested in a two dimensional numerical model where random temperature fluctuations are transported by anisotropic advection, diffusion, and relaxation. The algorithm rapidly converges to the true values of the transport fields. We are currently applying the new method to climatological data, and output from a global climate circulation model. Preliminary estimates of the advective, diffusive, and relaxation fields comprising SST transport in the mid-latitude North Atlantic will be presented.