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SST dynamics from a stochastic linear inverse method

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The dynamics of SST anomalies in the midlatitude North Atlantic are investigated using a stochastic linear inverse method. The method is based on the stochastic climate theory of Hasslemann & Frankingoul where monthly SST variability is seen as the integrated response to a random atmospheric forcing. Our novel contribution is a locality assumption that extends recent developments in fluctuation-dissipation based inverse modelling. The assumption restricts the linear operator to representations of local physical transport mechanisms such as advection, diffusion, and decay. This assumption avoids the inversion of large (and noisy) covariance matrices that are often prohibitive. The method is applied to satellite SST data in the midlatitude North Atlantic. The 30 year timespan of satellite data is sufficient for the method to converge. The estimated transport operator gives an estimated SST impulse response function. For an impulsive source of heat at any location we estimate the timescales and magnitude of the response as it spreads throughout the North Atlantic. The results are broadly consistant with previous studies. Additionally, the transport operator is decomposed (by symmetry) into estimates of the velocity, diffusivity, and decay rate fields. The large scale features of these fields compare favorably with previous studies. However SST anomaly advection does appear to be dominantly driven by surface ocean currents.