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Decadal Changes in the Re-emergence of Sea Surface Temperature Anomalies in the Northeast Atlantic

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In many regions of the extra-tropics, local re-emergence can contribute towards the winter-to-winter persistence of large-scale sea surface temperature anomaly (SSTA) patterns. The process of re-emergence provides a basis for skilful seasonal climate forecasting. Local re-emergence is particularly evident in the northeast Atlantic, and this regional phenomenon is investigated using a new observational dataset (ENACT) and ocean model hindcasts obtained with both coarse (1°) and eddy-permitting (1/4°) resolution versions of the NEMO ocean model, for the period 1958-2007. A running-lag correlation analysis between winter SSTA and mixed layer temperature anomalies from the previous winter demonstrates evidence for a decadal signature of local re-emergence in both hindcasts and observations. Prior to 1980, an active re-emergence phase is evident, followed by a period, throughout the 1980s and into the early 1990s, during which very little re-emergence occurs. Recently, re-emergence has reverted back to an active phase during the mid-late 1990s/early 2000s. This decadal cycle coincides with corresponding transitions in the phase of the North Atlantic Oscillation (NAO). A combination of NEMO tracer experiments and offline trajectory calculations are undertaken to diagnose differences in the lateral and vertical spreading of temperature anomalies, over seasonal timescales, during periods of more and less active re-emergence. The relative large-scale influences of subduction and advection (hypothesized to vary with the NAO), in disrupting local re-emergence over decadal timescales, are thus partitioned.