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The Gulf Stream – Troposphere connection: warm and cold paths

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In this talk, the role of moist processes in ocean-atmosphere coupling over the Gulf Stream will be discussed, using ERA interim reanalysis data (1979-2012) and nested simulations with the UK Met Office Unified Model. The focus is on the cold season (December through February).
Two types of moist processes will be highlighted. First, shallow convection driven by surface fluxes of heat and moisture, usually found behind the cold front of extra-tropical cyclones. It will be shown that the warm flank of the Gulf Stream is instrumental in amplifying these convective events. In addition, it will be suggested that they are also responsible for simulated changes in precipitation found in numerical experiments with Atmospheric General Circulation Models forced with smoothed and realistic sea surface temperature (SST) distributions. The impact of this type of air-sea interaction on the larger scale is however unclear as it mostly affects low levels (below 700hPa).

The second type of moist processes of relevance is that of moist inertial ascent along the cold front of extra-tropical cyclones. It will be shown that such ascent typically occurs 10% of the time in winter and that it is preferentially rooted over the warm flank of the Gulf Stream. The moist inertial ascent is intense and narrow, and not compensated within a given synoptic system. As a result, and despite being infrequent, it will be shown to contribute crucially to the time mean upward motion over the Gulf Stream at middle (500hPa) and upper tropospheric levels (300 hPa). This result suggests that warm advection by the Gulf Stream acts in effect as a horizontally broad, downward push, on air masses above the boundary layer, a push required to compensate for the upward mass flux in the moist inertial ascent.