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A new mechanism for ocean-atmophere coupling in midlatitudes

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The role of moist convection in "transferring" upward surface ocean conditions throughout the troposphere is studied in reanalysis data for the Northern and Southern extra-tropical Hemispheres in winter. It is found that conditions for the development of a convective air column from the sea surface to the tropopause are met frequently over all major western boundary currents and their extension in the oceanic interior (sometimes by as much as 50% of the time). These large occurences are shown to be jointly controlled by oceanic advection of warm waters and, on the atmospheric side, by the downward displacement of the tropopause associated with synoptic weather systems.

Based on these results, it is proposed that the oceans can influence the atmosphere directly through convection in midlatitudes, as is commonly thought to occur in the Tropics. Analysis of the Richardson number R_i found at low levels suggest that moist symmetric instability ($0 < R_i \leq 1$) is a key process involved in linking surface ocean temperatures to atmospheric lapse-rates, in addition to standard upright convection. These low R_i processes are not currently parameterized in climate models, which raises the possibility that the extra-tropical oceanic influence on climate might be underestimated in the current generation of models.