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Extratropical ocean influence on climate: The East China Sea example

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By now it is well established that the atmospheric boundary layer is strongly modulated by ocean fronts, characterized by sharp cross-frontal variations in wind velocity and cloud. Still under debate, however, is the relative importance of sea surface temperature (SST) effects on vertical mixing and atmospheric pressure. Along the Kuroshio front in the East China Sea, both mechanisms appear at work albeit on different timescales. On monthly or longer timescales, the thermal wind due to the SST front anchors northeasterly winds at the surface. On synoptic scales, enhanced surface instability on the warm flank of the SST front intensifies transient wind speed. As a result, a maximum of scalar wind speed is displaced southward from the maximum of the northeasterly vector wind.

In Qingdao (representative of the Chinese coast of the Yellow Sea), the fog season sets in April associated with the onset of the southerly winds and its advection of warm and moist air. The southerly winds in the western Yellow is part of a basin-scale anticyclonic circulation trapped in the atmospheric boundary, which forms in spring over the cold ocean surface surrounded by the warming Asian Continent to the west and warm Kuroshio to the southeast. The fog season of the Yellow Sea lasts until late July, the time of the Meiyu-Baiu termination.

The Meiyu-Baiu rain band is perhaps the single most important climate phenomenon for East Asia. The Kuroshio front induces a band of surface wind convergence on the warm flank, presumably contributing to rainfall including Baiu. Meiyu-Baiu is also controlled by larger-scale features such as the westerly jet aloft. These and other ocean factors for the summer rainband will be discussed.

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