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Summer Drying Trends in East Asia: Different Physical Mechanisms between Land and Ocean

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Summer precipitation-evaporation patterns across East Asia have shifted toward drier conditions over the past four decades, contrasting with the region's traditionally humid climate. We analyze precipitation-evaporation changes during April–September from 1980–2022 to understand regional mechanisms behind these drying trends. Results show significant drying over southeastern China, the Yellow Sea, and Korean Peninsula regions. Moisture budget decomposition reveals that the physical processes causing drying differ substantially between continental and oceanic areas. Over southeastern China, dynamic processes dominate the drying trend through enhanced moisture divergence. This results from strengthened subsidence linked to Indo-Pacific warm pool heating, driven by both anthropogenic warming and Pacific Decadal Oscillation patterns. In contrast, Yellow Sea drying occurs through thermodynamic processes involving moisture advection changes driven by global warming-induced humidity redistribution. Stronger humidity gradients between the Northwest Pacific and inland China enhance dry air transport from the continent to the Yellow Sea via prevailing southwesterly flows. These results show that East Asian summer drying involves spatially varying processes, improving our understanding of monsoon system changes under climate change.

Keywords: East Asia, Summer drying, Precipitation-evaporation, Moisture budget, SST patterns

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