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Influence of sea surface temperature variations over the western Kuroshio-Oyashio confluence region on explosively developing extratropical cyclones

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This study investigated how explosively developing extratropical cyclones respond to sea surface temperature (SST) variations over the western Kuroshio-Oyashio confluence (WKOC) region using regional cloud resolving simulations. We focused specifically on an explosive cyclone that moved along the southern side of the Kuroshio/Kuroshio Extension in early February 2014 and conducted a real SST experiment (CNTL run) and two SST sensitivity experiments with warm and cool SST anomalies over the WKOC region (warm and cool runs). The results derived from the CNTL run showed that moisture that evaporated from the WKOC region contributed substantially to latent heat release over the bent-back front with the aid of the cold conveyor belt (CCB), leading to the cyclone's development and to the transition from axisymmetric to asymmetric structure around the cyclone center. Such successive processes were more active in the warm run than in the cool run. The dominance of the zonally asymmetric structure caused a difference in sea level pressure around the bent-back front between the two runs. The WKOC SST variations have the potential to affect strong wind distributions along the CCB through the modification of the cyclone inner structure. Additional experiments with regard to two other cyclones indicated that the cyclone response to the WKOC SST variations became evident when the CCB north of the cyclone center overlapped with that region, confirming that the CCB plays a vital role in latent heat release over the bent-back front through enhanced moisture supply from warm currents.