# Roles of Warm Sea Surface Temperature over the Gulf Stream in Extreme Precipitation Related with the Extratropical Transition of Hurricane Sandy (2012)

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Hurricane Sandy in late October 2012, which underwent extratropical transition (ET) over the warmest sea surface temperature (SST) over the Gulf Stream (GS) during 1981-2018, induced extreme precipitation on the its western side. This study focused specifically on the impact of warm SST over the GS on Sandy's front structure and precipitation at the ET phase. We conducted a real SST run (control run: CTL run) and a sensitivity experiment without SST anomaly over the GS (climate run: CLM run). The CTL run revealed that the horizontal gradient of potential temperature was evident to the west of Sandy's center, which is called western front (WF). Backward trajectory analyses in CTL run showed that a number of air parcels related with precipitation around the WF were transported from high-latitude region through the atmospheric boundary layer over the GS. While such dry air parcels passed over the GS, they were modified by receiving abundant vapor from the underlying ocean. A comparison of trajectory analyses between the two runs showed that the warmer SST over the GS facilitated the modification of the dry air parcels. The increased vapor import toward the WF in CTL run enhanced WF-related precipitation by 10-20%, compared to CLM run. Another significant difference between the two runs is the change in the WF structure within the boundary layer. Near-surface potential temperature on the eastern side of WF is higher in the CTL run than in the CLM run. The larger potential temperature gradient created stronger frontogenesis around the WF, leading to active ascending motion. Enhancement of updrafts accelerated vapor condensation and reinforced rainfall around the WF. Thus, it is suggested that warm SST over the GS played important roles in amplifying extreme precipitation related with Sandy's ET through abundant vapor supply toward the WF and enhancement of front structure.

Keywords: tropical cyclone, the Gulf Stream, extreme precipitation, extratropical transition

 