Influence of Sea Surface Temperature Fronts and Jet Streams on the evolution of North Atlantic Storms

*Leonidas Tsopouridis[1,2], Thomas Spengler[1,2], Clemens Spensberger[1,2]

1. University of Bergen (UiB), 2. Bjerknes Centre for Climate Research (BCCR)

Midlatitude sea surface temperature (SST) fronts associated with the western boundary currents in the Northern Hemisphere co-locate with the storm track and the jet stream. Sensible and latent heat fluxes maximize along the SST fronts, strongly influencing the baroclinicity near the surface and hence the evolution of mid-latitude storms. Previous climatological studies associated the influence of the SST front with cyclones mainly through increased precipitation on the warm side of the SST front and enhanced low-level baroclinicity at the entrance of the storm track. The actual mechanisms by which SST fronts interact with developing cyclones, however, are still unclear. In addition to the SST front, cyclone development is also influenced by the position of the cyclone relative to the jet stream, with cyclones intensifying at the jet entrance and exit as well as when they cross under the jet stream.

To gain a more mechanistic understanding of the connection between cyclones, SST fronts, and jet streams, we track individual cyclones and their characteristics to categorize them in terms of their propagation relative to SST fronts and jet streams. We focus on cyclones in the North Atlantic and detect them in the ERA-Interim reanalysis for the period 1979-2015 using the University of Melbourne tracking algorithm. The positions of the North Atlantic SST front and jet stream are also objectively detected with established algorithms. Each North Atlantic cyclone is then classified by its trajectory with respect to the position of the SST front and the jet stream, where trajectories can either be north, south, or crossing the SST front or jet stream in either northward or southward direction. Cyclones crossing the SST front northward are found to be the most rapidly developing storms, accompanied by the most vigorous precipitation, while storms remaining south of the SST front are associated with the highest surface fluxes. Our results shed light on how cyclones respond to the SST front and jet position based on their different trajectories, with particular focus on storm development and intensity, distribution and type of precipitation, as well as surface fluxes.

Keywords: Cyclones, Storm Tracks, SST Front, Jet Stream

