# The Contributions of Atmospheric Rivers to Extreme Weather Events Arising from the Interactions of Tropical Disturbances with Tropospheric Jet Streams

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Transient disturbances of tropical and polar origin that interact with atmospheric rivers (ARs) and tropospheric jet streams can often facilitate downstream baroclinic development (DBD), the formation of eastward-moving Rossby wave trains (RWTs), and the subsequent occurrence of extreme weather events (EWEs). The impacts of ARs on DBD and RWTs can be direct (e.g., deep ascent along AR corridors leads to diabatically driven ridge building immediately downstream of recurving and transitioning tropical cyclones; TCs) or indirect (e.g., tropical moisture is transported quasi-horizontally in ARs for thousands of kilometers before being ingested into the rising branch of a thermally direct frontal circulation that is further strengthened by latent heat release). The RWTs develop in an environment of enhanced baroclinicity due to the juxtaposition of poleward-moving warm, moist tropical air masses with equatorward-moving cold, dry air masses that are directly attributable to disturbance-jet interactions. Additional flow amplification and downstream ridge building may also occur in conjunction with dynamically driven ascent and diabatically driven latent release, especially when ARs are present, on the forward side of progressive baroclinic troughs in the amplifying flow that characterizes these disturbance-jet interactions.

The occurrence of EWEs is favored, especially if ARs are present, when RWTs become sufficiently amplified and slow-moving so that the extensive north-south exchange of tropical and polar air masses is facilitated. Examples of EWEs that form by these processes will be presented for: 1) the widespread high-impact disruptive ice storm that occurred over parts of Canada and the northeastern United States on 21-22 December 2013, 2) flooding rains over the eastern United States and Mexico, and wildfires in California during October 2007 and the equally, and 3) an event of interest that occurs during the 2015–2016 winter. The ice storm EWE occurred as the result of the interaction of an equatorward-moving arctic disturbance (potential vorticity anomaly) with a poleward-moving surge of very warm, moist tropical air that was associated with anticyclonic wave breaking along the subtropical jet stream that culminated in the formation of a 125+ m $s^{-1}$ jet. The flooding rains and wildfire EWEs of October 2007 were a response to DBD response over the North Pacific in which upper-level ridge amplification was further enhanced by diabatic heating associated with tropical moisture moving poleward along ARs and then condensing along warm conveyor belts.