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Spatial and temporal variability of the three-dimensional flow around African Easterly Waves

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This presentation will start with a review of how the AEW structures evolve as they propagate between East Africa and the East Atlantic. Most AEWs undergo a structural change from cold-core when they are over the continent to warm-core at the West African coast. This is consistent with a dramatic change in the diabatic heating rate profile from one that is more stratiform dominated over land to one that is more characteristic of deep convection at the coast.

To provide further insight into understanding the evolution of AEWs, a large-scale trajectory analysis of AEWs across West Africa and the eastern Atlantic is provided. Back trajectories were initialised at multiple pressure levels from around tracked vortex centers of the AEW troughs to reveal the source regions of environmental inflow. Over West Africa, the inflow towards the AEW troughs represents the large-scale West African Monsoon circulation with low-level moist flow from the south and west and mid-level dry air from the east and northeast. As the AEW troughs move over the eastern Atlantic, a substantial number of trajectories originate at low-levels over the northeastern Atlantic. This low-level route is characterised by cool and dry air and had a relatively short inflow route to the vortex center. Cluster analysis showed that air from the southwest and west were important for precipitation around the trough. Trajectories in these clusters had the highest flux of moisture toward the AEWs troughs and evidence of ascent and diabatic heating as they reached the troughs' center.

Motivated by this work, we also explore the wave-to-wave variability of convective activity around AEW troughs including an assessment of the influence of environmental characteristics with an emphasis on the humidity. The analysis confirms the significance of the various source regions. The relevance of this work for weather prediction and predictability will be discussed.