

Emergence of the Concept of Atmospheric Rivers

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Abstract submitted for Keynote presentation at the International Atmospheric Rivers Conference

This presentation will review major milestones in the development of the concept of atmospheric rivers. The term AR started appearing in the 1990s and spawned concern about the jargon and its relationship to topics studied earlier. After falling relatively out of favor by the early 2000s, the availability of satellite images showing long filaments of large IWV, confirmed by research aircraft measurements to correspond to strong horizontal water vapor transport, the concept reemerged in scientific papers. By 2005, a series of experiments and programs began pursuing the topic in a focused manner. The HMT program in particular, which focused on US West Coast heavy precipitation, identified ARs as a primary cause of heavy precipitation and flooding in the region. This was followed by the creation of the CalWater program of field studies that emerged from a community planning workshop in 2008 that identified climate change science gaps around ARs and aerosol-precipitation topics as the top priorities. Impacts on drought and water supply then became apparent in the Western US, while European and South American scientists began studying their impacts on the west coasts of those continents. The first AR session at a conference was held at AGU in 2010 - right as a major AR struck California.

During this period some in the research community continued to have concerns about the appropriateness or need for the term. One manifestation of this was the perception by some that the concept was duplicative of the warm conveyor belt (WCB) concept. To help resolve this a workshop was held at Scripps Institution of Oceanography bringing together experts on ARs, WCBs and the related tropical moisture exports (TME). This workshop brought closure to the subject by identifying the unique attributes of each and how they relate to one another.

While the science community debated and advanced the understanding of the phenomenon, the water management and flood control communities became aware of the topic and quickly recognized its value. So too did climate change researchers. As of 2016 many studies are underway to advance the science, field programs are being planned, tailored forecast tools are operating, applications tools are under development, policy makers briefed, and programs formed - key examples being this International AR Conference and the creation of its host organization, CW3E. From the 10 or so peer-reviewed scientific articles published in the 1990s, to the over 400 published since then, the topic has helped bring greater attention to the structure, behavior, predictions and importance of the horizontal water vapor transport part of the global water budget. A topic that had long been considered simple and secondary to the topics of vertical transport by convection and air-sea-land fluxes.

The emergence of the atmospheric river concept represents an example of the complex and often circuitous route that major new research directions take before maturing and having impact through applications. The path provides a telling example of the importance of sustained basic research, and of connecting researchers with people in operational or application-oriented roles.