

# Center for Environmental & Applied Fluid Mechanics



## **"Human Influence on the Large-Scale Atmospheric Flow in Recent Decades"**

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**Abstract:** The large-scale atmospheric flow plays a central role in shaping Earth's regional weather and climate. On daily to multi-decadal timescales, the tropical and extra-tropical flows transport heat, momentum, and moisture across latitudes and longitudes, thereby affecting the distribution of precipitation, temperature, and winds. It is thus critical to assess the impacts of anthropogenic emissions on the large-scale flow. Yet, while observed thermodynamic changes have been attributed to human emissions with high confidence, currently, there is a large uncertainty in recent circulation changes. This uncertainty precludes assessing the impacts of human emissions on the circulation and informing our confidence in climate projections. Here, I will present two examples of how the large-scale flow has changed in recent decades and assess the relative role of anthropogenic emissions in these changes. Specifically, first, I will show that climate models severely underestimate the recent intensification of winter storm tracks in the Southern Hemisphere, which questions their ability to accurately predict climate changes in austral extra-tropics. Second, I will elucidate the models-reanalyses discrepancy in recent Northern Hemisphere Hadley cell strength changes. Observations of sea-level pressure constrain changes in the Hadley cell strength and show that the Hadley cell has weakened in recent decades, in agreement with climate models. The weakening of the circulation is further attributed to anthropogenic emissions, which increases our confidence in future human-induced tropical climate changes.



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