Session: B6 Oral presentation

Modeling the extratropical jets: Connections between the mean climate, variability, and response to anthropogenic forcing

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The poleward expansion of the midlatitude jets streams and storm tracks is perhaps the most robust response of the extratropical atmospheric circulation to climate change. While the synoptic scale dynamics of the midlatitude atmosphere are fairly well represented in coupled climate models in comparison to other critical processes that can only parameterized at current resolution, recent studies have shown that the large scale circulation is not yet a solved problem. First, the trends in both hemispheres have been shown to be sensitive to upper atmospheric processes. The case is particularly extreme in the Southern Hemisphere due to stratospheric ozone loss: over the past four decades, GHG induced tropical tropospheric warming and ozone induced cooling of the stratosphere have worked in concert, pushing and pulling the SH jet stream poleward. In the future, with the expected recovery of the ozone layer, the two process will oppose each other, necessitating a more careful understanding of the balance in forcings. Second, the sensitively of the midlatitude atmosphere to climate forcing in models appears to be related to biases in the mean climate and internal variability; models tend to place the jet streams to equatorward, and models with a larger equatorward bias respond more strongly to all climate forcings. The link between biases in the mean climate and the time scales of internal variability suggest that these errors may be associated with a misrepresentation of eddy-mean flow coupling in comprehensive models, and ideas from fluctuation-dissipation theory could help explain differences in the sensitivity to climate forcings. That all of these processes can be captured in idealized general circulation models, which capture the full dynamics, but with highly simplified climate physics, suggests that these biases are fundamentally associated with the large scale dynamics of the atmosphere.