

## ***Interactive comment on “Observed poleward expansion of the Hadley circulation since 1979” by Y. Hu and Q. Fu***

**Y. Hu and Q. Fu**

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Reply to Referee #2's comments on “Observed poleward expansion of the Hadley circulation since 1979” by Y. Hu and Q. Fu

We thank the reviewer for nice reviews and two specific comments, which will stimulate our further studies on this topic. Replies to the two specific comments are as follows.

1. At current stage, we are not very sure what caused the poleward expansion of the Hadley circulation in both hemispheres. It is a plausible guess that the expansion of the Hadley circulation is related to warming in tropical sea surface temperatures (SSTs) in recent decades. To verify this, we are carrying out GCM simulations with forcing of observed time-varying SSTs. In addition, we will also use results from the Atmospheric Model Intercomparison Project (AMIP), which was designed to simulate

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atmosphere's responses to the observed sequence of monthly averaged global sea surface temperatures and sea-ice distributions, to study whether there exists such a poleward expansion in these simulations.

Using AR4 coupled atmospheric-oceanic GCM simulation results with the 21st century increasing greenhouse gas scenarios, Lu et al. (2007) have showed robust widening of the Hadley circulation. However, the magnitudes of expansion are weak, less than 1 degree in latitude over 100 years. We are worried about whether the coupled GCMs can properly simulate changes in tropical SSTs in responding to increasing greenhouse gases.

2.This is a very good point. It is one of the issues we are working on and try to figure out. From NCEP/NCAR and ERA40 reanalyses, we found that for each hemisphere the poleward expansion of the Hadley circulation mainly occurs in summer and fall seasons, and that intensification mainly occurs in winter and spring seasons (the NCEP/DOE reanalysis shows expansion of the Hadley circulation, but no intensification). It appears that the two kinds of changes in the Hadley circulation do not exist in same seasons. We currently have no clear answers to this.

Technique comments: 1. Change will be made.

2. Change will be made.

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Interactive comment on Atmos. Chem. Phys. Discuss., 7, 9367, 2007.

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