Interhemispheric Coupling Study by Observations and Modelling (ICSOM)

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Recent observational and modelling studies suggest that the Northern and Southern Hemispheres of the earth atmosphere are potentially coupled by the Lagrangian mean flow in the mesosphere modulated by waves interacting with the mean flow. However, observations of modulated wave and flow fields which are needed for quantitative understanding of the interhemispheric coupling are not sufficient. Simultaneous observations of gravity waves at various locations are most important because they are a main driver of the Lagrangian mean flow in the mesosphere.
With the start of full system observation by the PANSY radar in the Antarctic in March 2015, a global mesosphere-stratosphere-troposphere (MST) radar network extending from the Arctic to the Antarctic has been realized. The MST radars are able to observe wind vectors with fine temporal and vertical resolutions including vertical wind components in the troposphere, stratosphere and mesosphere, although an observational gap of the middle and upper stratosphere remains. Thus, the characteristics of small-scale or short-period wave motions including gravity waves and the momentum fluxes associated with these waves can be estimated with a good accuracy.
In addition, recent high-resolution general circulation models enable an explicit simulation of gravity waves under ideal and/or climatological boundary conditions and allow us to examine the momentum budget in the MST region including gravity waves, although their resolution is currently not sufficient to resolve the entire gravity wave spectrum. Real atmosphere simulations utilizing such high-resolution models are still a challenge for the MST region. However, if such real atmosphere simulations are successful, they will help quantitative interpretation of the dynamical fields observed by the MST radar network, and the observations will provide invaluable validation data for the model improvement.
Therefore we will examine the interhemispheric coupling of the earth atmosphere through a combination of simultaneous observations by networking the MST radars over the world and high-resolution model simulations of the observed atmosphere. The first international campaign was performed in 22 January-17 February 2016. Two minor stratospheric warmings occurred in the Arctic. The second one was a minor warming by its definition but the temperature at the north pole increased by about 70 K in two days at 10 hPa. Seven MST radars over the world and a lot of complementary observations were performed by more than 30 participants in eight countries. Preliminary results from this campaign will be reported.

Keywords: interhemispheric coupling, middle atmospehre, sudden stratospheric warming, mesosphere-stratosphere-troposphere radars, general circulation, gravity waves

