Geophysical Research Abstracts
Vol. 16, EGU2014-1080, 2014
EGU General Assembly 2014

Modes of low-frequency circulation variability in the Southern Hemisphere

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In the Northern Hemisphere (NH), the modes of variability of tropospheric circulation on intra-seasonal timescales (also referred to as teleconnections) were described in detail several decades ago. Somewhat surprisingly, a similar description for the Southern Hemisphere (SH) is lacking, a possible reason for this being that the atmospheric circulation in the SH is more transient and less stationary than in the NH, which may have downplayed the importance of the modes for the description of the SH circulation. The only three exceptions that have been described and discussed in detail, including the temporal changes and effects on surface climate elements, are the Southern Annular Mode and two Pacific-South American modes. In the contribution, we present an overview of all the modes of the low-frequency circulation variabiltiy in the Southern Hemisphere extratropics, in all seasons, detected by rotated principal component analysis of monthly mean values of 500 hPa heights. The modes have different spatial structures: zonally oriented dipoles, annular strctures, wavetrains, and monopoles appear among them. Some of the modes are active throughout the year (e.g., the Southern Annular Mode); some of them are active in parts of year only (e.g., wavenumber-3 pattern in the cold half year and wavenumber-4 pattern in the warm half year); some modes forming circumpolar wavetrains in winter are split into two parts in other seasons. One particular mode, consisting of a bi-annular structure, active in all seasons except summer, carries the response of SH circulation to the climate shift in the late 1970's and/or the introducton of satellites in 1979. We provide evidence of the physical realism of the modes by comparing them with correlation maps.