Geophysical Research Abstracts
Vol. 17, EGU2015-7654-1, 2015
EGU General Assembly 2015

Winter atmospheric modes of variability over North America: the added value of RCMs on the large-scale atmospheric signal

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In this work we assess the skill of the Regional Climate Model RegCM4 in reproducing atmospheric variability modes (AVM) during winter compared to a couple of GCMs used as boundary conditions for a RegCM4 historical (1970-2005) simulation. The AVMs are obtained from empirical orthogonal functions of 500 hPa geopotential height anomalies (Z500). The RegCM4 simulations improve the spatial representation of the AVMs compared to the GCMs', as shown by a correlation analysis between simulations and observations (reanalysis). For the 21^{st} Century projections we found that the first AVM is an inhomogeneous atmospheric expansion which induces changes in the atmospheric circulation favoring the advection of oceanic humidity, and therefore precipitation in the Southwestern US and Northwestern Mexico (SWUS-NWMX) region. The second AVM represents a dipole of zonal expansion-compression which apparently modulates the interannual precipitation variability in the SWUS-NWMX region. This second mode is a response to El Niño: accountable for the occurrence of very wet and very dry winters in the region; therefore this is the cause for the projected increase in interannual variability of winter precipitation.