Geophysical Research Abstracts
Vol. 16, EGU2014-13020, 2014
EGU General Assembly 2014

South Asian summer monsoon and the eastern Mediterranean climate: the monsoon-desert mechanism in CMIP5 simulations

Annalisa Cherchi (1), Hariharasubramanian Annamalai (2), Simona Masina (1), and Antonio Navarra (1)
(1) CMCC/INGV, Bologna, Bologna, Italy (annalisa.cherchi@bo.ingv.it), (2) IPRC UH, Honolulu, HI, US

Dry summers over the eastern Mediterranean are characterized by strong descent anchored by long Rossby waves, which are forced by diabatic heating associated with summer monsoon rainfall over South Asia. The large-scale teleconnection between rising and subsiding air masses is referred to as monsoon-desert mechanism. Our study evaluates the ability of the CMIP5 models in representing the atmospheric fields and the physical processes involved in this mechanism. An evaluation of statistics between summer climatologies of monsoon diabatic heating (Q) and that of vertical velocity over the eastern Mediterranean suggests a linear relationship. We found that despite large spatial diversity in Q, descent over the Mediterranean is coherently located and realistic in intensity. To measure the sensitivity of descent to the diversity in the horizontal and vertical distribution of Q, we perform a series of linear atmosphere model experiments. We show that column integrated heating over both the Bay of Bengal and Arabian Sea provides the largest descent over the eastern Mediterranean with the more realistic spatial pattern, whereas weaker descent occurs for near-equatorial heating. In the vertical, CMIP5 models underestimate Q at upper levels, while they overestimate it at lower levels, resulting in a weaker forced response and weaker associated descent over the Mediterranean. A moist static energy budget analysis applied on CMIP5 suggests that most models capture the dominant role of horizontal temperature advection and radiative fluxes in balancing descent over the Mediterranean. Based on our objective analysis, we identify a subset of models that capture the teleconnection for reasons consistent with observations. The recognized processes vary at interannual time scales as well, with imprints of severe weak/strong monsoons noticeable over the Mediterranean. The characteristics and consequences of this teleconnections for the projected precipitation and atmospheric circulation changes in the Mediterranean sector are discussed as well.