Geophysical Research Abstracts
Vol. 20, EGU2018-8820, 2018
EGU General Assembly 2018
© Author(s) 2018. CC Attribution 4.0 license.

MESETA: Modelling physical and dynamical processes over the Tibetan Plateau and their regional effects over East Asia

Reinhard Schiemann (1), Andrew G. Turner (1), Julia Curio (1), Kai Chi Wong (1), Senfeng Liu (2), and Kevin Hodges (1)

(1) NCAS Climate, University of Reading, Meteorology, Reading, United Kingdom (r.k.schiemann@reading.ac.uk), (2) University of the Chinese Academy of Sciences, Beijing, China

We present the MESETA Tibetan Plateau project, part of the Climate Science for Service Partnership China (CSSP China) research collaboration between the United Kingdom and China. MESETA has a twin focus on (i) establishing the relative role of mechanical and thermodynamic effects of Tibetan Plateau (TP) orography on the temperature and circulation of the region and its downstream impacts over East Asia; and (ii) TP atmospheric circulation, in particular the formation of Tibetan Plateau vortices (TPVs) and their role in extreme events downstream of the Plateau.

Regarding (i), sensitivity experiments have been conducted with the atmosphere-only HadGEM3 model at N96 resolution, in which the Asian orography is modified in different ways (no TP, no TP but Himalayas retained, no Iranian Plateau). We find that the Indian Summer Monsoon (ISM) is more sensitive to orographic blocking from the Himalayas and from the Iranian Plateau than to elevated heating by the TP. At the same time, the East Asian Summer Monsoon (EASM) is seen to be more sensitive to the presence of the TP. By conducting the same experiments in a second model, FGOALS-FAMIL, we find that the ISM and EASM circulation response in the sensitivity experiments is similar in both models, yet differences exist in the rainfall responses over India and China. These results highlight that a multi-model approach, as planned in the forthcoming Global Monsoon Model Intercomparison Project (GMMIP), is needed to clarify the impact of orographic forcing on the Asian monsoons.

Part (ii) is concerned with TPVs, mesoscale cyclones that occur over and downstream of the TP. A tracking algorithm has been applied to derive TPV climatologies in two reanalyses (ERA-Interim, NCEP-CFSR) and in HadGEM3 simulations at N512 resolution (about 25 km in midlatitudes). We find that, throughout the year, there is a preferred TPV genesis region to the east of a mountain ridge in the northwest TP, near 85°E, 35°N. We show that the position and strength of the subtropical westerly jet control the distance TPVs can travel eastwards and shape the annual cycle of TPV occurrence. The TPV climatologies of the model and the two reanalyses are very similar to one another in their representation of the TPV climatology, including in the precipitation associated with TPVs over and downstream of the TP. The fact that our high-resolution global climate model can represent the TPV climatology opens a wide range of options for future model-based research on TPVs.