Geophysical Research Abstracts
Vol. 19, EGU2017-15047, 2017
EGU General Assembly 2017


# Simple solutions for the summer shallow atmospheric circulation over North Africa

Giovanni A. Dalu (1), Marco Gaetani (2), Christophe Lavaysse (3), Cyrille Flamant (2), Amato T. Evan (4), and Marina Baldi (1)

(1) Istituto di Biometeorologia, CNR, Roma, Italia, (2) LATMOS, Institut Pierre Simon Laplace, Paris, France (marco.gaetani@latmos.ipsl.fr), (3) Joint Research Centre, European Commission, Ispra, Italia, (4) Scripps Institution of Oceanography, University of California San Diego, USA

In this study, we present a model analysis of the summer shallow atmospheric circulation over North Africa driven by desert heat lows, performed by using a two layer Matsuno-Gill model system, where a lower Rayleigh frictional layer is coupled with an upper almost frictionless layer. We analyse the early summer circulation, when a single heat low spans from the west coast of Africa to the Arabian Peninsula, and the full summer circulation, when two separate heat lows are observed, one over western Sahara (the Saharan heat low, SHL) and one over the Arabian Peninsula (the Arabian heat low, AHL).

In early summer, the SHL drives a lower layer cyclone and an upper layer anticyclone, with a jet on its southern edge (the African easterly jet, AEJ). The lower layer depression and its related cyclone are almost in-phase with the diabatic forcing, while the upper high pressure (West African high, WAH) and its related anticyclone are almost in quadrature with it. This phase shift between lower and upper dynamics is entirely due to the frictional difference between the two layers.

The full summer shallow circulation over North Africa is characterised by two Walker-like cells, one generated by the AHL and the other generated by the SHL. These cells partially overlap resulting in a strengthening of the WAH and the AEJ. The model shows that the AEJ originates over the Arabian Peninsula, crosses the North Africa, and, invigorated by the SHL, crosses the Tropical Atlantic. The addition of a heating source in the upper layer, associated with the Saharan airborne dust, reveals a further strengthening of the AEJ.