

Integrated climatology and trends in the subtropical Hadley cell, sunshine duration and cloud cover over South Africa

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Abstract:

This study uses two methods to diagnose the local Hadley circulation; first the zonally averaged mass stream function, and second the stream function vector method. The two methods have been applied to the ERA-Interim reanalysis data for the period 1979–2015, to calculate both the climatology and trends of the Hadley cell. Both diagnostics advocate downwards mass flux being dominant over the subtropics, particularly over South Africa, yet the strength of Hadley is seasonal. Contrasts have been found between linear trends of the two diagnostics. Zonally symmetric diagnostics indicate strengthening of the Hadley cell, particularly in the subtropics of the Southern Hemisphere in winter and weakening in summer. The zonally asymmetric results indicate maximum strengthening of the Hadley over South Africa to be in spring and weakening in summer. Furthermore, maximum decrease in cloud cover and increase in sunshine duration over South Africa is in spring, implying more opportunities for solar energy generation.