

Estimating Precipitation Recycling in Sudan using a Bulk Model

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The objective of this study was to estimate precipitation recycling ratio (PRR) in Sudan. The numerical bulk model of Eltahir and Brass was used. It was adopted to fit the moisture flux in the domain. The data was retrieved from the European Re-Analysis (ERA-40) of the European Centre for Medium and long-range Weather Forecast (ECMWF) archive. Surface evaporation, horizontal wind speed and specific humidity for 11 levels between the ground surface and the tropopause were used. The grid mesh was $2.5^{\circ} \times 2.5^{\circ}$ latitude by longitude. The period was the rainy season for the years 1984, 1988 and 2001. By calculating the vertical integrals for moisture fluxes the troposphere was reduced to a 2-dimensional domain. PRR values indicated a strong coupling between the ground surface characteristics and the rain patterns. Precipitation recycling ratio was found to be 19% in July, 21% in August and 27% in September. The contribution of the evaporation in South Sudan to the local rains exceeded 25%. It approached zero north of latitude 15°N . While evaporation from South Sudan was recycled, evaporation from North Sudan was not entrained in rain-producing systems due to air subsidence. This raised the question about the benefit of storing water in the desert.

Key words: Precipitation recycling Moisture feedback Vertical integral
