

Atmospheric circulation patterns in the Arab region and its relationships with Saudi Arabian surface climate: A preliminary assessment

ABSTRACT

This paper establishes and analyses the principal circulation patterns in and around Saudi Arabia (domain: 10°E– 70°E; 5°N–40°N) based on the daily mean sea-level pressure (MSLP) 0.75° × 0.75° gridded data derived from the European Centre for Medium-Range Weather Forecasts (ECMWF) re-analysis ERA-Interim for the period 1979–2012. Association of the circulation patterns to the local climate is investigated using observed daily temperature and rainfall data at 27 locations over Saudi Arabia for the period 1979–2010. Using the widely-used mathematical technique principal component analysis (PCA) we determine with MSLP data the principal patterns. We only analyse data for the wet season (October–May). The automated typing procedure establishes 12 circulation types, which represent all the main synoptic features especially those that originate from the Mediterranean, the European and African continents, Siberia, and also the Red and Arabian seas. There is a strong link between the circulation types and surface climate that is synoptically and spatially interpretable. Particular circulation types are associated with specific climatic conditions across the country: rainfall is linked with Types 9, 10 and 11, whilst warm days (nights) with 1, 2, 3, 9, 10, 11 and 12 (1, 2, 3, 10, 11 and 12), and cold days (nights) with 2, 3, 4, 5, 6, 7, 11 and 12 (2, 4, 5, 6, 7 and 8). In terms of regional influences, the circulation types also exhibit specific links between certain types and climatic divisions across Saudi Arabia