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Lagrangian tracing of Sahelian Sudan moisture sources

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Sahelian Sudan, 10° to 16°N, is an arid to semi-arid zone that separates the Saharan to the north and the wet Savannah to the south. The region is characterized by, relatively, limited water resources, and hence has a high dependency on the annual rainfall. According to the latest IPCC report, regions that have such limited water resources are highly vulnerable to the ongoing climate change and variability. Taking into account that the agriculture is the main economical activity, the variability in annual rainfall is of direct soci-economical relevance. Similar to the rest of the African Sahel, the rainy season, June through September, across Sahelian Sudan is connected to the annual march of the Intertropical Convergence Zone (ITCZ). However, there still a limited understanding of the actual sources of moisture that supplies this region with water vapor during the rainy season. Broadly speaking, the Atlantic, the Congo rain forest, the Read Sea and the Indian Ocean are the main potential sources. In this study we use Lagrangian tracing technique to indentify the sources of moisture of Sahelian Sudan and attempt quantifying their contribution to the total annual moisture convergence. For this we utilized output from the Lagrangian trajectory model FLEXPART driven by the meteorological fields from the European Center for Medium range Weather Forecast ERA-interim for period of ten years 2000 to 2009. We trace back, for ten days each mass element to indentify the source region. The models also accounts for precipitation and moisture uptakes through the course of the transport of the air parcel from source to destination. Identifying the sources of moisture is of great importance, and can help in two connected directions. First, identifying sources of moisture will help in understanding the variability and will provide insight about the drought causes and mechanisms. Second, revealing the moisture sources would enhance ongoing efforts in seasonal forecasting.