Precipitationshed data for the moisture recycling analysis within the article ‘On the social dynamics of moisture recycling’

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Abstract:
The biophysical phenomenon of terrestrial moisture recycling connects distant regions via the atmospheric branch of the water cycle. This process, whereby the land surface mediates evaporation to the at- mosphere and the precipitation that falls downwind, is increasingly well-understood. However, recent studies highlight a need to consider an important and often missing dimension – the social. Here, we explore the social dynamics of three case study countries with strong terrestrial moisture recycling: Mongolia, Niger, and Bolivia. We first use the WAM-2layers moisture tracking scheme and ERA-Interim climate reanalysis, to calculate the evaporation sources for each country’s precipitation, a.k.a. the precipitationshed. Second, we examine the so- cial aspects of source and sink regions, using economic, food security, and land-use data. Third, we perform a literature review of relevant economic links, land-use policies, and land-use change for each country and its evaporation sources. The moisture-recycling analysis reveals that Mongolia, Niger, and Bolivia recycle 13, 9, and 18 % of their own moisture, respectively. Our analysis of social aspects suggests considerable heterogeneity in the social characteristics within each country relative to the societies in its corresponding evaporation sources. We synthesize our case studies and develop a set of three system archetypes that capture the core features of the moisture-recycling social–ecological systems (MRSESs): isolated, regional, and tele-coupled systems. Our key results are as follows: (a) geophysical tele-connections of atmospheric moisture are complemented by social tele-couplings forming feedback loops, and consequently, complex adaptive systems; (b) the heterogeneity of the social dynamics among our case studies renders broad generalization difficult and highlights the need for nuanced individual analysis; and, (c) there does not appear to be a single desirable or undesirable MRSES, with each archetype associated with benefits and disadvantages. This exploration of the social dimensions of mois- ture recycling is part of an extension of the emerging discipline of socio-hydrology and a suggestion for further exploration of new disciplines such as socio-meteorology or socio-climatology, within which the Earth system is considered as a coevolutionary social–ecological system.

• **Format of data files** – Matlab format, i.e. .mat files

• **Location** where data were collected – Data were processed using the Water Accounting Model 2 layers (hereafter, WAM-2layers). This model (available here: https://github.com/ruudvdent/WAM2layersPython). The original driving data for the model are reanalysis data from the ERA-Interim archive, produced by the European Centre for Mesoscale Weather Forecasting (ECMWF). These data were downloaded at the 1.5 degree x 1.5 degree resolution, including: 6-hourly zonal and meridional winds, surface pressure, and humidity; and 3-hourly evaporation and precipitation. These ERA-Interim data were processed in the WAM-2layers, first calculating the "fluxes_and_states" (see linked model description), and second using the backtracking procedure to identify the evaporative origins of precipitation for a given sink region. The data span nearly the entire planet, excluding the Antarctic continental region in the south and the extreme Arctic in the north.

• **Time period**– Data were retrieved from the ERA-Interim archive, located at the ECMWF for the time period of 1979-01-01 to 2014-12-31.

• **File Information** – There are 3 data files, in Matlab (.mat) format. The dimensions of the files are: [year,month,latitude,longitude]. The size of the files are: [36,12,92,240].

• **Variable information** – Each data point is the total monthly evaporation, corresponding to the appropriate [year,month,latitude,longitude] location.

• **Uncertainty, precision, and accuracy of measurements** – Model-based data with no uncertainty measures (since its not that type of model).

• **Method(s)** – Please see the original published article for the Methods used.

• **Software** – Matlab

• **Limitations to reuse** – I recommend contacting the author of this work before use, simply to ensure that the user understands the output properly.

• **Date dataset was last modified** – May 2018

• **Related Files** – These data were used in the manuscript "On the social dynamics of moisture recycling" published in Earth System Dynamics (9) 1–18, 2018. https://doi.org/10.5194/esd-9-1-2018