



## Seasonal precipitation predictability in central-northern Chile for dryland management

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The seasonal predictability of daily winter rainfall characteristics relevant to dry-land management was investigated in the Coquimbo Region of central-northern Chile, with focus on the seasonal rainfall total, daily rainfall frequency, and mean daily rainfall intensity on wet days at the station scale. Three approaches of increasing complexity were tested. First, an index of the simultaneous El Niño-Southern Oscillation (ENSO) was regressed onto May-August (MJJ) observed precipitation; this explained 32% of station-averaged rainfall-amount variability, but performed poorly in a forecasting setting. The second approach used retrospective seasonal forecasts made with three general circulation models (GCMs) to produce downscaled seasonal rainfall statistics by means of canonical correlation analysis (CCA). In the third approach, a non-homogeneous Hidden Markov Model (nHMM) driven by the GCM's seasonal forecasts was used to model stochastic daily rainfall sequences. While the CCA is used as a downscaling method for the seasonal rainfall characteristics themselves, the nHMM has the ability to simulate a large ensemble of daily rainfall sequences at each station from which the rainfall statistics were calculated. Similar cross-validated skill estimates were obtained using both the CCA and nHMM, with the highest correlations with observations found for seasonal rainfall amount and rainfall frequency (up to 0.9 at individual stations). These findings were interpreted using analyses of observed rainfall spatial coherence, and by means of synoptic rainfall states derived from the HMM. The downscaled hindcasts were then tailored to meteorological drought prediction, using the Standardized Precipitation Index (SPI) based on seasonal values, the frequency of substantial rainfall days (>15mm; *FREQ15*) and the daily Accumulated Precipitation Deficit. Deterministic hindcasts of SPI showed high hit rates, with high Ranked Probability Skill Score for probabilistic hindcasts of *FREQ15* obtained via the nHMM. An overview of the results can be found in Verbist et al. (2010).

### References:

Verbist, K., Robertson, A.W., Cornelis, W.M., Gabriels, D., 2010. Seasonal predictability of daily rainfall characteristics in central northern Chile for dry-land management. *J Appl Meteorol Clim* 49(9), 1938-1955.