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Assessing the linkages between agricultural drought index derived from remote sensing data and a Land Data Assimilation system and cereal production in Morocco.

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In Morocco, cereal production shows a high interannual variability due to uncertain rainfall and recurrent drought periods that may occur at key phenological stages. In view of the importance of this resource to the country's economy, it is important to better characterize the impact of drought strength and duration on yields in order to better anticipate production at the seasonal scale. While meteorological drought is usually derived from precipitation anomalies, the monitoring of agronomical drought may be more complex because of data availability issues. In this study, drought is assessed through, on one hand, classical indices derived from remote sensing data (Vegetation Condition Index -VCI-, Temperature Condition Index -TCI- and Vegetation Health Index -VHI-) and on the other hand, the outputs of a land data assimilation system (LDAS). NDVI and land surface temperature MODIS products are used to compute VCI, TCI and VHI. The LDAS has been developed by the CNRM/Meteo-France and is composed of the ISBA-A-gs land surface model forced by ERA-5 re-analysis constrained by LAI product and a surface soil moisture derived from scatterometer data. LAI, Transpiration and soil moisture at 20 and 40 cm depth are used. The study period is 2001-2017. The first results obtained on the Settat agricultural province which is the most productive province of cereal in Morocco exhibit a strong correlation between cereal production obtained from agricultural statistics and VCI and VHI during February to March (R=0.8-0.9) corresponding to the critical flowering and grain-filling stages. By contrast, the correlation with TCI was found to be significant during the tillering stage (December-January). TCI is a normalized temperature index computed from the observed extreme values of the time series. It thus represents the anomaly due to air temperature condition. A modified temperature index hereafter called Temperature Hydric Conditions Index (THCI) for which extreme temperature values are computed spatially over each agricultural province at the daily time step is proposed. In order to discard temperature change due to elevation conditions, pixel are filtered using the SRTM MNT. A higher correlation (R=0.87) was observed between THCI and cereal production during the grain maturity stage in April. Finally, outputs from the LDAS appeared very promising as strong correlation were obtained with LAI assimilated in March (R=0.92), with transpiration from February until March (R=0.85-0.9) and for soil moisture at 20 and 40 cm deep at the beginning of crop season (December R=0.86) during emergence. Our current work is focused on the development of empirical models for early forecasting cereal production at the provincial and national scales based on linear and non linear (support vector machine regression) approaches.