Monitoring and forecasting the summer 2018 heatwave impact on vegetation

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abstract-This study investigates the potential of LDAS-Monde offline land data assimilation system to monitor the impact of the summer 2018 heatwave over Europe on vegetation. LDAS-Monde forced by ECMWF's (i) latest reanalysis, ERA-5, and by (ii) its operational high resolution analysis (IFS, Integrated Forecasting System, HRES) are used in conjunction with the assimilation of Copernicus Global Land Service (CGLS) satellite derived observations: Surface Soil Moisture (SSM) and Leaf Area Index (LAI). It leads to reanalyses of the Land Surface Variables (LSVs) at 0.25°x0.25° (over 2008-07/2018) and 0.10°x0.10° (over 04/2016-09/2018) spatial resolution, respectively. Analysis of long time series of satellite derived CGLS LAI (2000-09/2018) and SSM (2008-09/2018) permits to highlight strong negative anomalies for July 2018 affecting large areas of North Western Europe and reflecting the heatwave impact. Such large anomalies spreading over large part of the considered domain have never been observed in the LAI product in this 18-yr period. LDAS-Monde forced by either ERA5 or HRES leads to a good a representation of the vegetation state in general and for this specific event, with HRES configuration exhibiting better monitoring skills than ERA-5 configuration. The consistency of model runs forced by ERA5 and IFS HRES over a common period of time (April 2016 to July 2018) is explored leading to a spatial resolution vs system study. In order to understand if the improvement from the use of ERA-5 to HRES was due to the resolution only (e.g. better representation of the land cover, orography) or the forcing quality, we have evaluated two others LDAS experiments down-scaling(up-scaling) ERA-5(HRES) to HRES(ERA-5) spatial resolutions. Results suggest that resolution is the key but that system still adds some skills. If there is a surface physiography and modeling advantage of HRES configuration, there is added value in down-scaling ERA5 too. If the improvement from LDAS-Monde analysis on control variables (soil moisture from layers 2 to 8 of the model representing the first meter of soil and LAI) from the assimilation of SSM and LAI was expected, other model variables benefit from the assimilation through biophysical processes and feedbacks in the model. Finally, it is shown that a 10-day forecast of LAI initialized by LDAS-Monde analysis has more skills than the model alone.