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Assessing the effect of lateral groundwater fluxes on the simulation of soil moisture in a regional land-surface model

Matteo Zampieri (1,2), Efthymios Serpetzoglou (2,3), Efthymios I. Nikolopoulos (2,3), Emmanouil N. Anagnostou (2,3), and Anastasios Papadopoulos (2)

(1) Institute of Atmospheric Sciences and Climate, National Research Council, 73100 Lecce, Italy (M.Zampieri@isac.cnr.it), (2) Hellenic Center for Marine Research, Institute of Inland Waters, Anavissos, Greece (manos@ath.hcmr.gr, eserp@ath.hcmr.gr, tpapa@ath.hcmr.gr) , (3) University of Connecticut, Civil and Environmental Engineering, Storrs, CT 06269, USA (manos@engr.uconn.edu, enikolop@engr.uconn.edu)

Soil moisture is a hydrologic parameter that affects the atmosphere through control on surface turbulent heat and moisture fluxes, especially during inter-storm periods. The state of surface soil moisture is directly affected by i) river water reinfiltration, and indirectly by ii) lateral groundwater fluxes convergence through the interaction with the ground water table.
A large scale land-surface model, namely the Community Land Model (CLM), was modified to account for both mechanisms and thus better represent hydrologic fluxes in regional climate studies. The modifications introduced to the model (hereafter named CLM-Hydro) are: (a) parameterizations of the reinfiltration of river water into the soil and (b) two-dimensional modeling of the lateral groundwater fluxes.
These changes are expected to alter the distribution of soil moisture at surface and the vadose zone and this hypothesis is examined by comparing the simulated soil moisture fields (from both CLM and CLM-Hydro) against a large number of in-situ soil moisture observations from the Oklahoma Mesonet, for a 2 yrs period (2004-2006).
This study also investigates the effect of horizontal resolution on the representation of these non-local soil moisture processes. Specifically, we run CLM-Hydro at 25 and 5 km, which is the range of scales spanned by the regional climate models and the convection resolving models, respectively.