EGU24-7705, updated on 19 Jul 2024
https://doi.org/10.5194/egusphere-egu24-7705
EGU General Assembly 2024

Soil enthalpy: an unheeded source of subseasonal predictability?

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Accurate soil moisture initial conditions in dynamical subseasonal forecast systems are known to improve the temperature forecast skill regionally, through more realistic water and energy fluxes at the land-atmosphere interface. Recently, results from the GEWEX-GASS LS4P (Impact of initialized land temperature and snowpack on sub-seasonal to seasonal prediction) multi-model coordinated experiment have provided evidence of the primal contribution of the initial surface and subsurface soil temperature over the Tibetan Plateau for capturing a hemispheric scale atmopsheric teleconnection leading to improved subseasonal forecasts. Yet, both the soil temperature and water content are key components of the soil enthalpy and we hypothesize that properly initializing one of them without modifying the other in a consistent manner can alter the soil thermal equilibrium, thereby potentially reducing the benefit of land initial conditions on subsequent atmospheric forecasts. This study builds on the protocol of the above-mentioned multi-model experiment, by testing different land initialization strategies in an Earth system model. Results of this pilot study suggest that a better mass and energy balance in land initial conditions of the Tibetan Plateau triggers a wave train which propagates through the northern hemisphere mid-latitudes, resulting in an improved large scale circulation and temperature anomalies over multiple regions of the globe. While this study is based on a single case, it strongly advocates for enhanced attention towards preserving the soil energy equilibrium at initialization to make the most of land as a driver of atmospheric extended-range predictability.