What's the impact of improved soil representations in the ECMWF land surface model?

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Why





The model bias in Tskin amplitude (Trigo et al. 2015)

vertical discretization would improve the match with Observation

Dirmeyer et al. 2021, also showed the importance of an accurate SM representation for a proper L-A feedback that could simulate drought such us the European 2018 one

How







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10 Layers; 8m depth for water +temperature 10 Layers;2.89m depth for water+ 8m temperature

10 Layers;

- 1.89m depth for water
- + 8m temperature

Impact I

Difference in correlation with FluxCom between the 10-layers soil experiment and the control 4-layers experiment



Better correlation with FluxCom sensible heat flux ==> could infer a better L-A interaction Latent heat flux shows an overall decrease of correlation and a slight increase over some arid areas

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Impact II

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Multi-annual monthly means fluxes



Depths configurations:

CTL: 4 Layers; 2.89 depth for water and temperature

10 Layers; 8m depth for water +8m for temperature

10 Layers; 2.89m depth for water + 8m for temperature

10 Layers;

1.89m depth for water + 8m for temperature



Increase in sensible heat flux and decrease in latent heat flux and minor sensitivity to depth configurations

Highest sensitivity of the different depth configurations to subsurface runoff

Impact II



Layer1 SM correlate better with ESA-CCI SM (plot for JJA 2018: Corr_10L –Corr_CTL)

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Increased SKT amplitude and better match with Land-SAF LST

Summary

- Real Potential to improve the L-A interaction especially the skin temperature amplitude
- Evaluation with the Hydrological parameters is essential for a better parametrisation
- Evaluation with LST observation is also indicative for the energy fluxes
- Better match with ESA-CCI SM product indicates a potential for better SM assimilation.
- Dual configurations for water and temperature show small impact on energy fluxes but most impact for subsurface runoff suggesting a need for a joint calibration of the model hydrological parameters
- Perspectives for improvement by combining this development with soil moisture stress function and available water for plant's transpiration (Stevens et al 2020)

Ref: Boussetta, S.; Balsamo, G.; Arduini, G.; Dutra, E.; McNorton, J.; Choulga, M.; Agustí-Panareda, A.; Beljaars, A.; Wedi, N.; Munõz-Sabater, J.; de Rosnay, P.; Sandu, I.; Hadade, I.; Carver, G.; Mazzetti, C.; Prudhomme, C.; Yamazaki, D.; Zsoter, E. ECLand: The ECMWF Land Surface Modelling System. *MDPI Atmosphere. Under review*.

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