

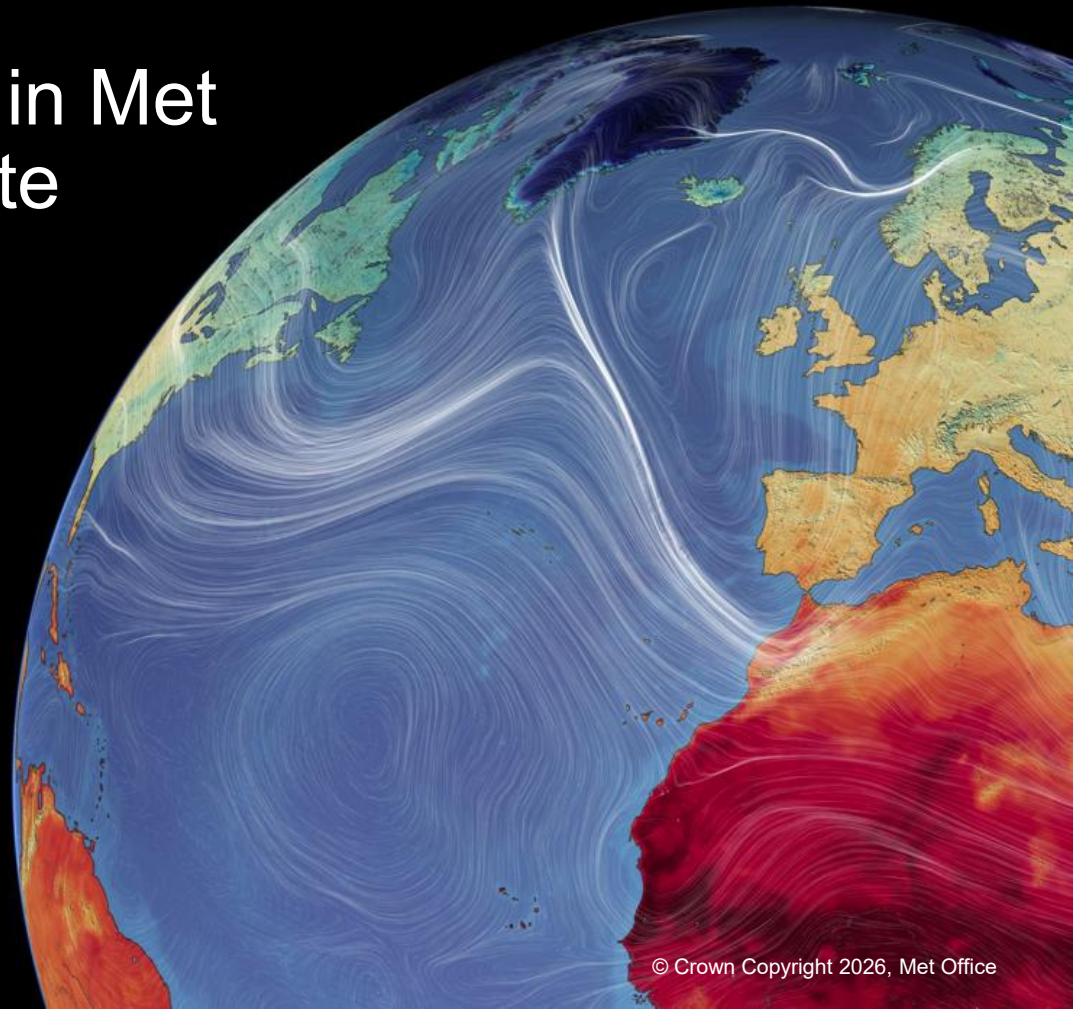
Impact of SoilGrids2.0 in Met Office NWP and Climate Models

John Edwards,

JULES Annual Science Meeting

Reading, 8th September 2026

This content has been created by the author.
AI [M365 Copilot] has also been applied to refine the document.



Sources of Soil Data – Soil Texture

- Harmonized World Soil Database (HWSD):
 - Latest version is 2.0, <https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v20/en/>
 - Soil properties (soil texture, pH etc.) on 7 levels
 - We actually use version 1.2, <https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v12/en/>
 - Two levels, Topsoil and Subsoil: we use the topsoil data
 - Resolution ~ 1 km
 - Each point gives fractions of a few soil textual units. Total number of units is ~30000
 - Currently we take the dominant soil at each point

SoilGrids2.0

- Global database generated by ISRIC using machine learning
 - Links: <https://isric.org/>, <https://soilgrids.org/>
 - Global maps of soil texture etc.
 - Data on 6 levels
 - Resolution 250 m with aggregated data at **1 km** and 5 km

Licences

- Harmonized World Soil Database
 - <https://creativecommons.org/licenses/by-nc-sa/4.0/>
 - No commercial use or (transmission for commercial use).
- SoilGrids 2.0
 - <https://creativecommons.org/licenses/by/4.0/>
 - No restrictions, but attribution required

Soil Hydraulic Properties

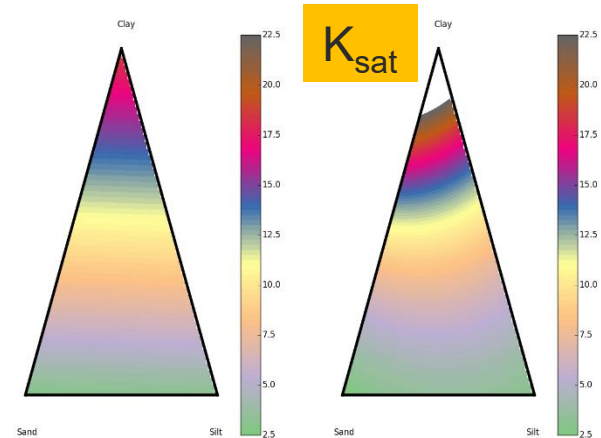
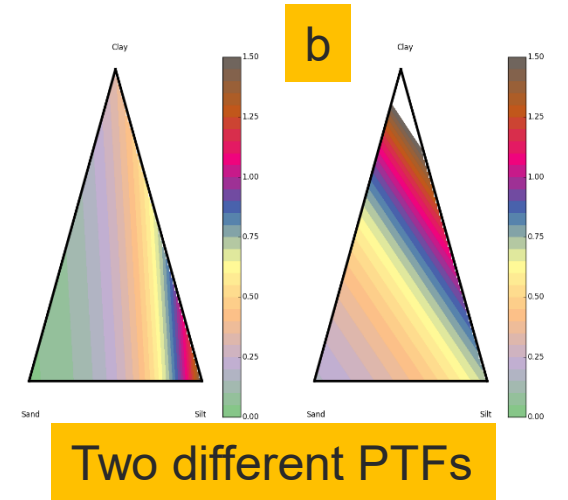
- Water flux:

$$F \downarrow = K_{sat} K_r \left(\frac{\partial \Psi}{\partial z} + 1 \right)$$

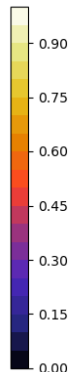
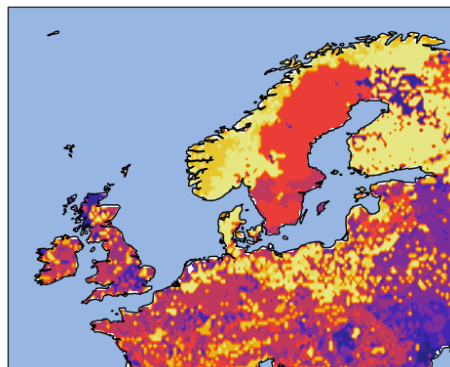
- Soil suction

$$\Psi = \Psi_{sat} \left(\frac{\theta}{\theta_{sat}} \right)^{-b}$$

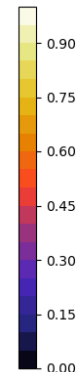
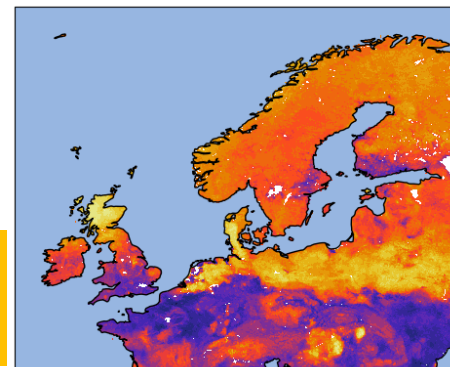
- Pedotransfer functions (PTFs) give $\Psi_{sat}, b, \dots$ from the sand, silt and clay fractions



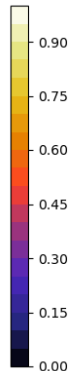
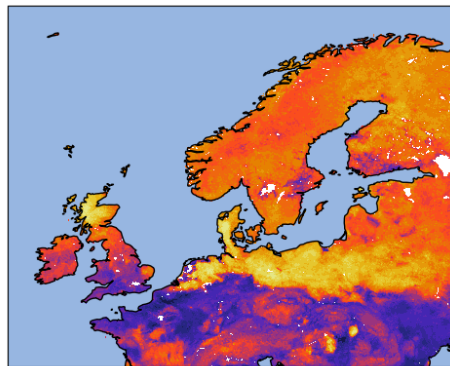
Differences in Soil Texture: Sand



HWSD:
Dominant Soil

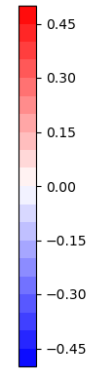
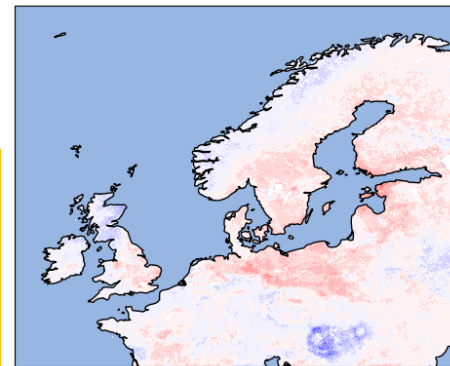


SoilGrids2.0:
100 – 200 cm

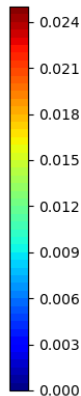
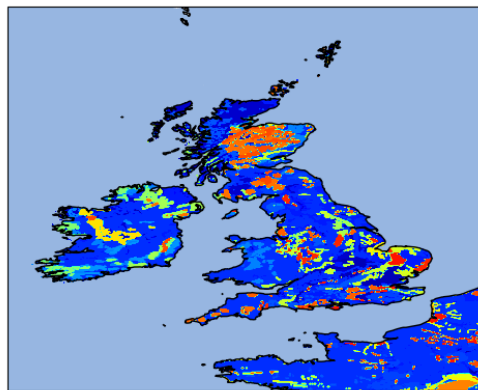


SoilGrids2.0:
5 – 15 cm

SoilGrids2.0:
Difference:
(5 – 15 cm) –
(100 – 200 cm)

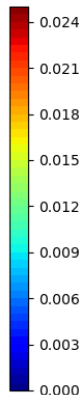
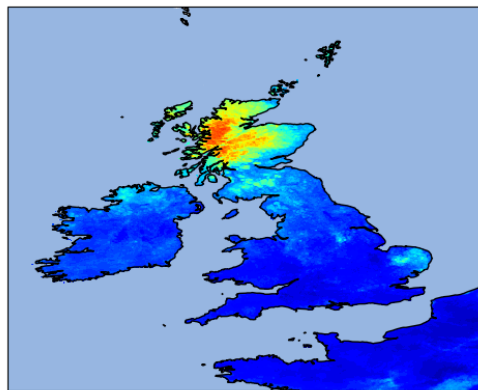
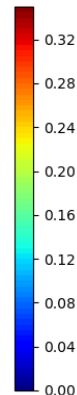
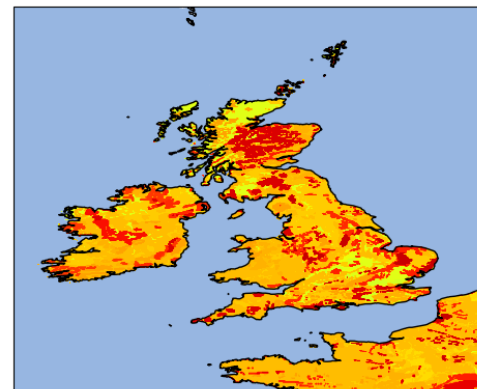


Differences in Soil Parameters



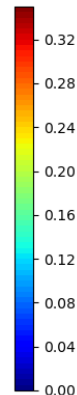
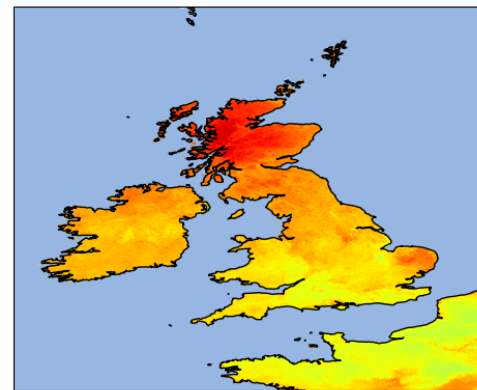
Hydraulic
Conductivity
HWSD

Thermal
Conductivity
HWSD

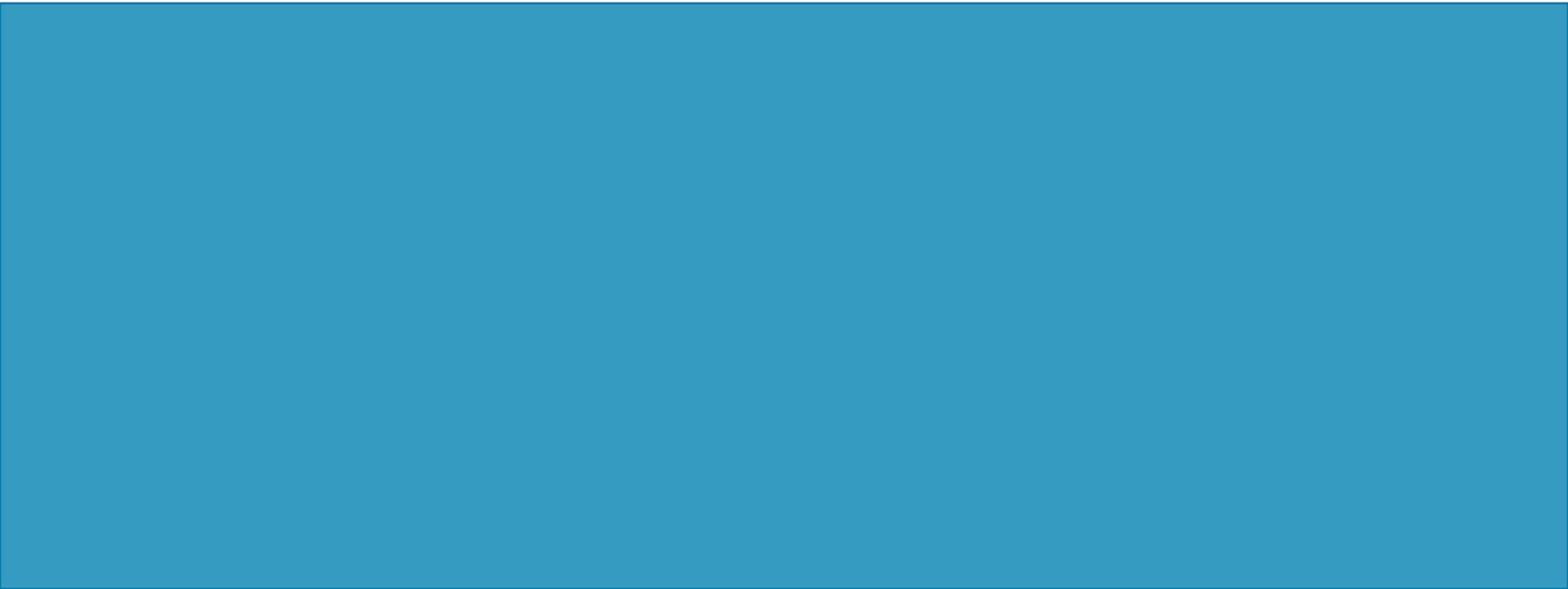


Hydraulic
Conductivity
SoilGrids

Thermal
Conductivity
SoilGrids

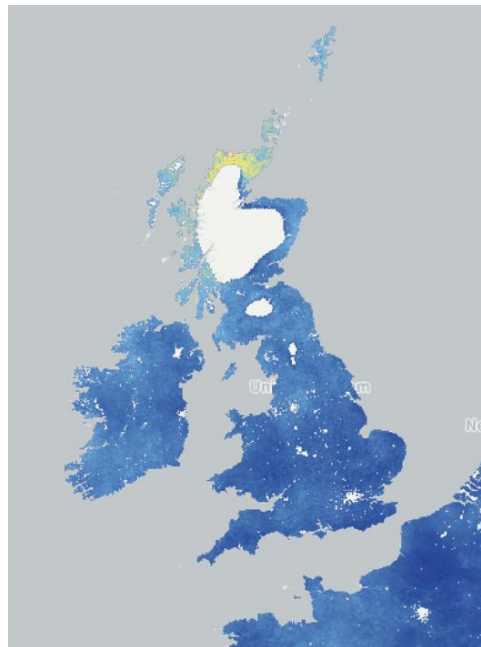


Impact over the UK



Impact in Forecasts for the UK

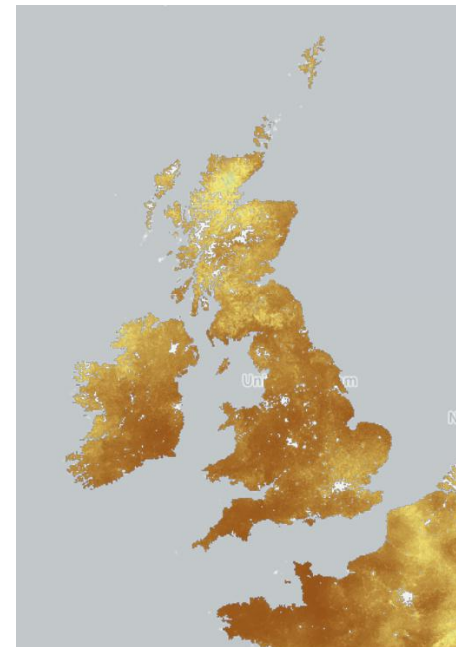
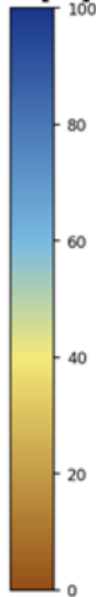
- Operational short-range forecasts for the UK rely on the UKV model at a resolution of 1.5 km over the UK
- 2026 has been a year of contrasts:
 - Very wet January and February
 - Very dry summer
- 48-hour forecasts on the 1st and 15th of each month from January to August with HWSD and SoilGrids2.0: assess in two groups
 - (Moist soil: Jan – Apr)
 - Dry soil: May -- August



1st March 2026

SWI010 - Soil Water Index 2025-present
(raster 1 km), Europe, daily - version 2

SWI [%]

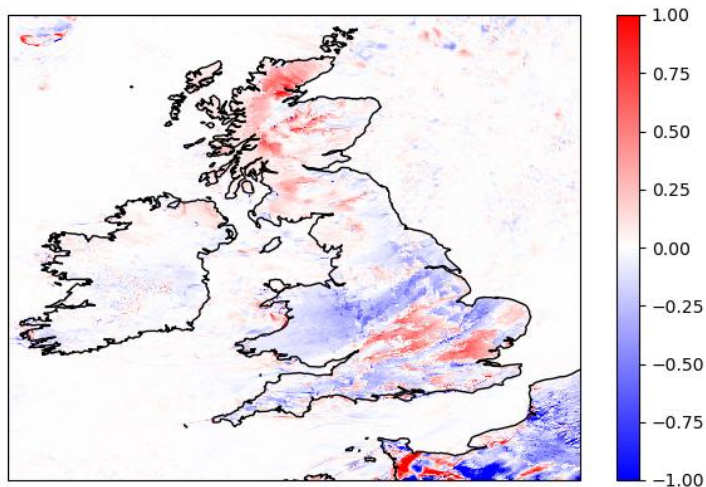


15th August 2026

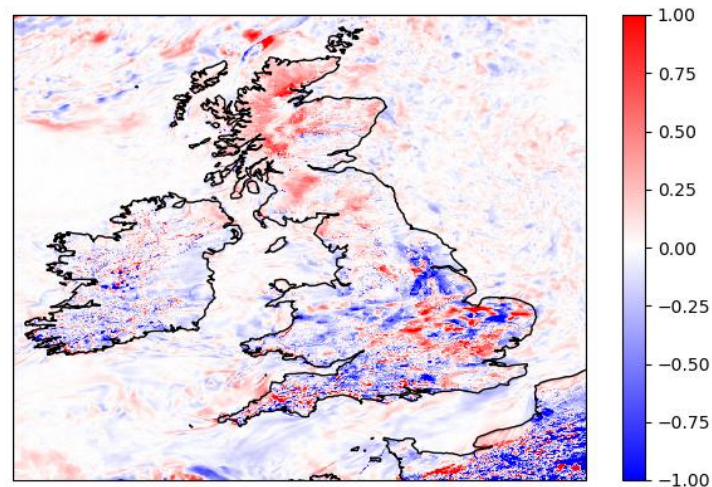
<https://land.copernicus.eu/>

An Example Forecast: 15th July 2026

Difference in Temperature at 1.5 m

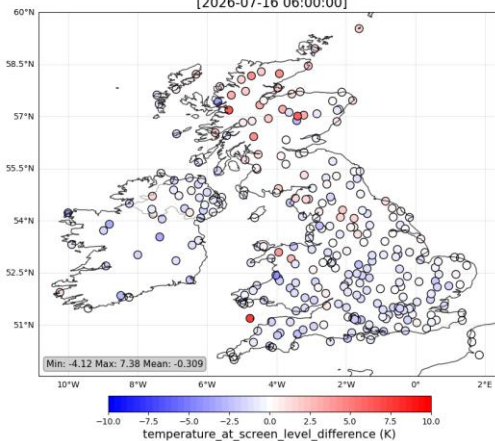


T+14: 14 UTC on 15/7/2026



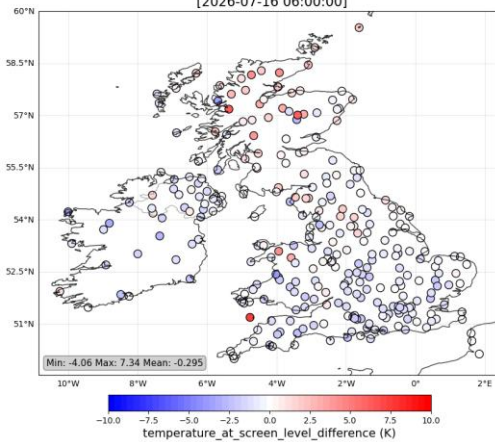
T+38: 14 UTC on 16/7/2026

UKV_wc_modis_HWSD_temperature_at_screen_level WMO Block 03
Difference (UKV_wc_modis_HWSD - OBS)
[2026-07-16 06:00:00]

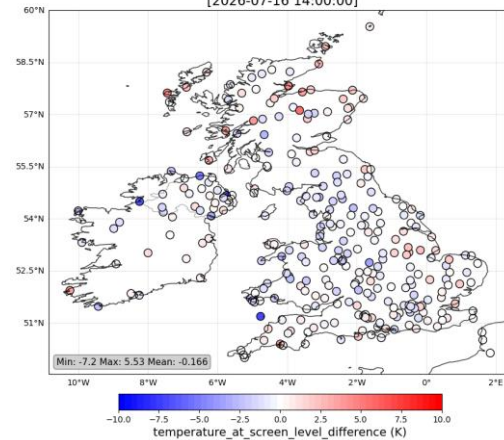


T+30

UKV_wc_modis_SG2_temperature_at_screen_level WMO Block 03
Difference (UKV_wc_modis_SG2 - OBS)
[2026-07-16 06:00:00]

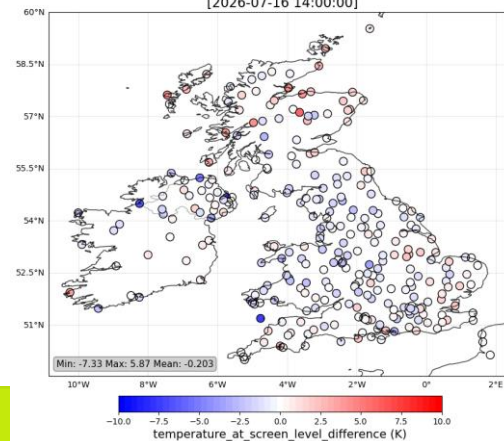


UKV_wc_modis_HWSD_temperature_at_screen_level WMO Block 03
Difference (UKV_wc_modis_HWSD - OBS)
[2026-07-16 14:00:00]



T+38

UKV_wc_modis_SG2_temperature_at_screen_level WMO Block 03
Difference (UKV_wc_modis_SG2 - OBS)
[2026-07-16 14:00:00]

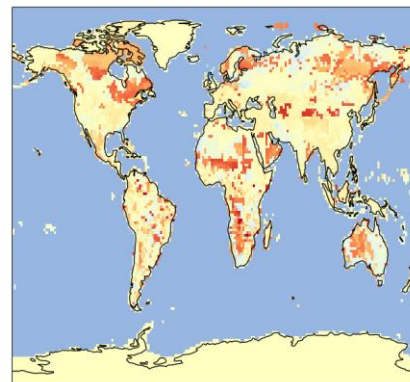
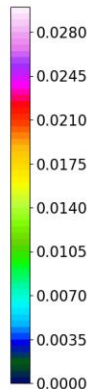
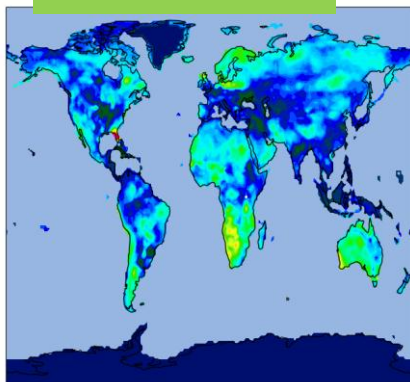
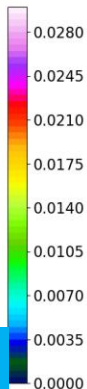
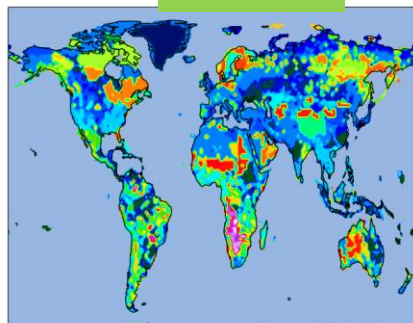


Global Modelling: A 20-year AMIP Simulation

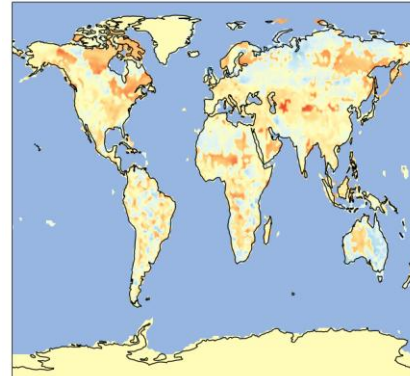
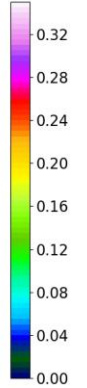
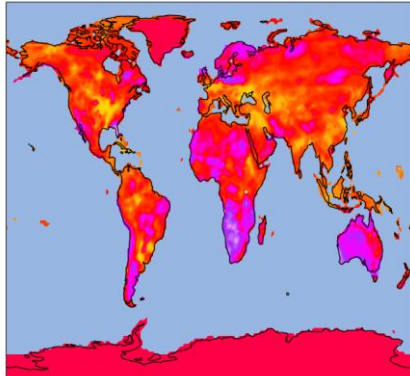
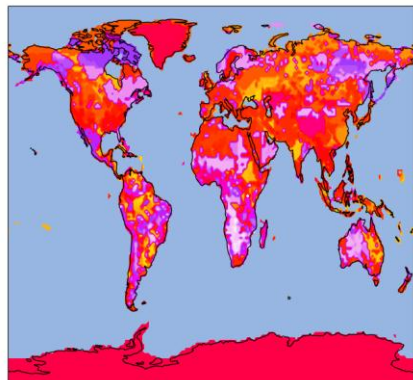
Hydraulic and Thermal Conductivity

HWSD

SoilGrids2.0

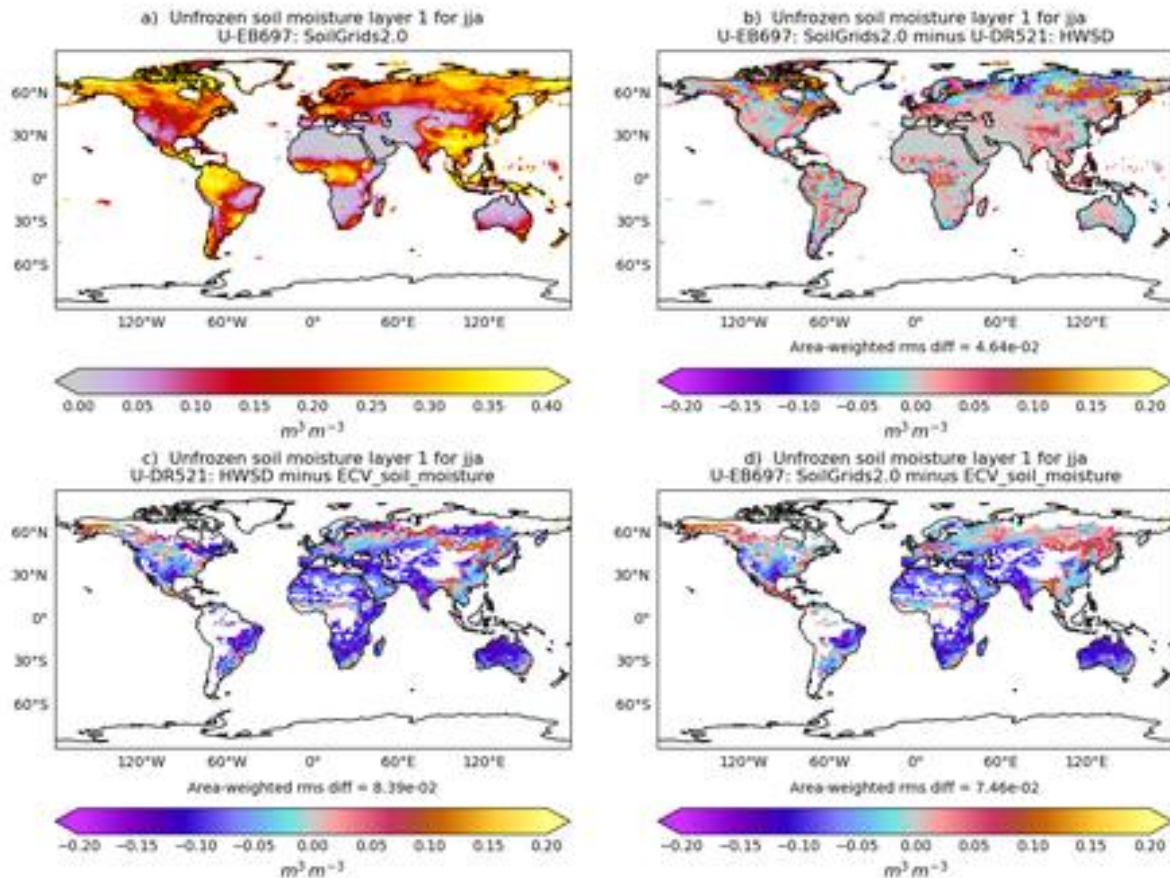


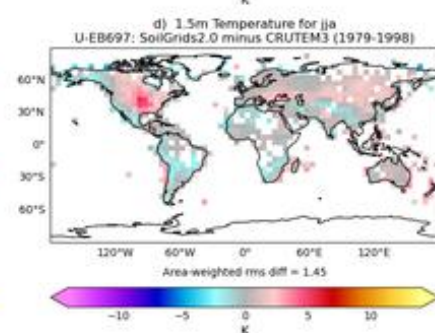
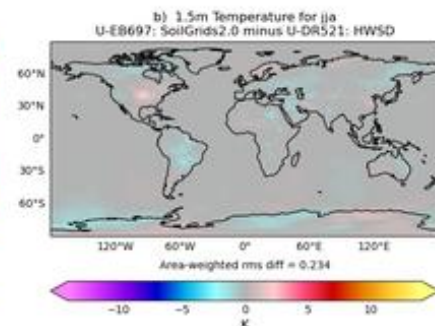
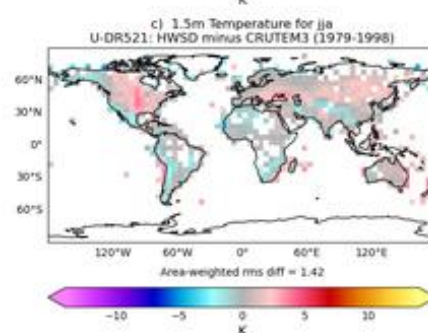
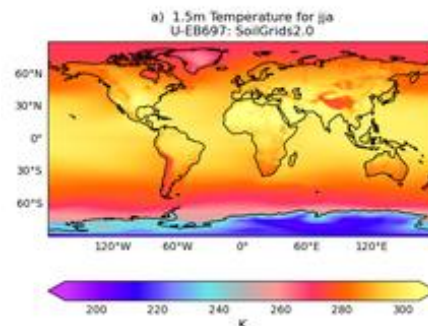
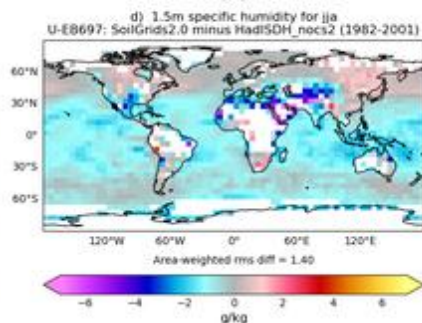
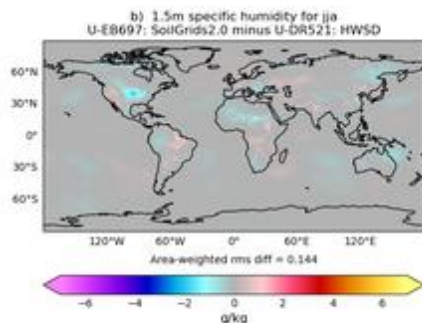
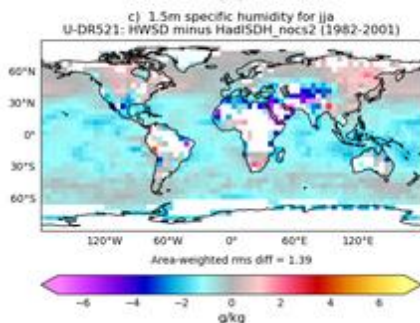
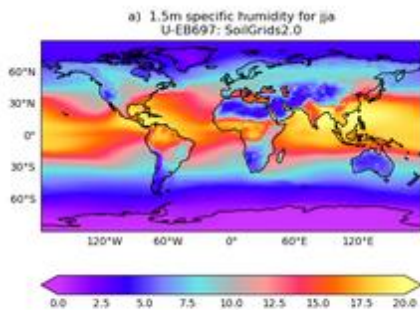
Hydraulic Conductivity



Thermal Conductivity

Soil Moisture is
generally improved
Relative to ESA's
ECV climatology





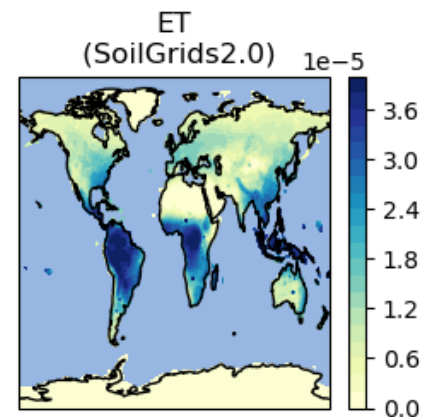
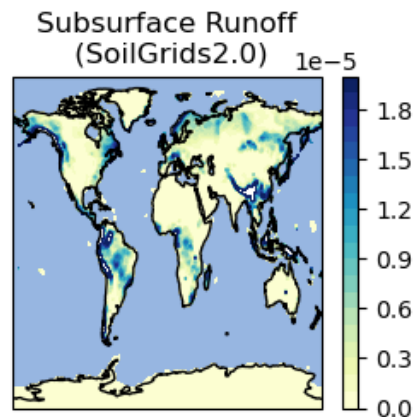
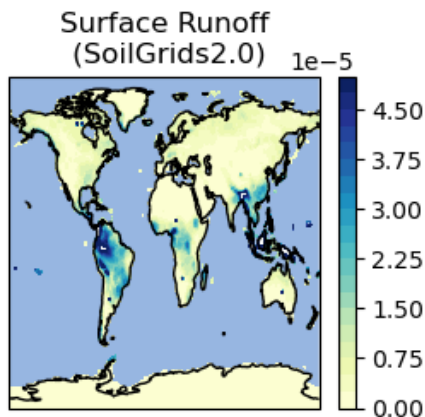
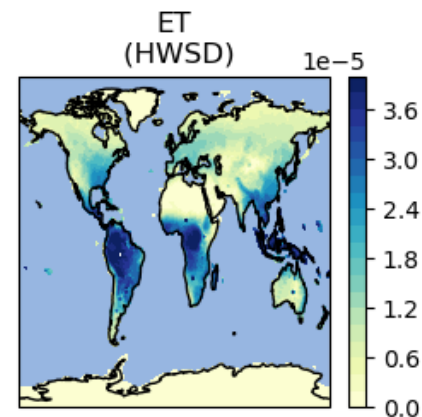
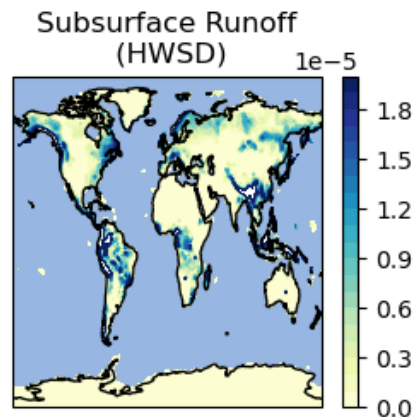
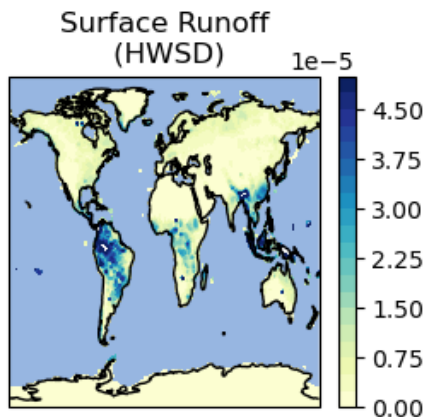
Meteorological impact in summer:
Drying and warming in the central US

Hydrological Budget

ET: +1 %

Surf Runoff: +5 %

SubSurf. Runoff: -12 %



Conclusions

- SoilGrids2.0 has a modest effect on simulated meteorology, but a larger impact on the partitioning of run-off
- In the longer term we aim to move to soil parameter maps produced under the [GEWEX-ISMC SoilWat Initiative](#), led by Anne Verhoef and Yijian Zeng