



# Update on JULES soil moisture stress JPEG

JULES annual meeting, 16 September 2022  
Anna Harper, Karina Williams and the JPEG  
team



# Individual updates

## Rafael Rosolem

- [Cosmic rays to diagnose soil moisture globally](#)

## Rodolfo Nobrega

- Remote sensing to estimate soil moisture deficit water stress in the P model





## Rob King

- Using satellite data to diagnose biomes of water LST vs air temperature difference.
- The evaluation is in a branch of ESMValTool – you're interested.



# Individual updates: publications

## JGR Biogeosciences

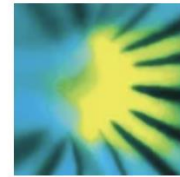
Research Article |  Open Access |   

Journal of  
Biogeosci

### Insensitivity of Ecosystem Productivity to Predicted Changes in Fine-Scale Rainfall Variability

Yiannis Moustakis , Simone Fatichi, Christian Onof, Athanasios Paschalis

First published: 26 January 2022 | <https://doi.org/10.1029/2021JG006735> | Citations: 1



## New Phytologist

Full paper |  Open Access |  

### Towards species-level forecasts of drought-induced tree mortality risk

Martin G. De Kauwe , Manon E. B. Sabot, Belinda E. Medlyn, Andrew J. Pitman, Patrick Meir, Lucas A. Cernusak, Rachael V. Gallagher, Anna M. Ukkola, Sami W. Rifai, Brendan Choat

First published: 01 April 2022 | <https://doi.org/10.1111/nph.18129>

## Ecohydrology



RESEARCH ARTICLE

### Precipitation variability can bias estimates of ecological controls on ecosystem productivity response to precipitation change

Anthony J. Parolari , Athanasios Paschalis

First published: 16 November 2021 | <https://doi.org/10.1002/eco.2384>

## Water Resources Research



RESEARCH ARTICLE

10.1029/2021WR031871

#### Key Points:

- Uncertainties between pedotransfer functions are comparable to uncertainties in soil texture
- Pedotransfer function choice has large effect on hydrological and smaller effects on ecosystem dynamics
- Complex topography amplifies the importance of pedotransfer function uncertainties

### On the Uncertainty Induced by Pedotransfer Functions in Terrestrial Biosphere Modeling

Athanasios Paschalis<sup>1</sup> , Sara Bonetti<sup>2</sup>, Yanran Guo<sup>1</sup>, and Simone Fatichi<sup>3</sup> 

<sup>1</sup>Department of Civil and Environmental Engineering, Imperial College London, London, UK, <sup>2</sup>School of Architecture, Civil and Environmental Engineering, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, <sup>3</sup>Department of Civil and Environmental Engineering, National University of Singapore, Singapore, Singapore

**Abstract** Hydrological, ecohydrological, and terrestrial biosphere models depend on pedotransfer functions for computing soil hydraulic parameters based on easily measurable variables, such as soil textural



# Individual updates: publications



Reference Module in Earth Systems and  
Environmental Sciences

2022



## Climate and land surface models: Role of soil ☆

Toby Richard Marthews <sup>a</sup>✉, Holger Lange <sup>b</sup>✉, Alberto Martínez-de la Torre <sup>a, c</sup>✉, Richard J. Ellis <sup>a</sup>✉, Sarah E. Chadburn <sup>d</sup>✉, Martin G. De Kauwe <sup>e</sup>✉

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Review Article | [Published: 29 March 2022](#)

## Mechanisms of woody-plant mortality under rising drought, CO<sub>2</sub> and vapour pressure deficit

[Nate G. McDowell](#) ✉, [Gerard Sapes](#), [Alexandria Pivovarov](#), [Henry D. Adams](#), [Craig D. Allen](#), [William R. L. Anderegg](#), [Matthias Arend](#), [David D. Breshears](#), [Tim Brodribb](#), [Brendan Choat](#), [Hervé Cochard](#), [Miquel De Cáceres](#), [Martin G. De Kauwe](#), [Charlotte Grossiord](#), [William M. Hammond](#), [Henrik Hartmann](#), [Günter Hoch](#), [Ansgar Kahmen](#), [Tamir Klein](#), [D. Scott Mackay](#), [Marylou Mantova](#), [Jordi Martínez-Vilalta](#), [Belinda E. Medlyn](#), [Maurizio Mencuccini](#), ... [Chonggang Xu](#) + Show authors

*Nature Reviews Earth & Environment* **3**, 294–308 (2022) | [Cite this article](#)

## Garry Hayman

- Evaluation of soil moisture for CSSP Brazil
- Crop heat stress (with Lina and Becky)

## Patrick McGuire

- Soil parameter model intercomparison (SP-MIP) - with Anne Verhoef and Rich Ellis (different model runs with different soil parameters setups).

## Tim Lam (PhD student)

- Drivers of large-scale drought and fires in Indonesian Borneo. Evaluating historical drivers and representation in CMIP6 models.



## Anna Harper

- Impacts of 2018 drought
- PhD student Enimhien Akhabue with Andy Cunliffe starting to work on African landscapes and ecosystem services (topic TBD)

## Colin Prentice

- Evaluating dry downs using measured flux data.
- Covariance of (VPD, GPP) went to zero at the soil moisture threshold for onset of water stress.
- There was also a difference in threshold for onset of water stress between the grassland and savanna models.



## Kate Halladay

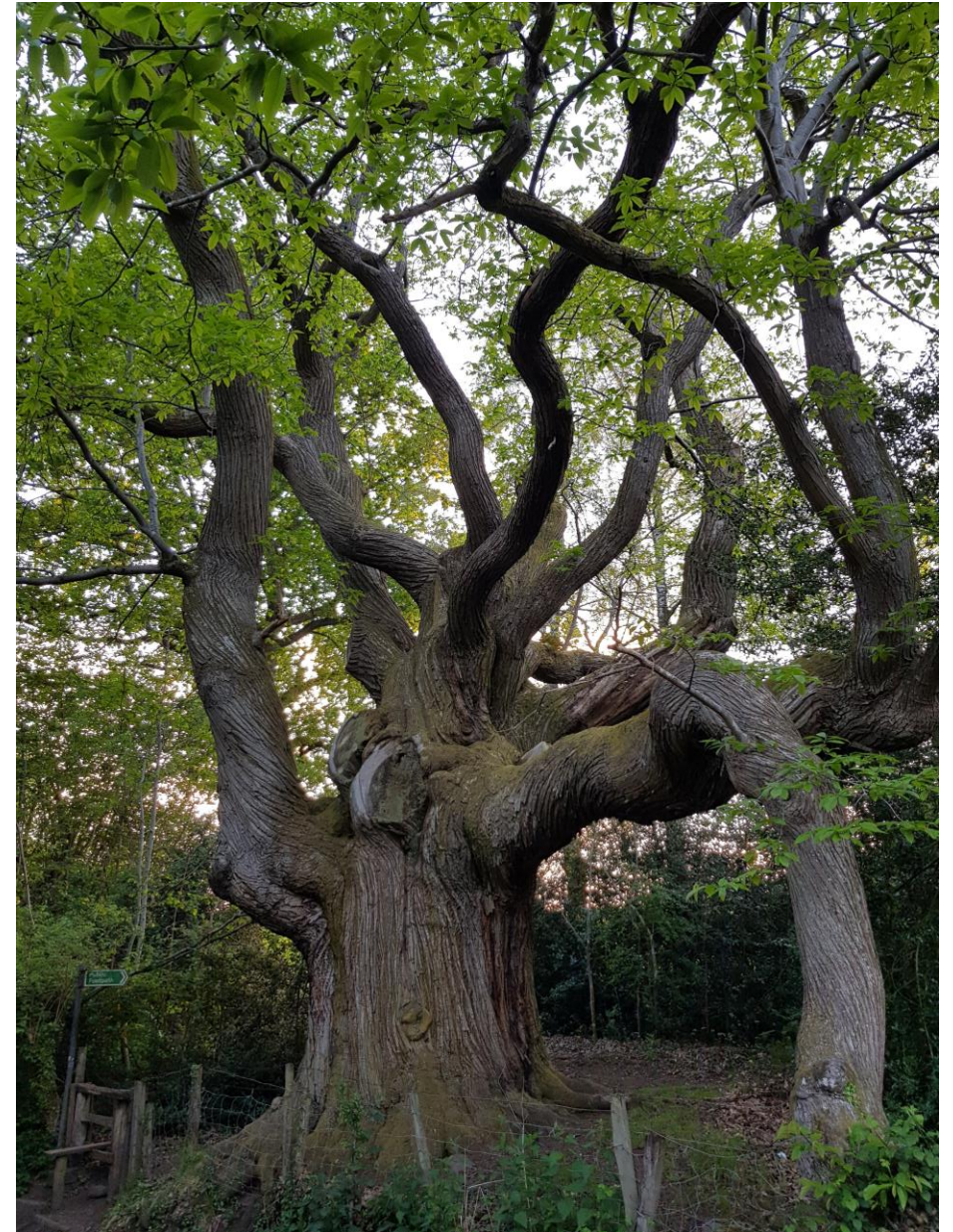
- Convection permitting model simulations (2.2km) for Brazil and Europe. Found the ratio of canopy evaporation to total ET is much less in CPM runs than the lower res, convection parameterising runs.

## Simon Jones, Cleiton Eller, Peter Cox

- Further work with SOX, linking with non-structural carbohydrate model

## Martin De Kauwe

- Paper: key advance is an attempt to make landscape-scale predictions of drought mortality at a species, rather than PFT level
- [Mortality during 2018 drought](#)



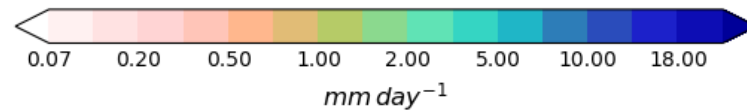
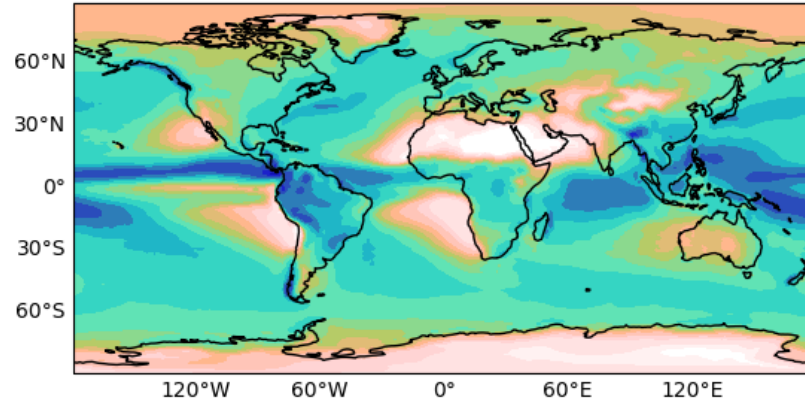


# Evaluation in UKESM

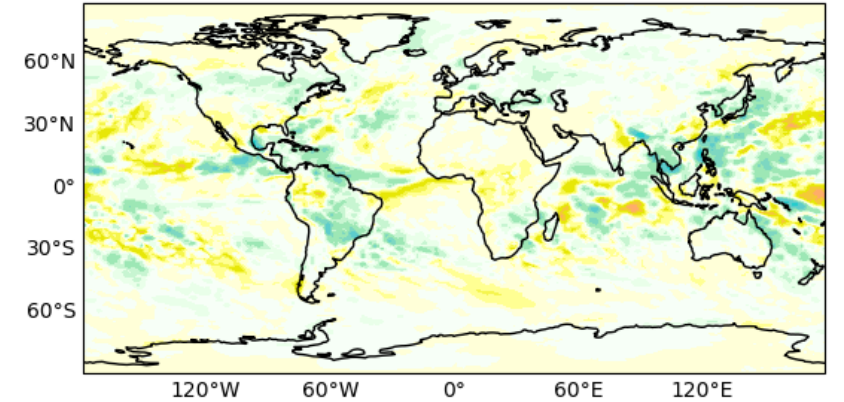
By Karina Williams

- saturated hydraulic conductivity exponentially varying from the surface
- same layers as Sarah & Eleanor are using for permafrost
- hopefully going into UKESM<sub>2</sub>
- Increasing lower layer depth to 3m
- More easily: Increase thickness of lowest layer?

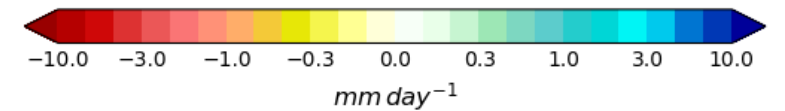
a) Precipitation for ann  
U-CJ913: DeeperSoilHigherp0



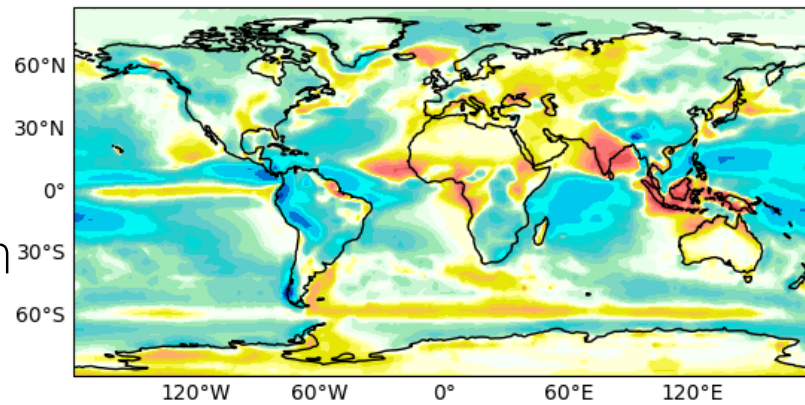
b) Precipitation for ann  
U-CJ913: DeeperSoilHigherp0 minus U-CD778: UKESM1.1 AMIP



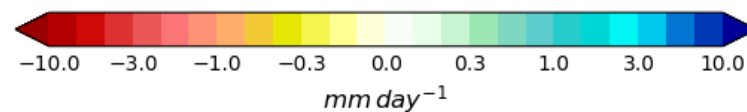
Area-weighted rms diff = 0.184



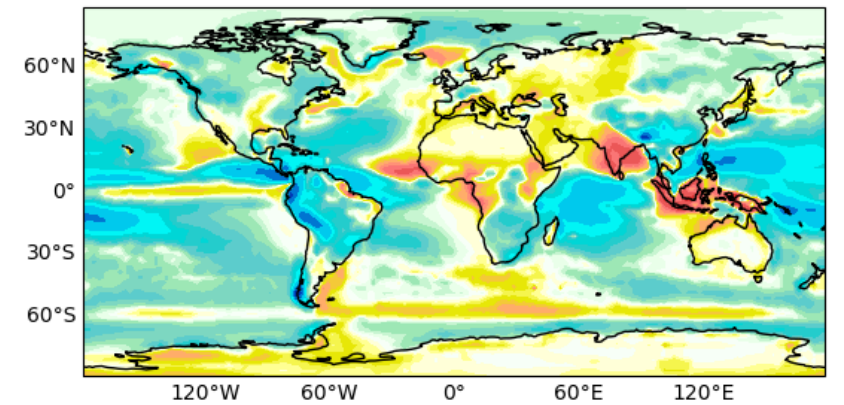
c) Precipitation for ann  
U-CD778: UKESM1.1 AMIP minus GPCP2 (1979-1998)



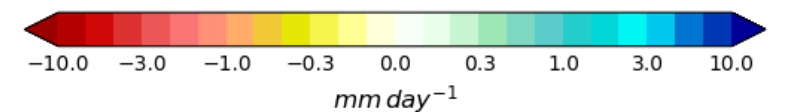
Area-weighted rms diff = 1.28



d) Precipitation for ann  
U-CJ913: DeeperSoilHigherp0 minus GPCP2 (1979-1998)



Area-weighted rms diff = 1.30



# Next steps

- Talks on recent papers from the authors
- New collaboration with Duke and Exeter Universities, including focus on plant hydraulics
- Further evaluation of impacts of deeper soils in UKESM with permafrost group
- Identifying common themes within our group:
  - Plant hydraulics
  - Remote sensing
    - Case study of 2018 (and maybe 2022!)
  - Model parameterizations
- Support new and existing PhD students
  - Allow PhDs to visit others in the group
  - Plan for 2023 academic year?

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