PAPERS

University of Exeter

JULES –Red application, emergent constraints for Topt of photosynthesis in the tropics and big leaf model linked to SOX

Arthur Argles, Nina Raould, Simon Jones, Anna Harper, Peter Cox et al

1.Validation of JULES-RED for the Harwood forest:

Argles, A.P.K., Robertson, E., Harper, A.B. *et al.* (2023). Modelling the impact of forest management and CO_2-fertilisation on growth and demography in a Sitka spruce plantation. *Sci Rep* **13**, 13487. https://doi.org/10.1038/s41598-023-39810-2 .

2.Hybrid constraint on the optimum temperature for photosynthesis in the tropics:

Raoult, N., Jupp, T., Booth, B., and Cox, P. (2023). Combining local model calibration with the emergent constraint approach to reduce uncertainty in the tropical land carbon cycle feedback, *Earth Syst. Dynam.*, 14, 723–731, https://doi.org/10.5194/esd-14-723-2023 .

3.Alternative method for implementation of SOX in JULES, including introduction of new big-leaf model:

Jones, S., Eller, C.B., Cox, P.M. (2022). Application of feedback control to stomatal optimisation in a global land surface model. *Frontiers in Environmental Science*, 10, https://www.frontiersin.org/articles/10.3389/fenvs.2022.970266 .

3. Substrate depletion can explain observed declines in nocturnal respiration under constant temperature

Simon Jones (presenting here) , Peter Cox, Dan Bruhn, Lina Mercado, to be submitted

Model development and applications

1 -Acclimation of photosynthetic capacity (Vcmax, Jmax) to CO2 and to temperature – Global study, to be submitted to GCB :"Contrasting impacts of acclimation and adaptation of photosynthetic capacity to temperature and CO2 across biomes".

Becky Oliver, Phil Harris, Doug Clark, Lina M, Belinda Medlyn

2 -Dynamic allocation scheme in response to varying soil nitrogen availability based on optimization theory –

Becky Oliver (presenting work here) , Chris Huntingford, Doug Clark, S. Sitch, Lina M et al

Evaluation of Impacts of land-based mitigation methods in JULES and 3 other models as part of the ESM2025 project (JSBACH, ORCHIDEE, CLM-FATES).

Focus on biophysical and biogeochemical impacts of the land-use change, impacts of carbon cycle uncertainty on the land allocation part of the model and how that affects scenario development.

Anna Harper, Eddy Robertson, Emma Littleton, Carolina Duran Rojas, Arthur Argles

Model development and applications

-Application and evaluation of Jules-CNP across the Amazon Region
CSSP-Brazil project

Jefferson Goncalves De Souza, Andre Nakhavali, Lina Mercado, Iain Hartley, Beto Quesada

Developments outside Jules, to be implemented at a later stage in Jules

-Parametrisation of leaf level photosynthesis models for dominant Andean tree species
Sebastian Gonzalez-Caro (presenting here), Lina Mercado