Update on JULES developments

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JULES science meeting, Lancaster, June 2016

JULES versions

There have been 3 new versions since the last annual meeting:

vn4.4   Oct 2015
vn4.5   Jan 2016
vn4.6   June 2016

each with new science (and bug fixes).

Science changes, including:

- JULES Nitrogen
  - upgrades to the Nitrogen scheme (l_nitrogen) to include fixation, leaching and gaseous losses

- CH_4 emissions from wetlands
  - different wetland methane emissions are calculated based on different substrates: soil carbon, NPP and soil respiration

- Irrigation supply
  - takes irrigation water first from deep soil and then from river

- Allow varying landuse with variable number of PFTs

- BVOC emissions allowed with trait physiology

JULES vn4.4 (Oct 2015)

Science changes (continued):

• Option to set tile elevations to absolute values above sea-level

• Adjustment to downward longwave radiation for elevated tiles

• Improvements to river codes

Bugs fixed, including:

• Removed drift in vegetation fractions – now sum(frac)=1 even in long runs with TRIFFID

• Fixed irrig_water diagnostic - between crop seasons irrigation is now zero

Technical changes

• Older versions of JULES can't be compiled with newer versions of FCM (unless make.cfg is edited)

JULES vn4.5 (Jan 2016)

Science changes, including:

• JULES-CN

    - l_nitrogen added to documentation (i.e. you can now find the Nitrogen scheme!)

• INFERNO fire model

    - burnt area and emissions (l_inferno=T)

• Represent crops using TRIFFID

    - crop and pasture PFTs (l_trif_crop=T, an alternative to the crop model)

• Altered seasonal cycle of soil respiration

    - l_soil_resp_lev2=T to use soil T and (total) moisture from layer 2

• Allow litter carbon fluxes from variable numbers of PFTs

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Science changes (continued):

• Nitrogen Trait Physiology

    - added parameters for trait physiology for N in roots and stem wood

• Removed MORUSES hard-wired roof coupling

• Diagnostic for canopy FAPAR

Bugs fixed

• O_3 diagnostics

• Litter C flux with landuse change

Science changes, including:

• Option to allow all components of plant maintenance respiration to be affected by soil moisture stress

    - not just leaf component

• Options to change soil moisture stress on vegetation

    - PFT-dependent parameter alters threshold for soil moisture stress
    - option to calculate stress from root-zone average properties (not weighting by exp root distribution)

• Modifications to snowpack physics

    - to better represent deep, compact firn/snow on ice sheets

• PFT-dependent canopy-clumping factor added to albedo code

• Allow for non-isotropic scattering in plant canopies

    - increases albedo

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Science changes (continued):

• Improved parameterisation of crop leaf senescence

– the fraction of leaf C moved to the harvest pool is no longer fixed but depends on the crop development index, allowing a slower decrease of LAI

• More crop parameters moved from code to JULES_CROPPARM namelist

• New diagnostics

- for crop harvest and FAO Penman-Monteith evapotranspiration for a reference crop

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Bugs fixed, including:

• Soil respiration
  - affects l_soil_resp_lev2 (wrong at v4.5)

• Respiring stem fraction and leaf litter N content (wrong at v4.5)

• Profile of leaf N (longstanding errors!)
  l_leaf_n_resp_fix=T
  Plant maintenance respiration corrected (increased) for can_rad_mod=1,4,5
    NPP potentially reduced by 10% or more
  Plant N demand corrected for can_rad_mod=1,2,3
  Documentation to be made available.

• Methane emissions from wetlands corrected when TRIFFID is used

- Need improved release notes
- Need a way to share documentation of developments and bug fixes

Both should be relatively easy.