Data and research needs for validating an Australian DGVM

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The problem

- A DGVM requires a set of inputs, parameters and initial conditions to produce output
- to "evaluate", we need to know these well enough so that our output range (or density function) is reasonably constrained - i.e. comparison with current observations has to be meaningful
- do we have the inputs, parameters and initial conditions to test DGVMs ? – No.
- we can therefore merely assess some components of the model – not the performance of the model as a whole.

Data needs

- Spatial scale dependent
  - Patch – catchment scales
    - FACE experiments
    - Ozflux/AEON
    - Long term soil measurements
  - Catchment – continental scales
    - Carbon inversion
    - NDVI-type measurements
    - AEON type infrastructure
  - Global scales
    - NDVI-type measurements
    - Lots of local examples of the above

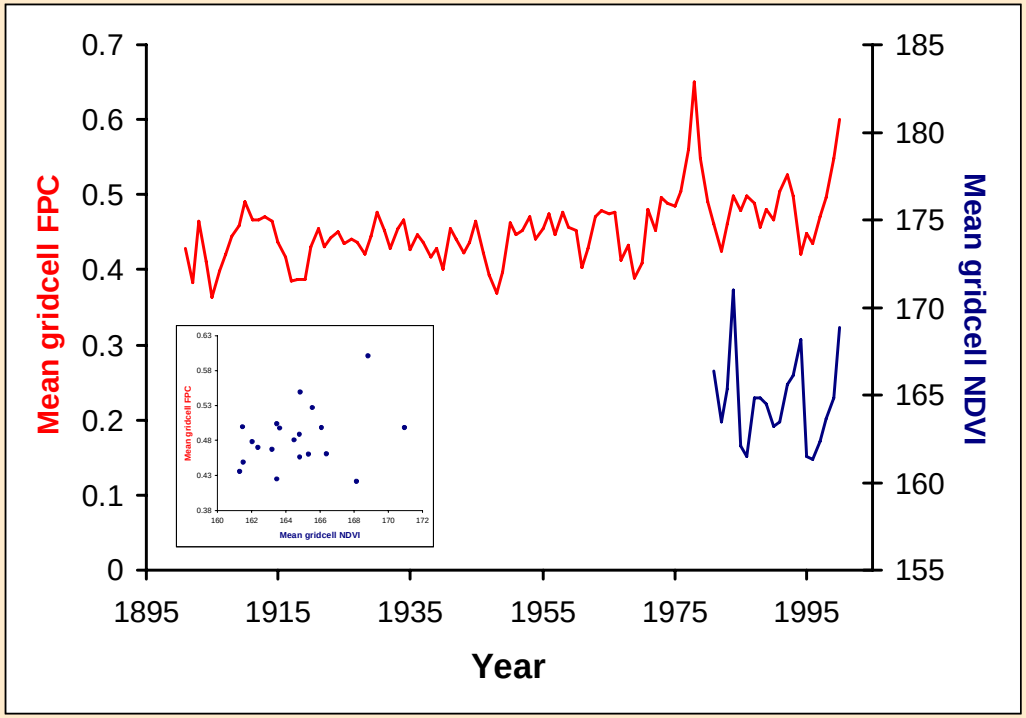
Data needs

- Time scale dependent
  - seasonal – annual scales
    - Satellites, FACE, local measurements …
  - Decadal scales
    - Some satellites, some point based
  - Century scale
    - PILPS C1, vegetation reconstructions
  - Abrupt change
    - Palaeo-reconstructions

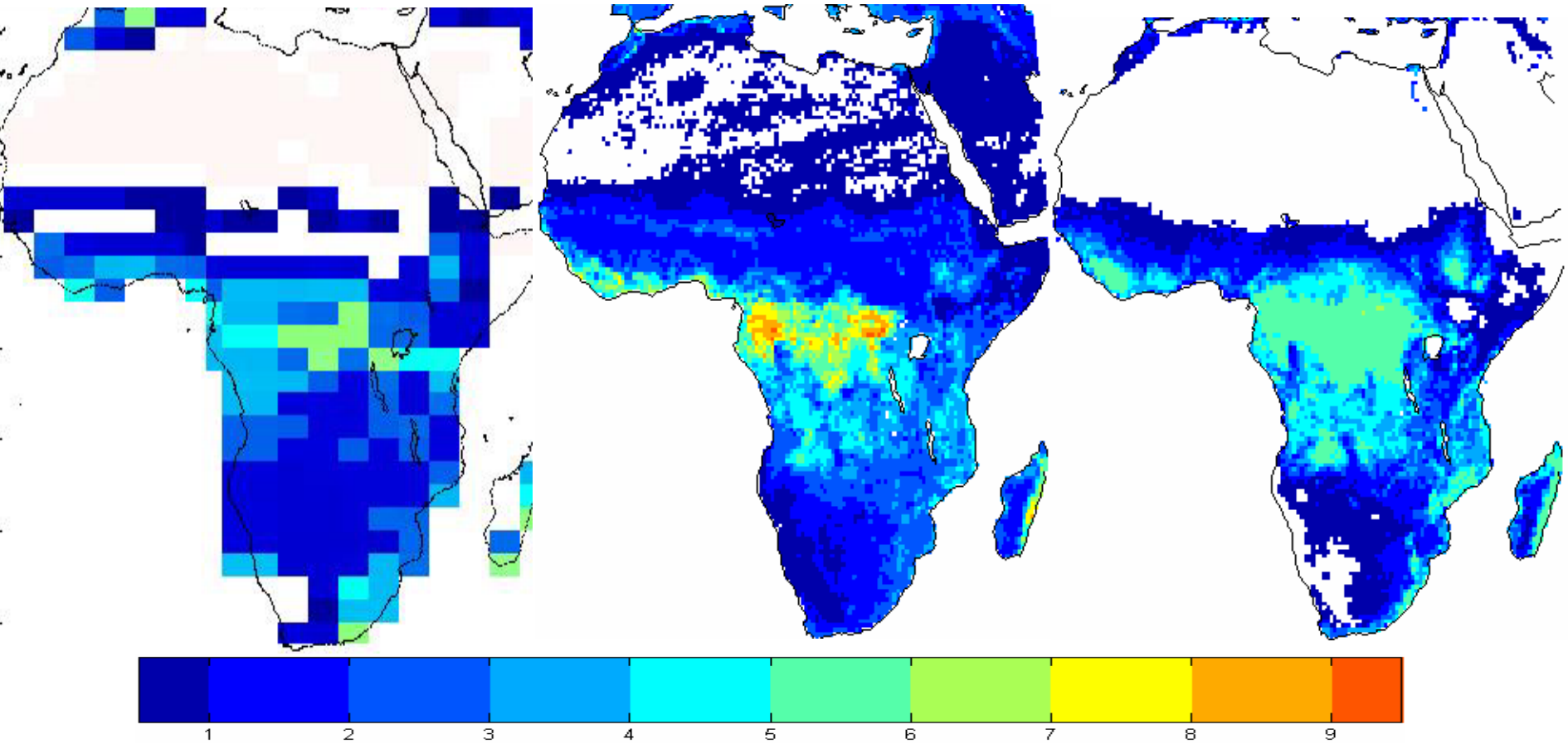
Evaluation .v. NDVI

LPJ Results – Foliage projected cover (FPC)

... vs. NDVI



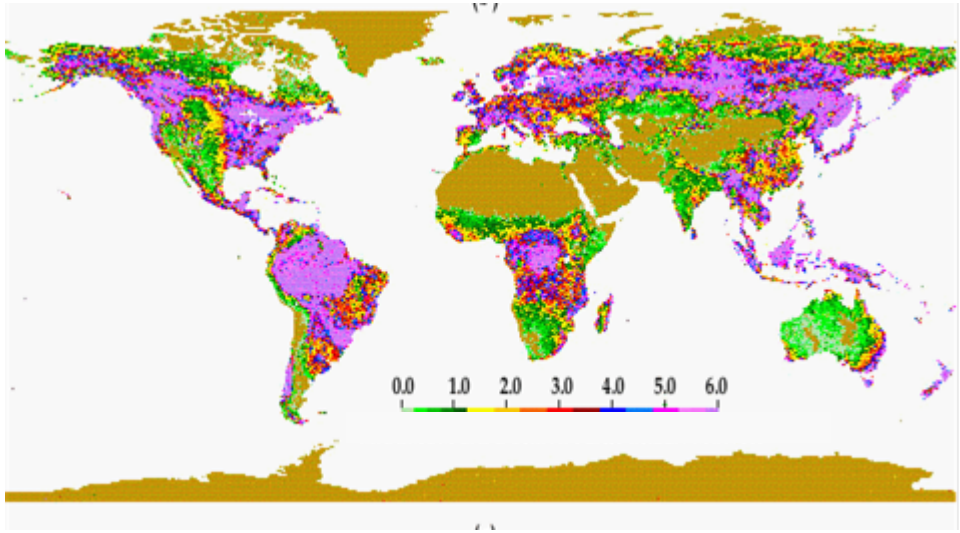
Model evaluations to date



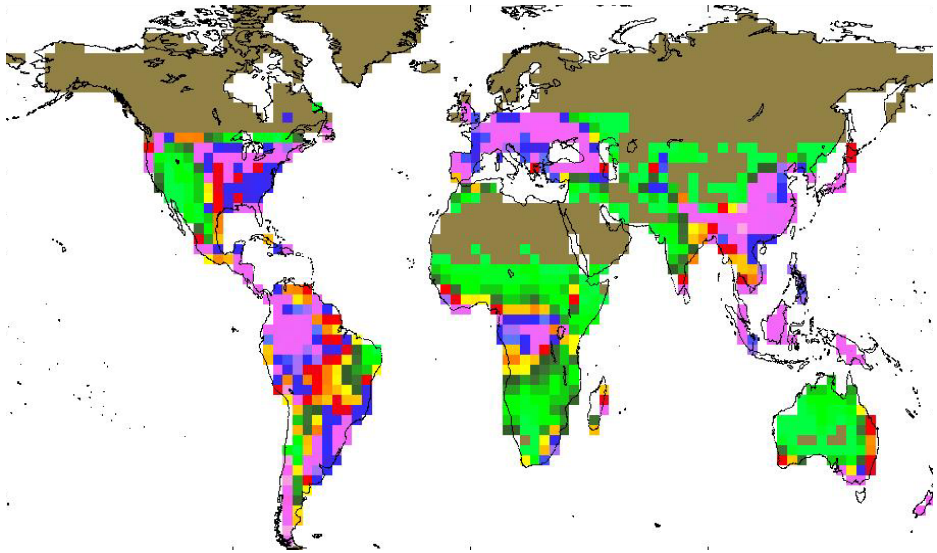
Annual LAI of Africa in y2000. IMOGEN-ED (left), Hagemann et al. (2002) and IMOGEN_TRIFFID (right)

Figures c/o Jiafu Mao.

Global LAI simulations



Myneni et al. 1997



IMOGEN_ED LAI

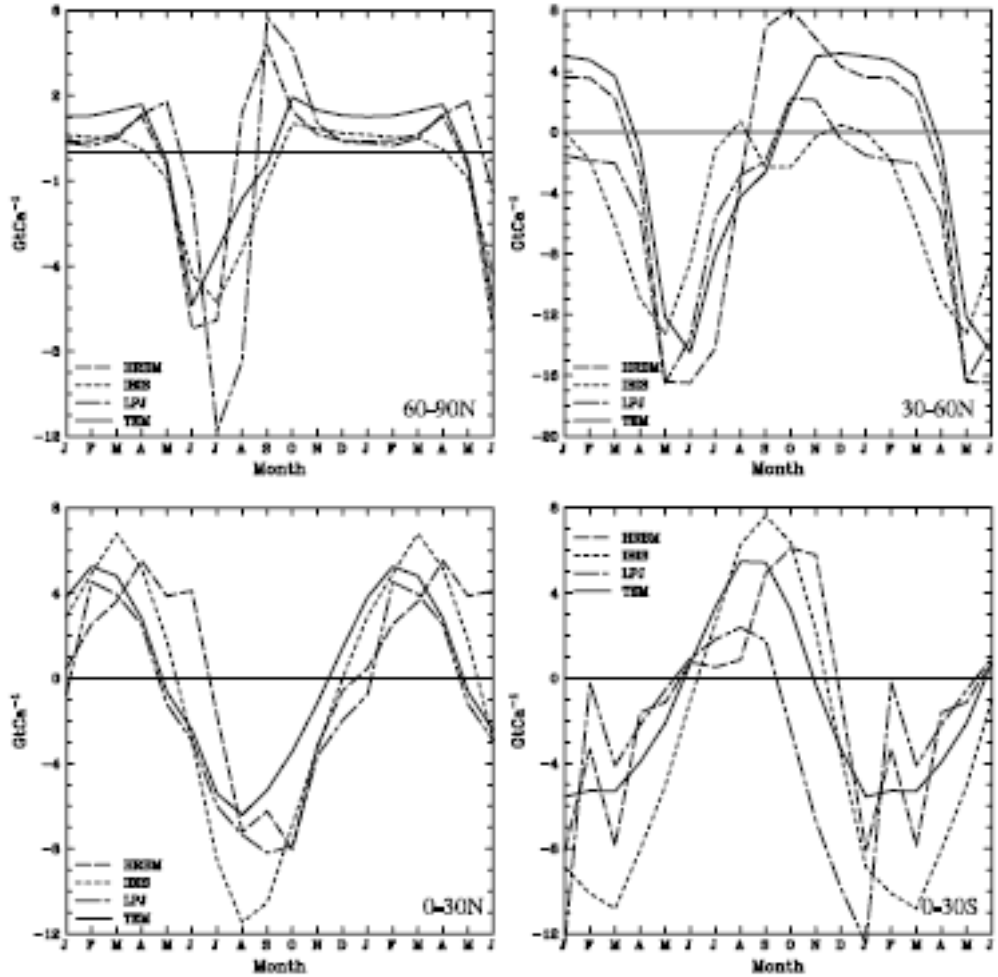
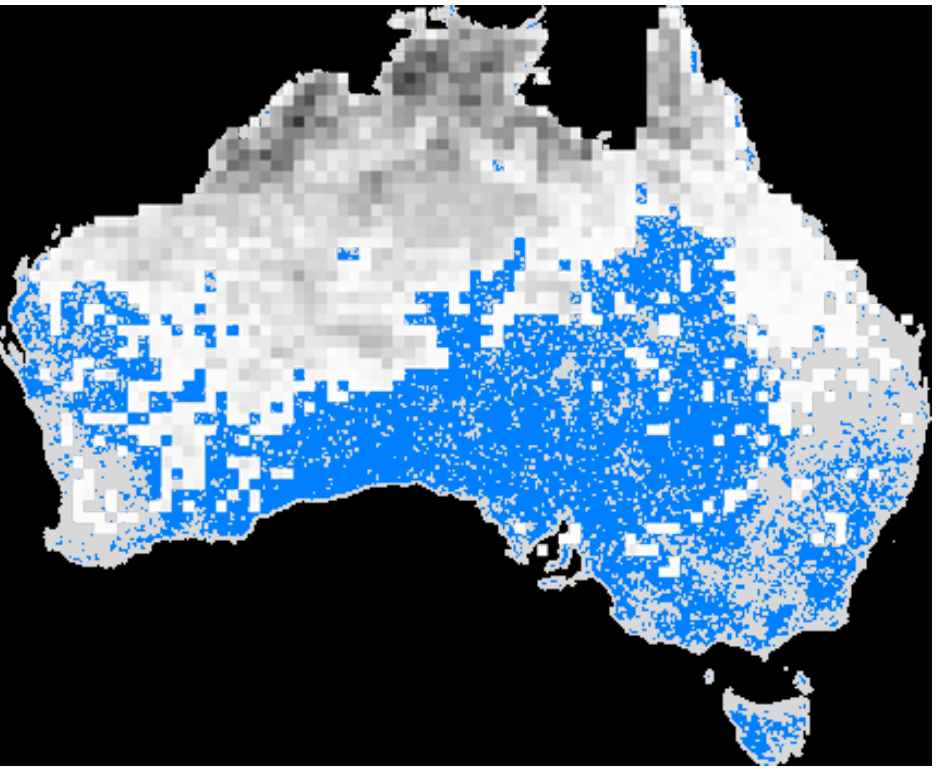


Figure 2. Average seasonal cycle aggregated over 30° latitude bands for the period 1980 to 1991 for the four biosphere models HRBM, IBIS, LPJ and TEM. The southern extratropical regions are not shown due to the small amount of biosphere is these regions. Note that the first 6 months of the annual cycle have been repeated.

Dargaville et al., 2002 - GCB

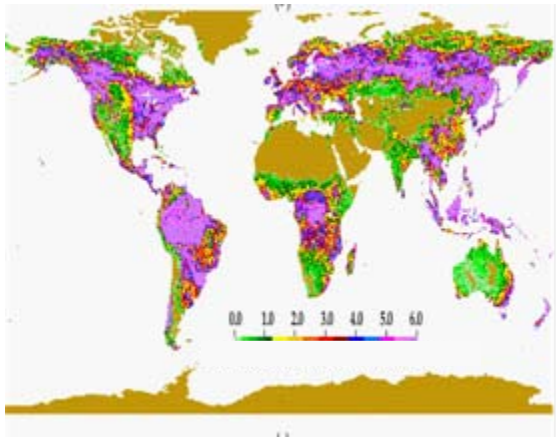
Fire as a vegetation driver

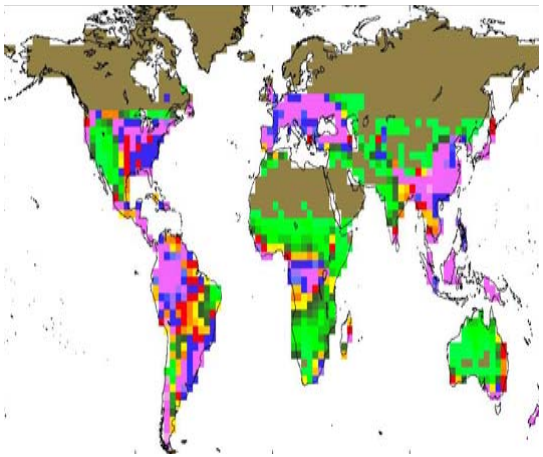


Combined fire scar + fire hotspot observations (DOLA)

LPJ

Fire as a vegetation driver





The questions is, is this an excellent simulation, a useless simulation or in between ?

What does excellent mean.

What would excellent imply for future simulation capacity

Is the model right by chance – or wrong unluckily ?

Data needs

- One therefore needs data to constrain your model relative to its use.
- Usage varies widely – therefore the data needs are highly variable
- Detailed knowledge of *X* may be vital – or a vague sense of *X* might be more valuable depending on the scales of the application
- We therefore have to start with a clear view of what we want the DGVM for, understand those components we wish to constrain with data and then hope the data exist

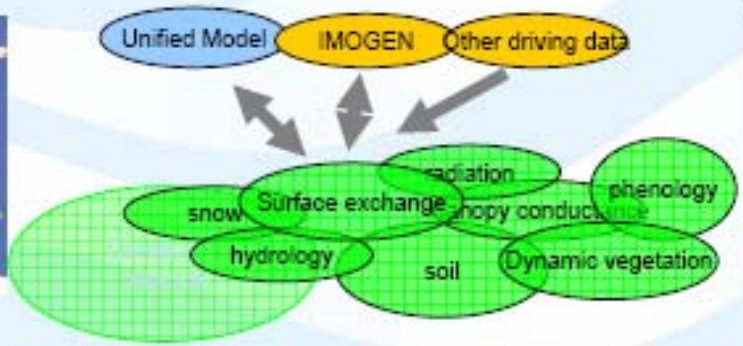
Research needs

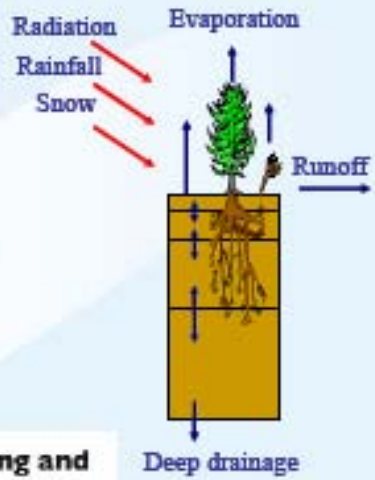
- Lots of process based understanding
- Significant challenges for key components
- Appropriate coupling of individual elements

- A research infrastructure !
  - e.g. JULES

What is JULES?

- JULES (Joint UK Land Environment Simulator) is a community land surface scheme.
- It builds upon the MOSES II and TRIFFID models developed at the Met Office.
- JULES is designed as a modular model which can incorporate various sub-models of land surface processes (e.g. snow model, river routing, dynamic vegetation model).
- JULES is expected to be used for a variety of meteorological, hydrological and climate applications from scales ranging from local to global.





Met Office

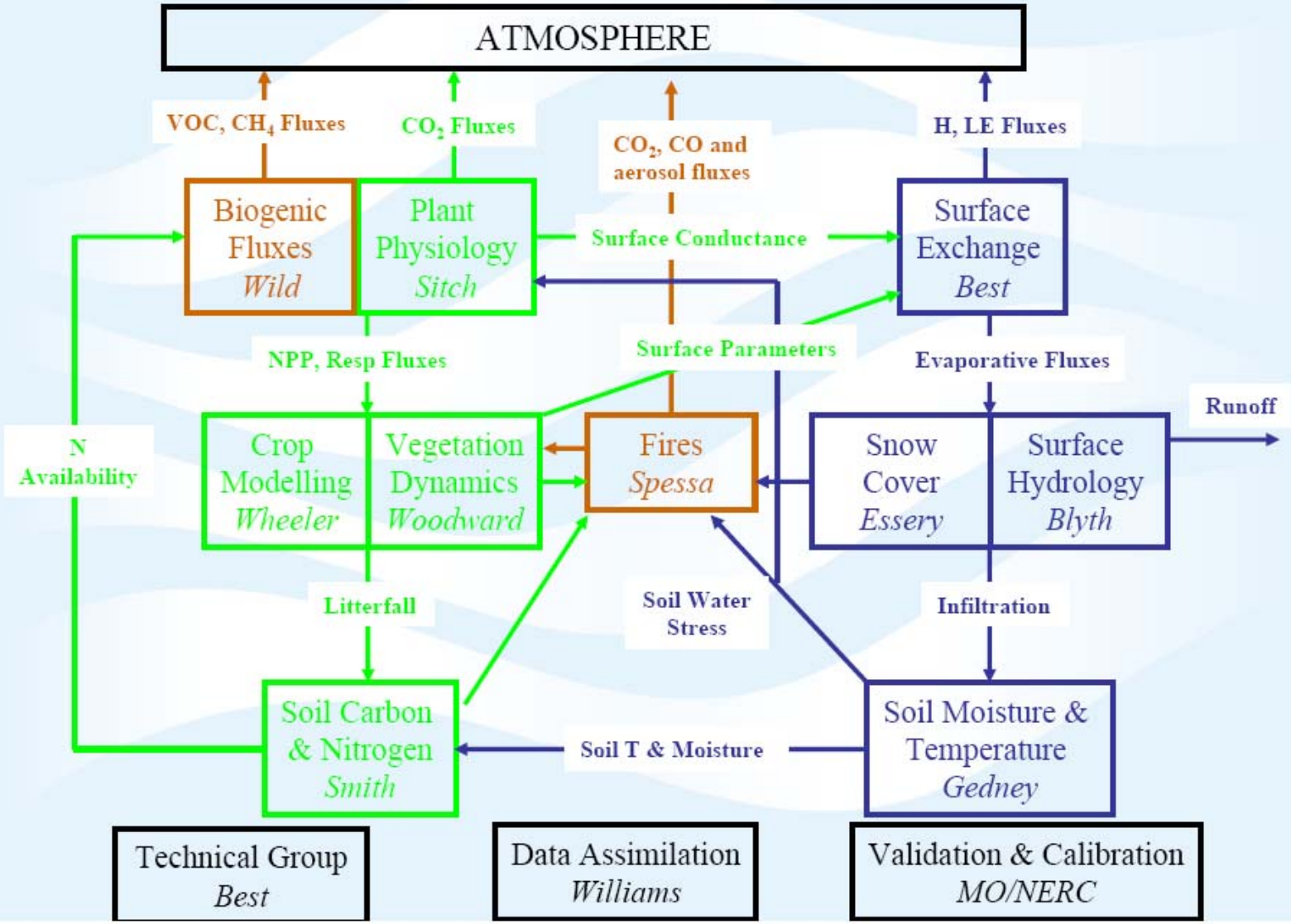
CEH Centre for Ecology & Hydrology

NERC Centres for Atmospheric Science
NATURAL ENVIRONMENT RESEARCH COUNCIL

NATURAL ENVIRONMENT RESEARCH COUNCIL

QUEST Quantifying and Understanding the Earth System

Structure of JULES



Structural issues

- Software engineering
- Code standards
- Version control !!!!!
- Data formatting
- Documentation requirements
- Host model demands

Structural issues

- there is no point doing DGVMs if major other components are relatively weak
  - hydrology, atmosphere, snow …
- DGVMs overlap with LSMs – photosynthesis, water balance, phenology
- Need clear communication to not duplicate

Conclusions

- We do not know the data we need – though we do all have our favourites.
- Research priorities are significantly at the process level.
- We need a clear sense of what we want to use the DGVM for before we can identify the research priorities and the data priorities
- A research infrastructure (e.g. JULES) will provide a fertile environment for a lot of this effort