



Progress in coupling Soil C and N routines into JULES

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JULES Science meeting

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Introduction

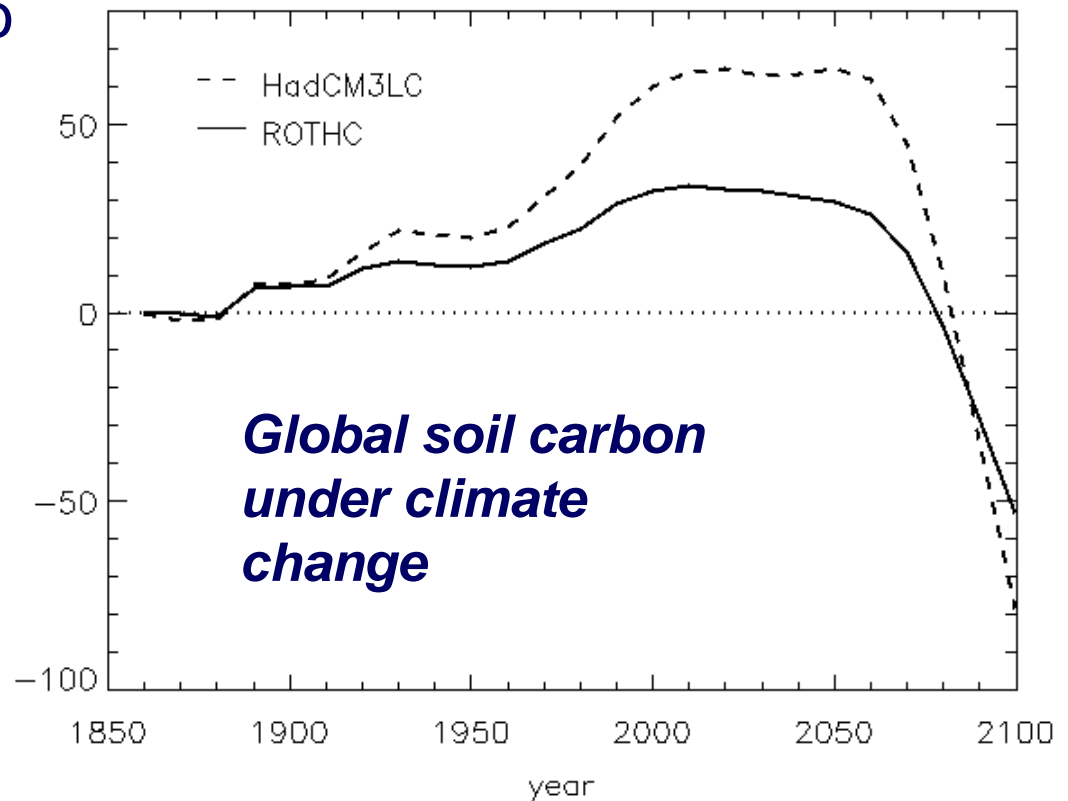
- Importance of soil C and N in global climate system
- Overview of existing models / components
- Aspects of coupling
- Future plans

Importance of soil carbon



- There is a consensus that climate change will weaken natural carbon uptake
 - Especially on land
 - Friedlingstein et al, 2006 (C4MIP)
- Response of soil carbon to changing climate and plant inputs is a key component
- Need to represent soil carbon processes and dynamics

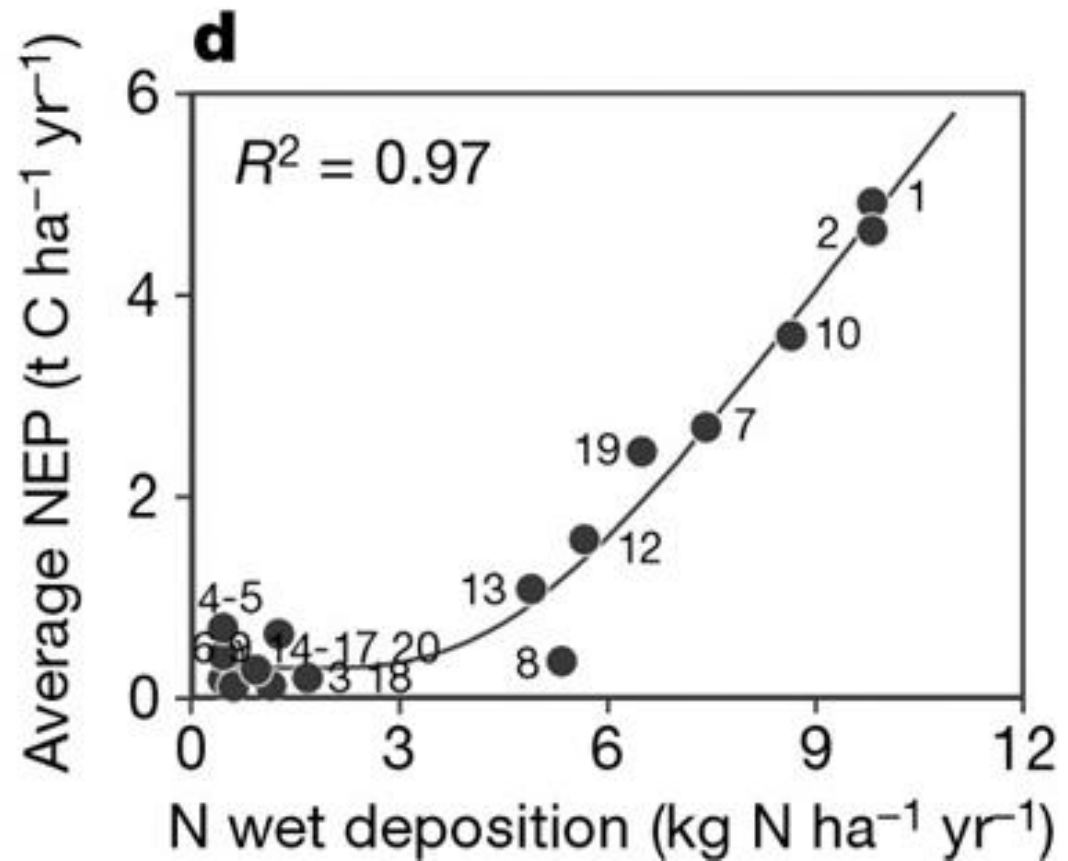
*Jones et al,
GCB, 2005.*



Importance of soil nitrogen



- Regulates C-cycle through plant growth

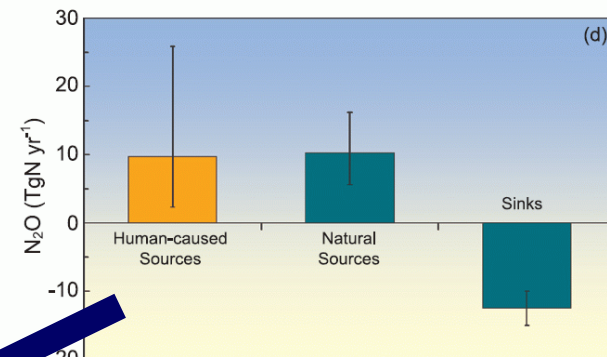
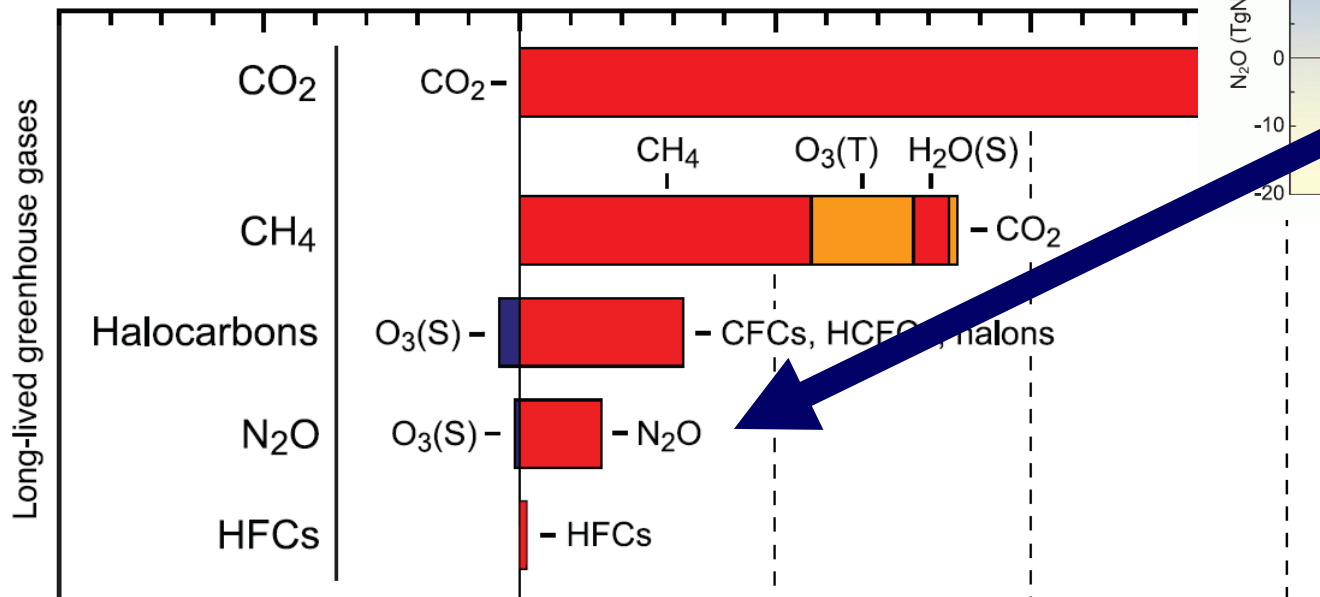


Magnani et al,
***Nature*, 2007.**

Importance of soil nitrogen

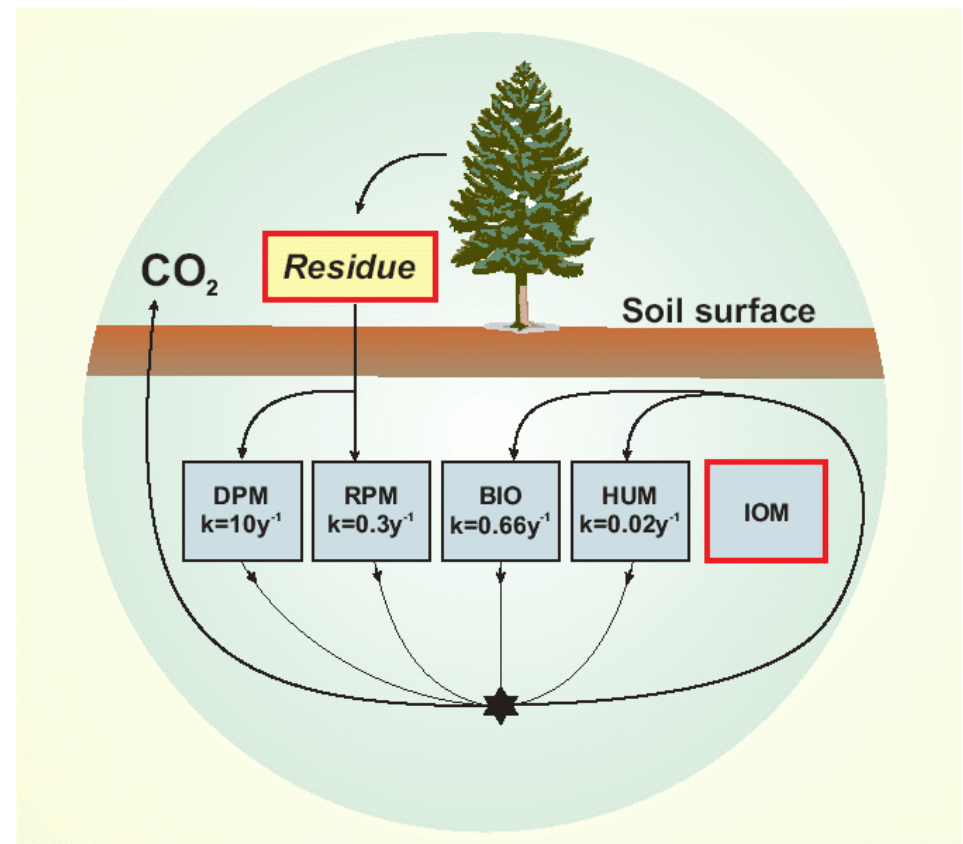


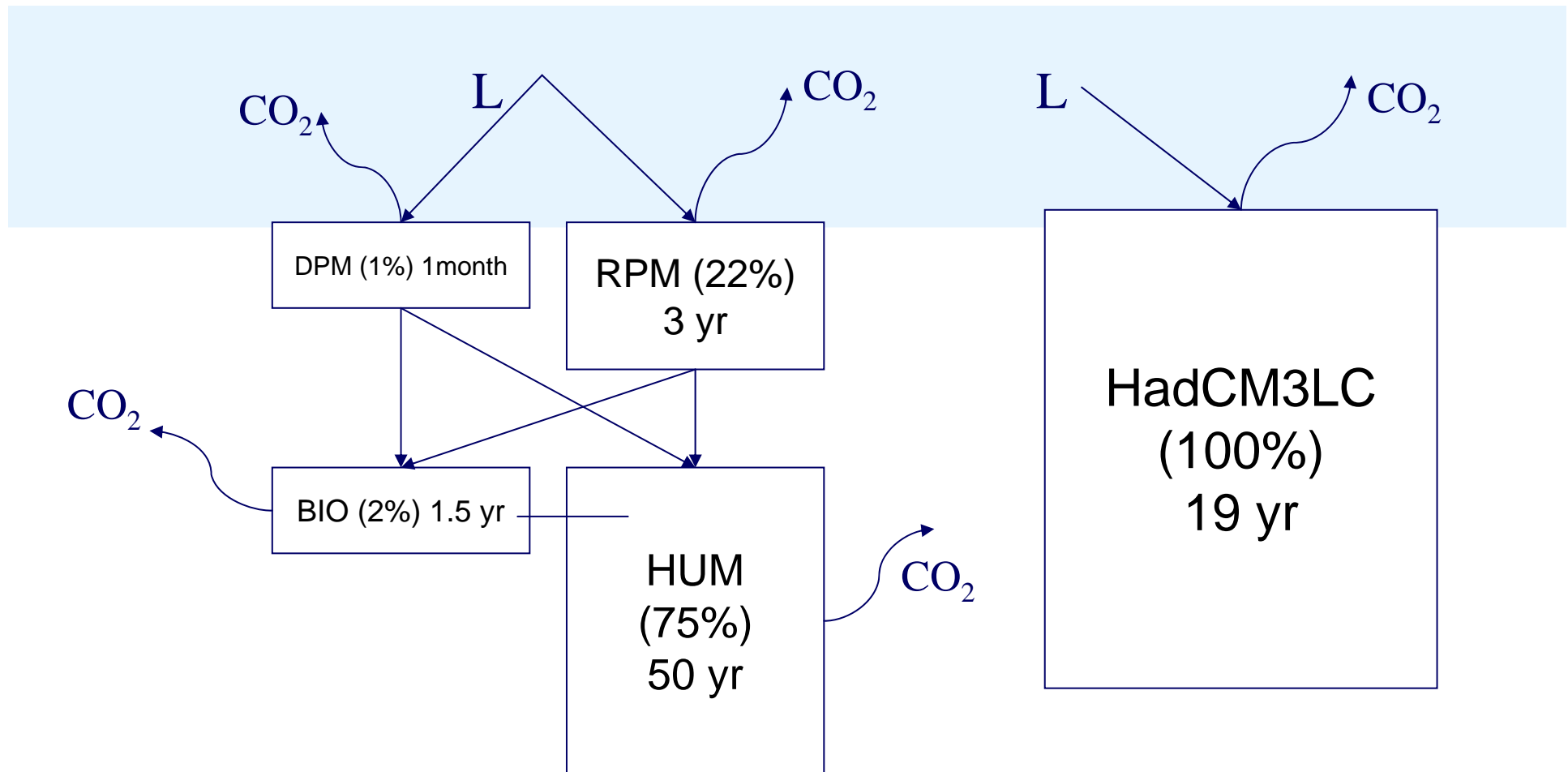
- Regulates C-cycle through plant growth
- N-greenhouse gases
- Both natural ecosystems
- And, importantly, agriculture



Source: IPCC AR4 Page 5

- JULES-1 (and HadCM3LC)
 - Single soil C pool
 - Driven by soil T & moisture
- RothC
 - 4 pool C dynamics
 - Driven by air T & precip. & ET
 - Use in HadGEM2-ES





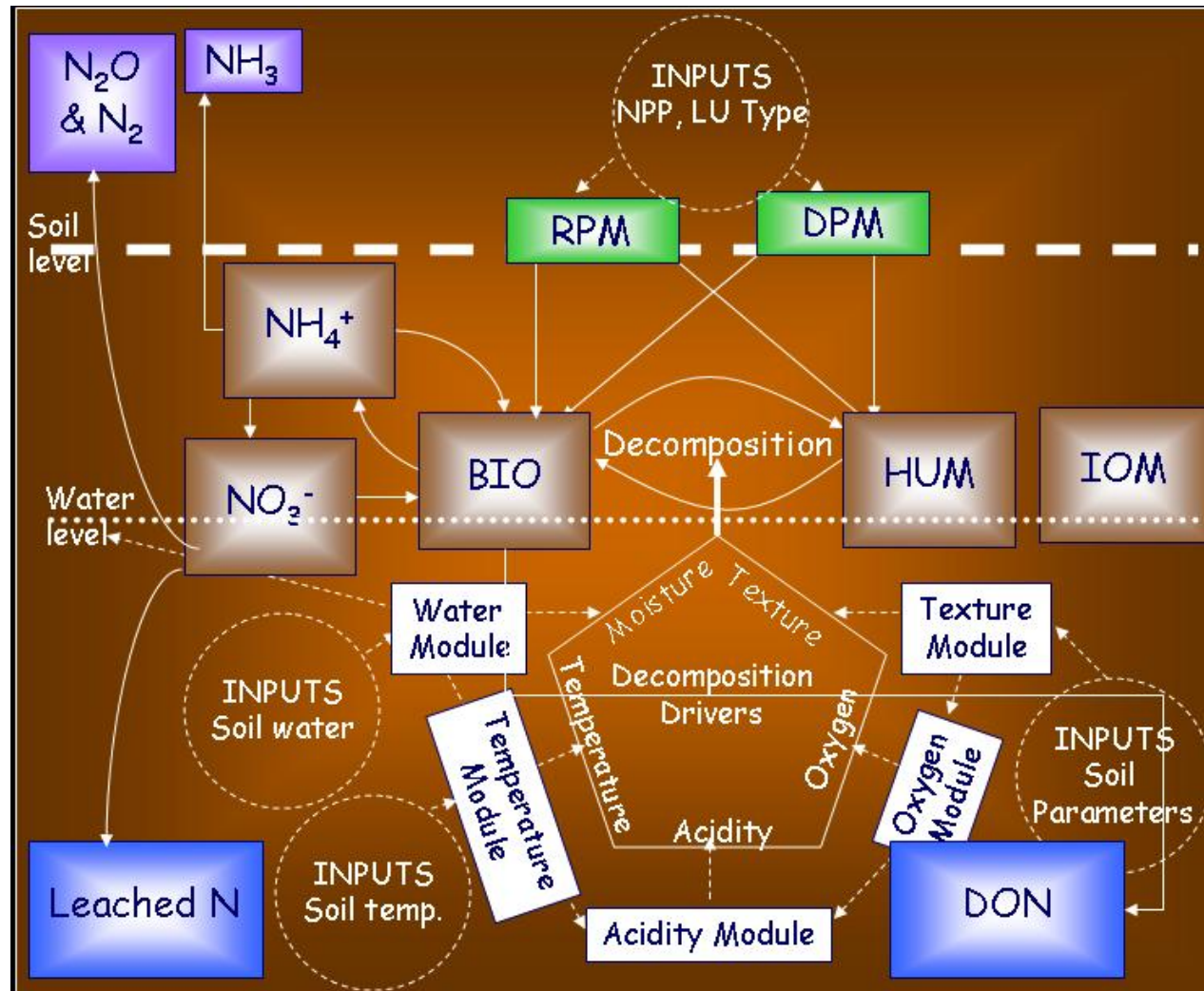
- **DPM – short lived: RPM – short lived relative to HUM**
 - Relatively quick turnover of fresh litter
 - increased litter inputs slowly increase SOC
- **HUM – long lived**
 - Majority of RothC soil carbon
 - Slower response to changes in temperature than smaller, faster pools

- **JULES-1 (and HadCM3LC)**
 - Single soil C pool
 - Driven by soil T & mois

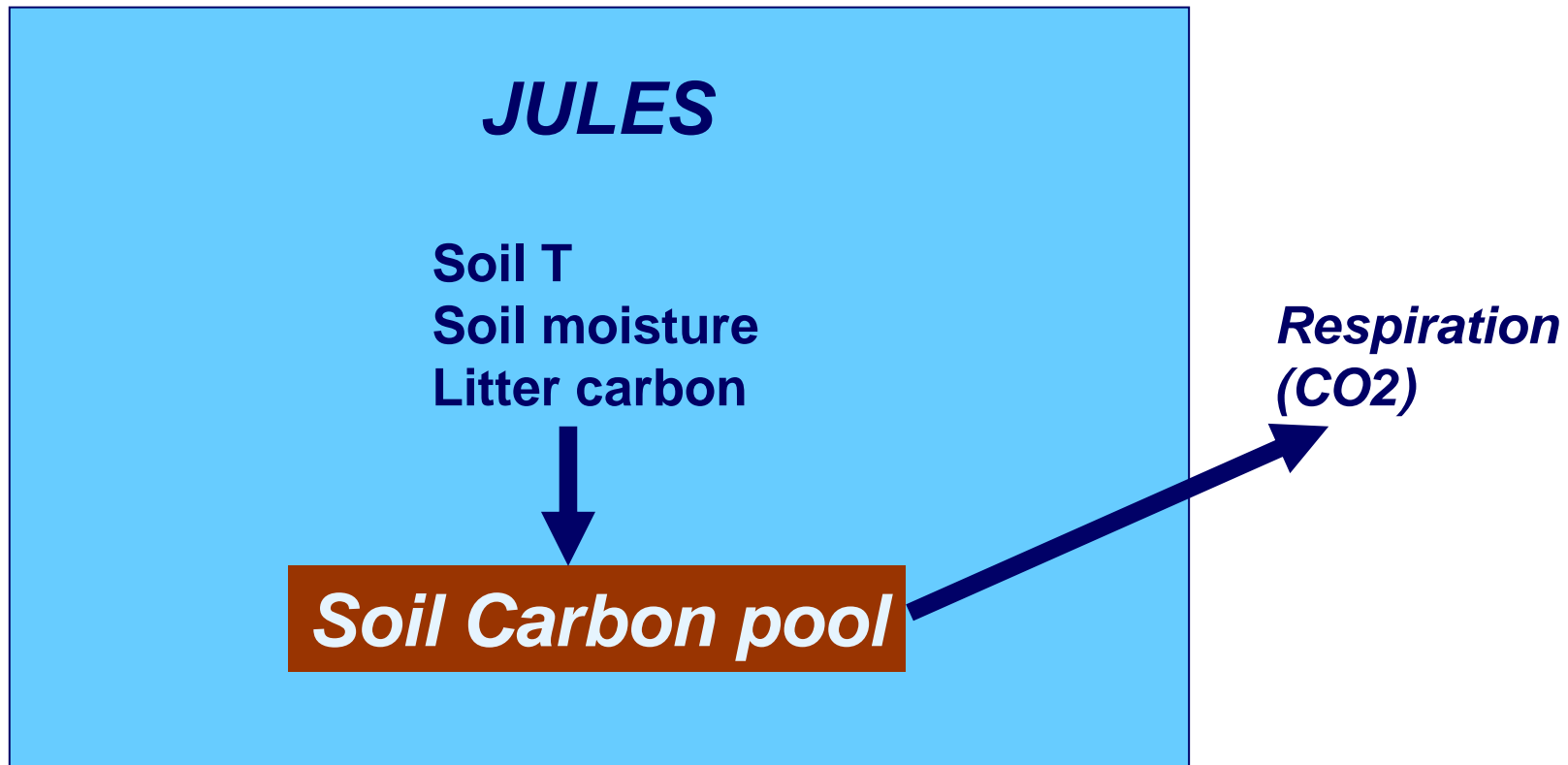
- **RothC**
 - 4 pool C dynamics (show schematic)
 - Driven by air T & precip. & ET
 - Use in HadGEM2-ES

- **SUNDIAL/ECOSSE**
 - Incorporates RothC soil C
 - Treats soil N

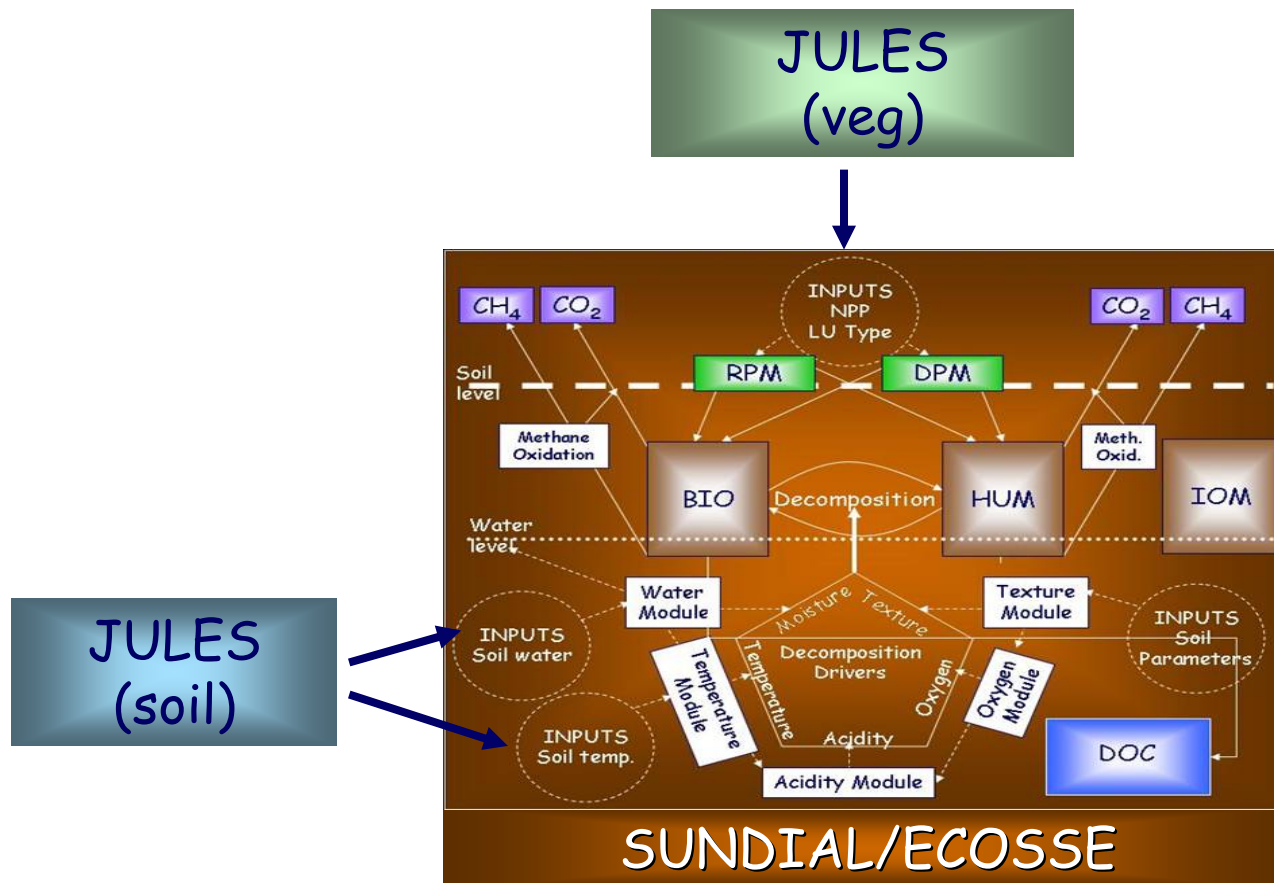
Nitrogen Components of SUNDIAL/ECOSSE



- Existing JULES-1 scheme



■ JULES-SUNDIAL/ECOSSE

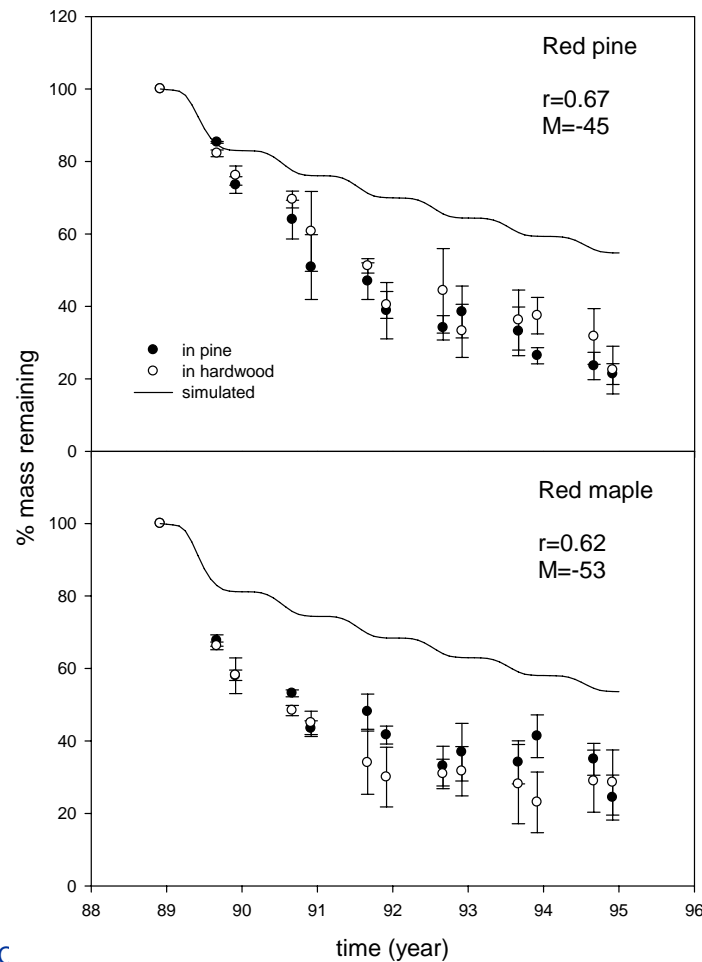


Offline test of ECOSSE-JULES C and N routines

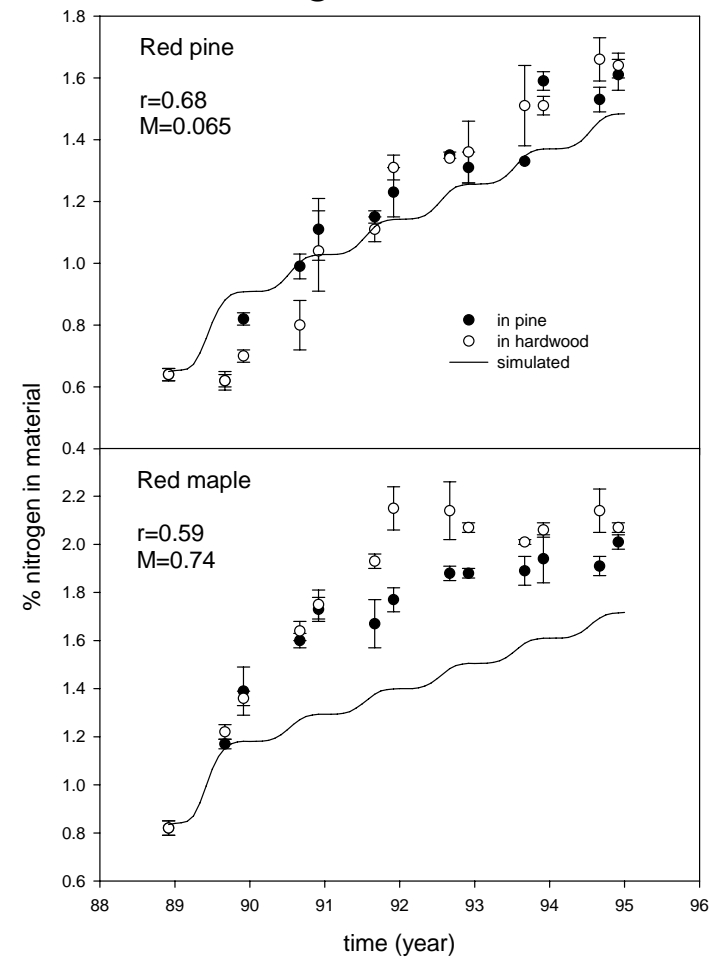


Harvard Forest

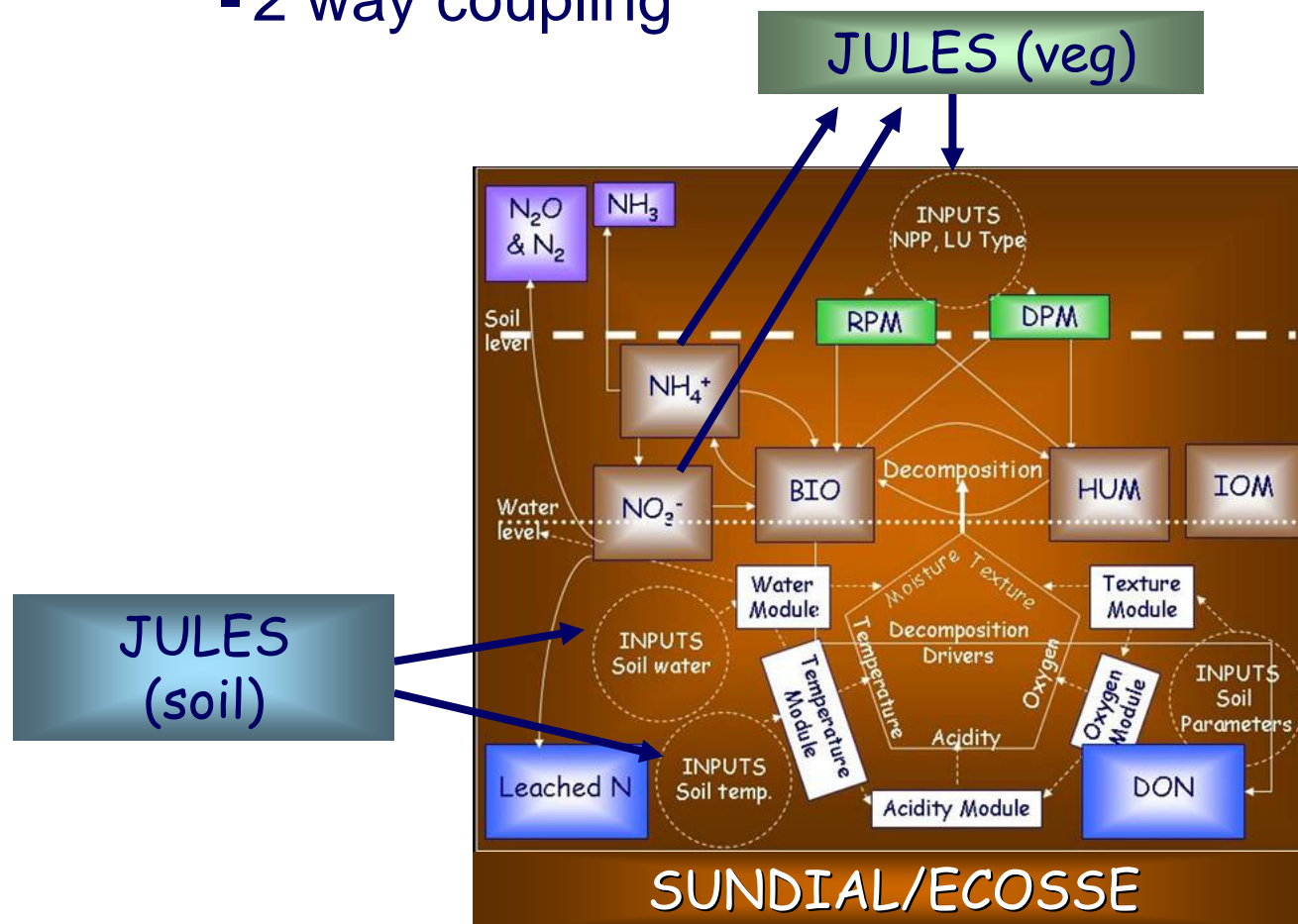
Mass loss



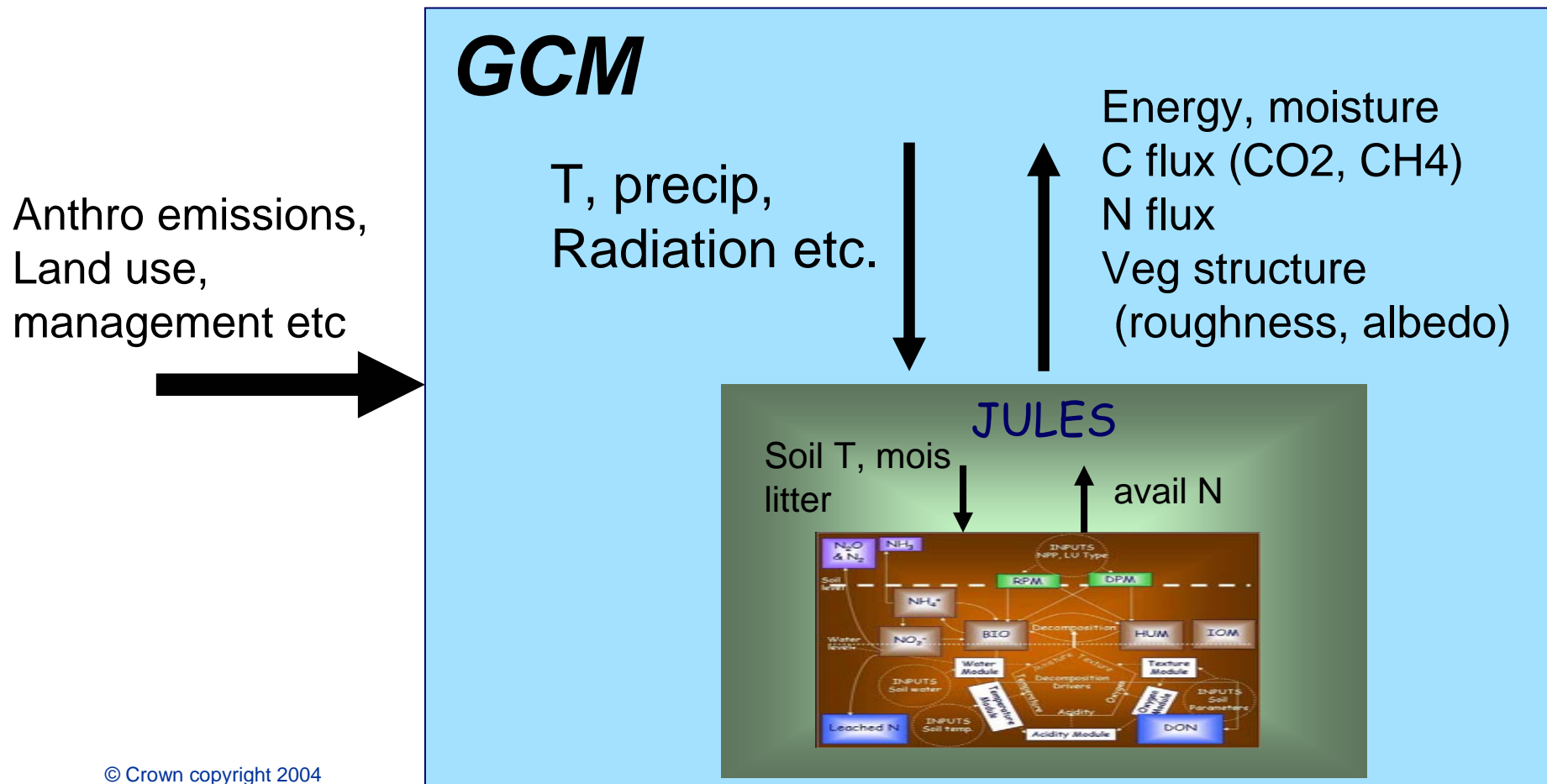
Nitrogen content



- JULES-SUNDIAL/ECOSSE-VegN
 - 2 way coupling



- JULES-SUNDIAL/ECOSSE-VegN within full Earth System GCM



- More processes
 - Peat/organic soils – in ECOSSE, evaluate (SEERAD / QUEST)
 - Wetlands & methane – in ECOSSE, evaluate (NERC proposal - University of Edinburgh (lead), University of Warwick & University of Aberdeen)
 - Permafrost – still in planning