

UKCA as a UM Component

Climate, Chemistry, and Ecosystems (CCE), Met Office Hadley Centre, UKCA team



Why UKCA ?

- To bring UM chemistry and aerosol modelling within the same framework
- To bring in expertise from the UK science community
- To provide a model coupled to the UM available for community use
- An improved model for climate and other applications



Elements of UKCA :

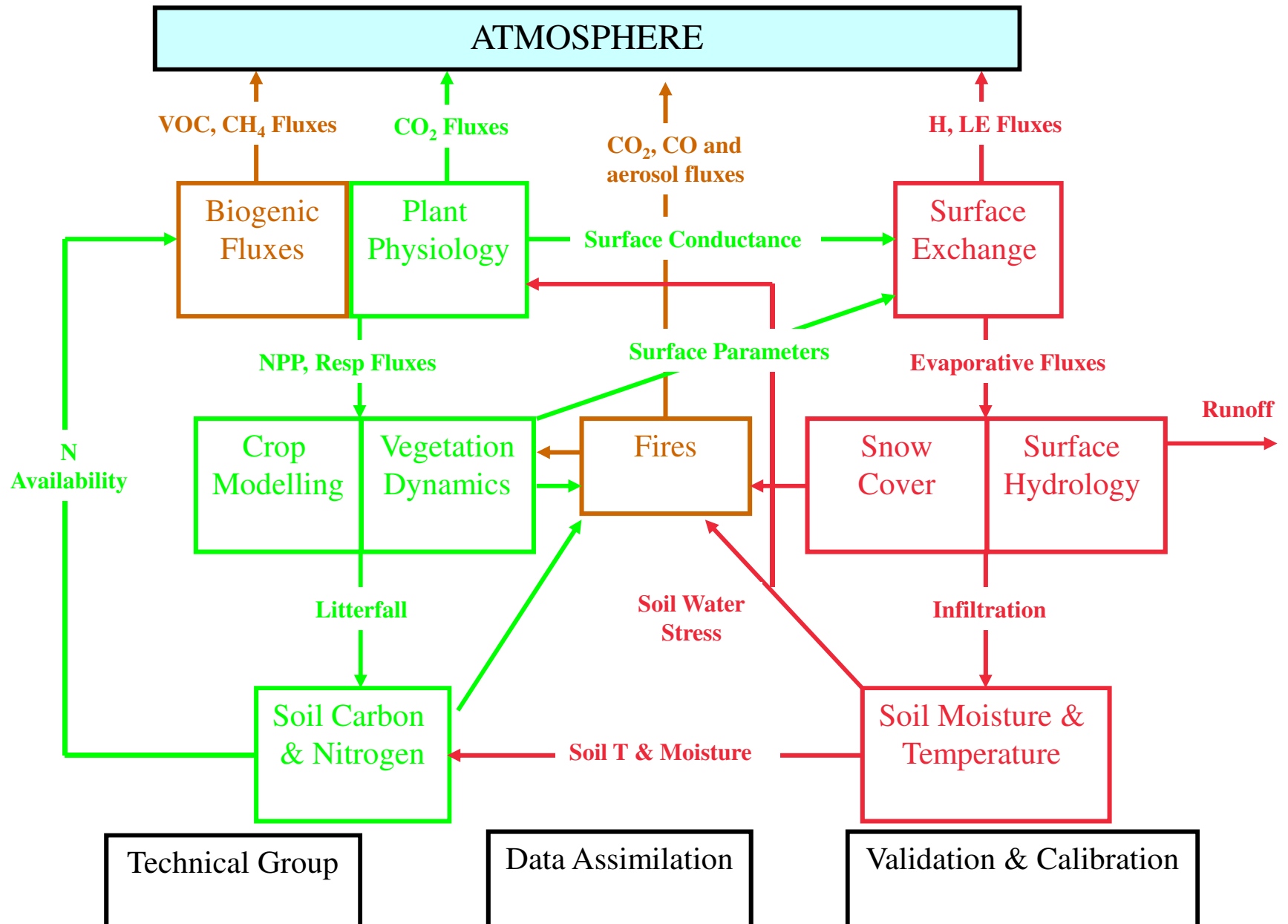
- Uses UM tracer transport and convective transport schemes (150 tracers)
- Uses standard prognostics and diagnostics from atmosphere model
- Selected and configured via the UMUI
- Available in UM since vn6.6, though needs update from FCM branch now



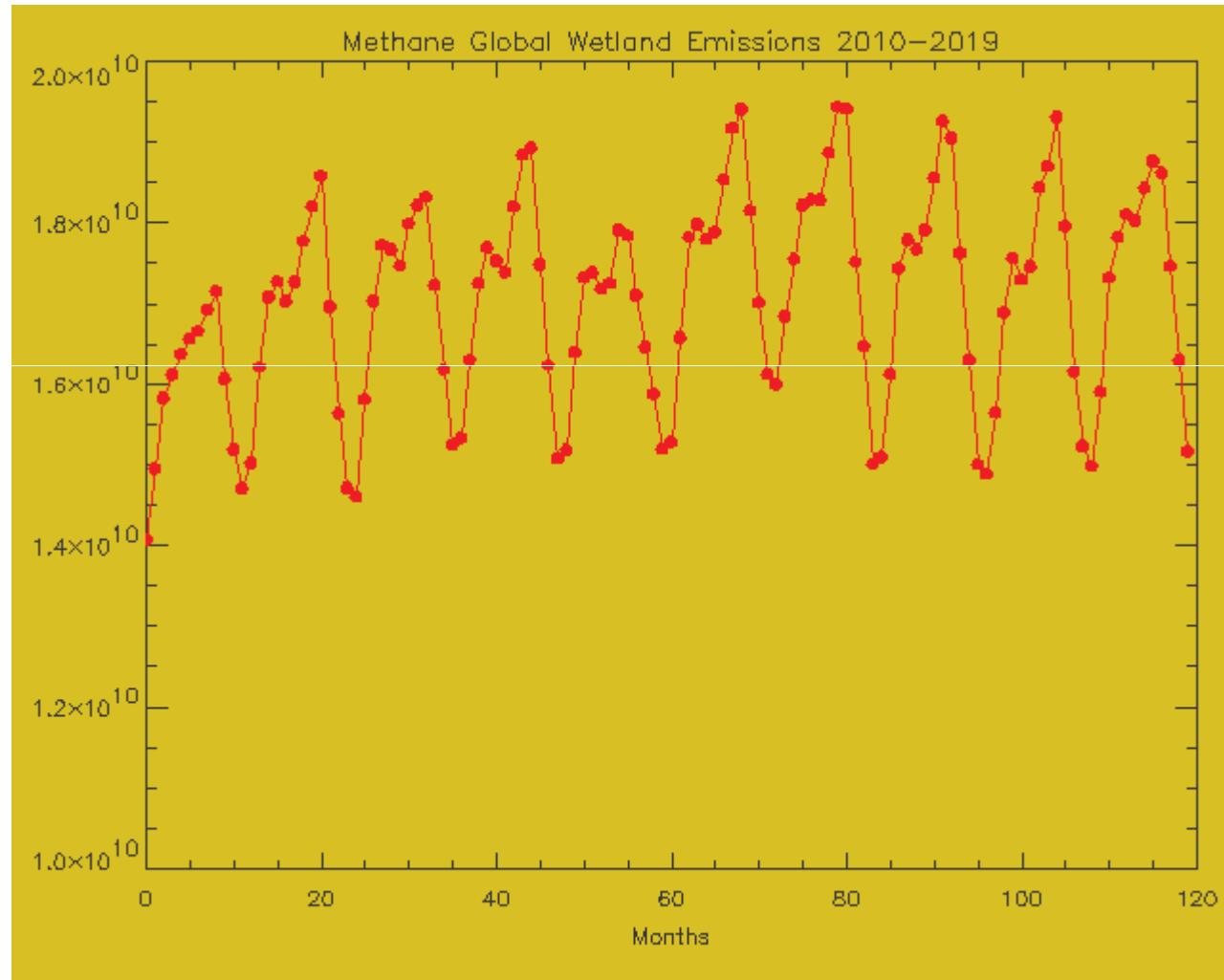
Interactions:

- A key feature to enhance, e.g.
- Dry deposition and natural emissions depend on the vegetation, hydrology, ocean carbon cycle, and land-surface schemes
- Schemes from the atmosphere are critical e.g. tracer transport, convection
- Implementation, validation and testing of a fully comprehensive earth-system model is central to climate model development

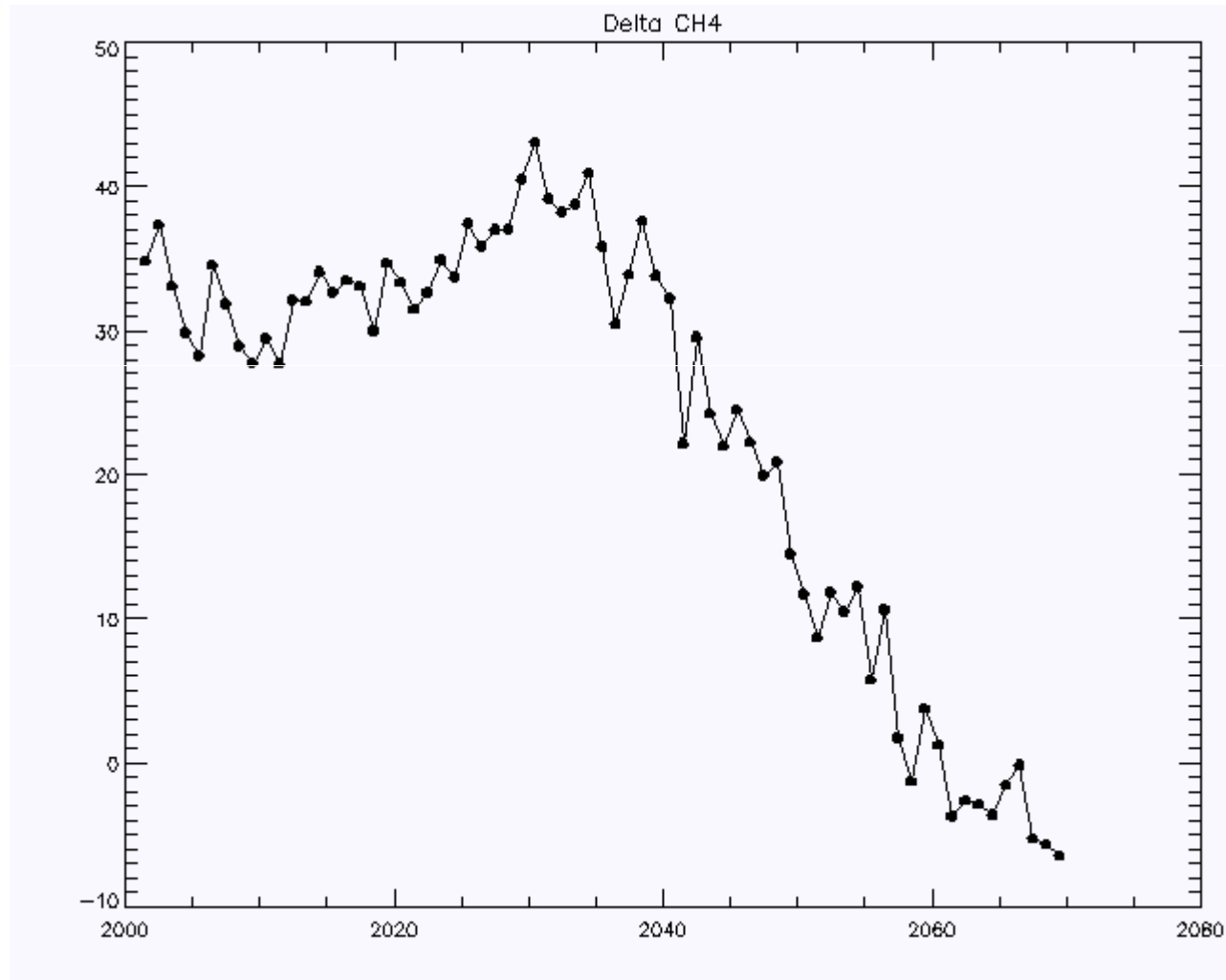
Land surface model: JULES



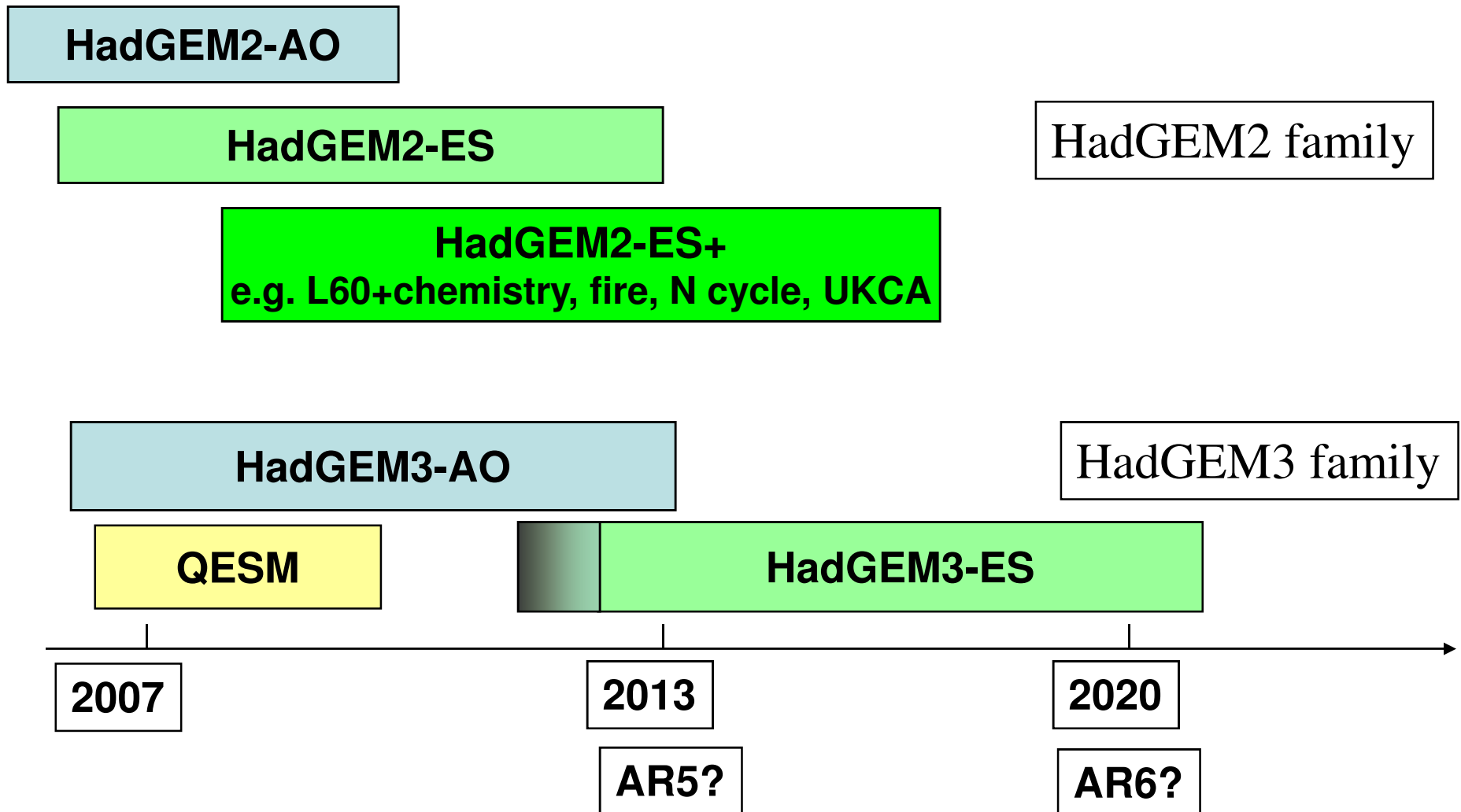
Wetland Methane Emissions



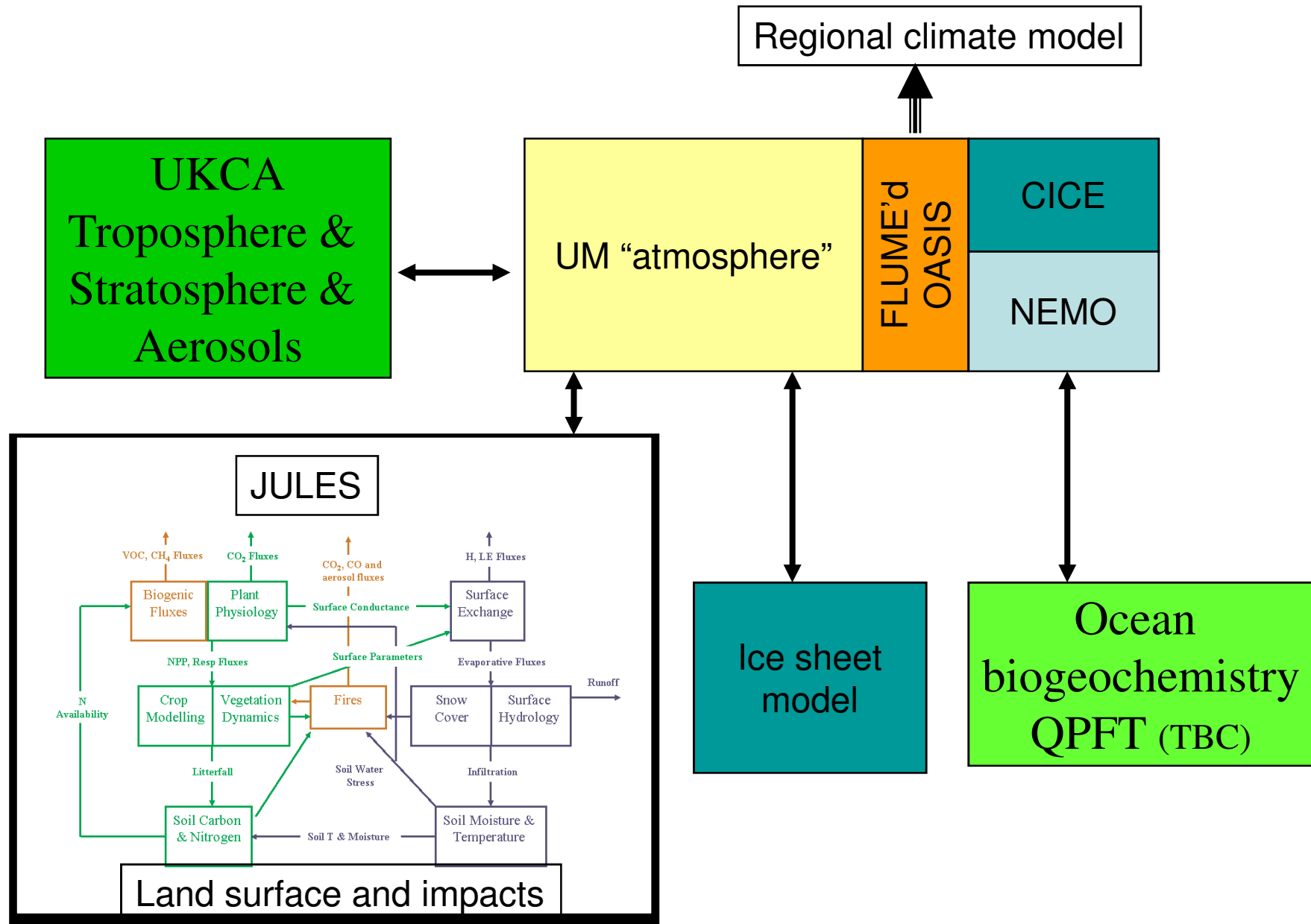
Methane annual increment



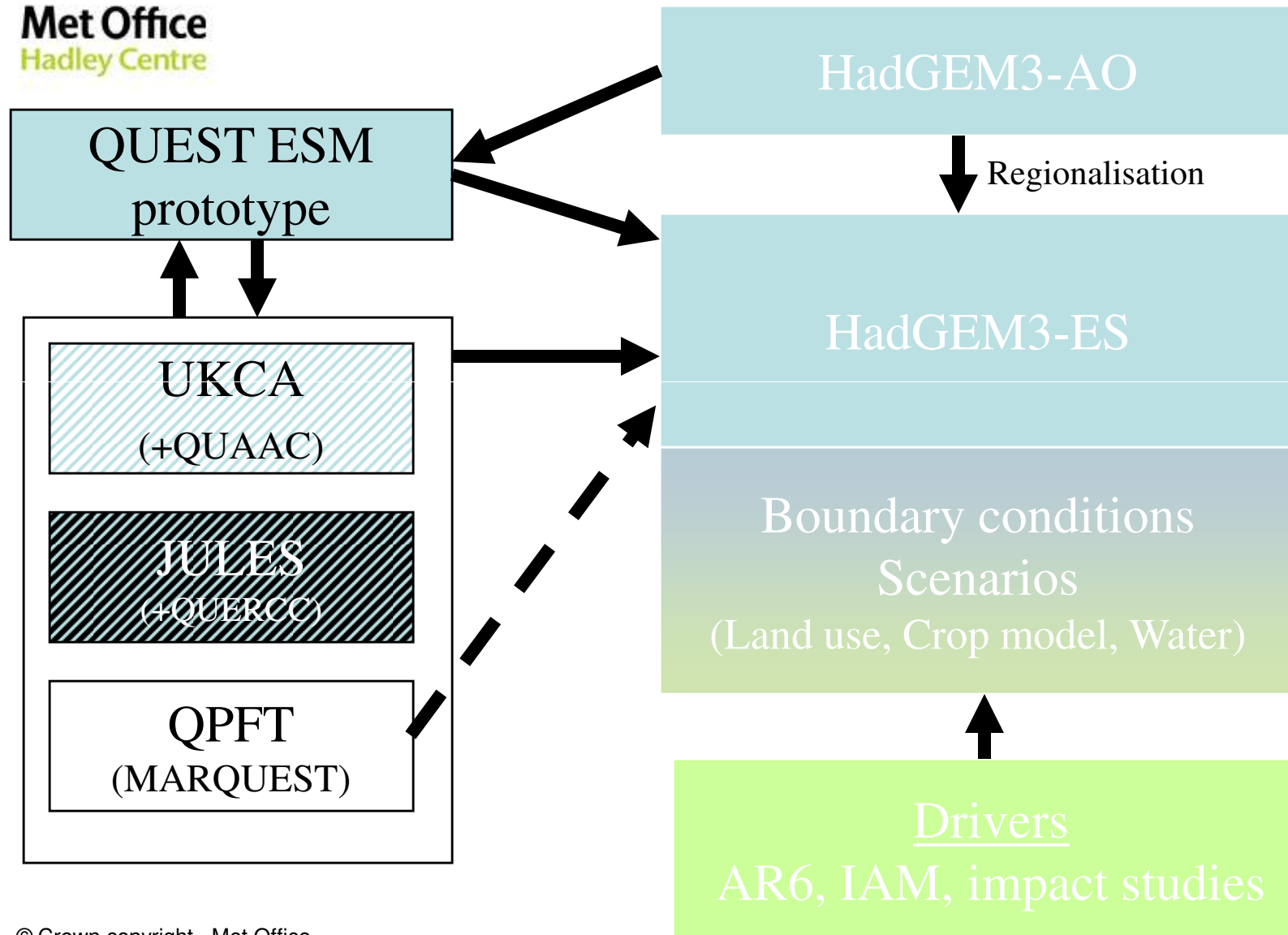
ESMs in the Hadley Centre model strategy



HadGEM3-ES



HadGEM3-ES




Choose the relevant section release  <0A> UKCA not included.
 <1A> UKCA included.

Select Aerosol and Tracer Scheme(s)


☐ Use Family Chemical Tracers

☐ Use Seperate Advected Tracer for Stratospheric H2O

Select Photolysis scheme

 Not include


 Use 2D Photolysis Scheme

 Use FASTJ Photolysis Scheme

Select Chemical Scheme

 No Chemical Scheme

 Standard Tropospheric Chemistry

 Isoprene + Tropospheric Chemistry

 Extended Tropospheric Chemistry

 Standard Stratospheric Chemistry

 Standard Strat+Trop Chemistry

 Explicit CFC treatment

 Tropospheric Aerosol Chemistry

 User Defined Chemical scheme

Select Aerosol and Tracer Scheme(s)

☐ UKCA-MODE Aerosol Scheme

☐ DUST: Woodward sectional scheme

☐ Radon/Pb-210 Tracer scheme

Push TROP button to set up other parameters

Push STRAT button to set up other parameters

Push RnPb button to define Ancillary file for Radon Emissions

Push COUPL button for Coupling between UKCA and Atmosphere

Push UKCA_TRA to initialise tracers available

Push MODE to setup aerosol model parameters

Help

Abandon changes

Close

TROP

STRAT

RnPb

COUPL

UKCA_TRA

MODE



Versions, versions, versions...

- Ideally, UKCA would operate at all versions and configurations however...
- Not all versions will be ported to the external UM
- A climate configuration is generally tied to a particular version
- There is a time delay between the development of a model like HadGEM3 and the release of a version
- Therefore updates will need to be back-ported
- This is done using an FCM branch



Development:

- Code improvements from users need adding and testing with documentation
- UKCA is maintained using FCM as part of the UM
- A code manager will be employed as part of the JCRP
- The users still have to submit changes!
- This is done using an FCM branch



Working versions:

- Climate resolutions N48L38 (96x73, with 38 levels to 39km) for tropospheric chemistry development
- N96L38 (192x145) for current tropospheric chemistry and aerosol modelling with HadGEM2-A and HadGEM3-A
- N96L38 for running HadGEM2-ES (coupled AO with carbon cycle schemes) over 100 years
- N48L60 (to 84km) in HadGAM1A for stratospheric chemistry (running for 100 years to provide stratospheric ozone predictions)
- Running in demonstration AQ regional forecast model (146X182 with 38 levels)



Growth:

- Model is working for tropospheric and stratospheric chemistry, together with a new aerosol scheme (MODE).
- A nudging scheme has been developed and tested.
- Radiative forcing from trace gases is included, and a scheme for forcing from MODE is being tested. Work on the indirect effect of aerosols on clouds is ongoing.
- More chemical schemes are being tested, and schemes to include heterogeneous chemistry on aerosols will soon be added.
- Interest and uptake of the model is growing, now running in Australia (CSIRO).



Acknowledgements

- Our funding agencies (NCAS, DEFRA, DECC)
- Everyone who has contributed to the success of the project



How to Run UKCA

Climate, Chemistry, and Ecosystems (CCE), Met Office Hadley Centre, UKCA team



How to Start

- Contact Met Office (Colin) or Cambridge (Luke) for advise on an appropriate version to use
- UKCA web site
- Get training about the UM and UMUI – don't forget the UM Documentation Papers
- UKCA will be available on NERC and Met Office machines including the NERC partition of the new IBM supercomputer



Help:

- UMUI help panels
- UMDP for vn7.4 (August)
- Experienced users
- Lots of error messages/warning/debugging facilities are available in UKCA
- A raft of ancillary and other files are needed