

JULES Science meeting 17-18 June 2009

Met Office, Exeter

Topic: The JULES Impacts Theme

Organisers

Dr Richard Betts, Head of Climate Impacts, Met Office Hadley Centre
Dr Olivier Boucher, Head of Climate, Chemistry and Ecosystems, Met Office Hadley Centre

Workshop Aims

1. To see current status of the JULES science modules in relation to application to impacts work
2. To discuss ways forward, especially in relation to current and upcoming research opportunities

Presentations

Introductions and context:

Introduction to JULES Impacts Theme	Richard Betts
Global scale impacts	Nigel Arnell

Updates on current status of JULES science modules:

Urban	Mark McCarthy, Maggie Hendry
Plant Physiology	Stephen Sitch
Crops	Tim Wheeler
Vegetation Dynamics	Allan Spessa
Fires	Allan Spessa
Snow cover	Richard Essery
Surface Hydrology	Eleanor Blyth
Soil moisture and temperature	Eleanor Blyth
Soil carbon and nitrogen	Pete Smith
Data Assimilation	Matt Williams
Adjoint of JULES	Tim Jupp

Management issues:

Update on next JULES version and benchmarking	Matt Pryor
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Notes from breakout groups discussions

Group 1: using JULES for assessing climate change impacts in the UK

What are the requirements?

Sector/Policy need	Research need for JULES
Generic	Greater accessibility of driving data and ancillaries including land use, land use changes, and land management.
	Methods to downscale UKCP09
	Model inter-comparisons for UK applications
	Justification of the benefits of JULES – i.e. for integrated, co-dependent sectors, such as water and agriculture.
Water (including quality, flooding, availability)	Reservoirs and Dams. Code exists but needs to be implemented with a UK focus
	Aquifers and Extractions
Agriculture	Expand vegetation types to include UK specific crops and veg.
	Identify capability and limitations for using JULES for study of ecosystem service directed research
Land Management (inc. biodiversity and ecosystems)	Health of water and soil
	Methodology for the assimilation of land use and management data.
Human Health (inc. pollutants, vector borne diseases, urban)	Atmospheric chemistry (links with UKCA)
	Vegetation issues (see above) important for disease vectors
	Urban impacts on energy and hydrology
	Urban drainage and water budget
	Urban green space
Coasts	Sea level
	Coastal ecosystems

Who is missing?

- Vegetation dynamics needs to involve ecologists and ecosystem view
- UK agricultural science
- Urban air quality (may come through new urban theme led by Sue Grimmond)
- Policy makers and stake holders
- Retain strong links with the Global model development
- Coastal zone?

How can we address this?

- How can we make UK-specific changes to JULES with no detrimental impact on other global or regional applications?

- How can we improve the accessibility of both the model and associated driving data and ancillaries?
- Does the version control for JULES need to include applications (e.g. IMOGEN, Chess) and driving data as well as the code? Can we support multiple versions of JULES applications?

Group 2: using JULES for assessing climate change impacts internationally and globally

What are the specific requirements?

We read that as requirements of end-users for JULES.

We split it into four categories:

WATER

FOOD

ENERGY

ECOSYSTEM SERVICES

Where are we with capability to use JULES for impacts assessments of these? And what or who is missing?

WATER

Water resources: ground water, extraction, dams, irrigation, glaciers, linking to human demand.

Many of these issues are being addressed in projects such as WATCH and HighNOON. Irrigation has already been implemented in stand alone JULES (Nik Gedney) and the Met Office Regional Climate Model (RCM)(Andy Wiltshire). River routing models have been linked to JULES which can be used for water resource studies.

Need for engagement on the water demand side and with the ground water community.

Flooding: River routing models have been coupled into JULES (Gird2Gird and TRIP). Regional scale studies, 25 km², are being done at CEH (Simon Dadson) looking at inundation. This focuses on the impacts rather than the feedbacks of flooding.

Drought: It was thought that the soil parameterisations within JULES were probably not sufficient to deal with drought impacts studies e.g. drying curve, rooting depth, soil type.

The potential to use EO data to identify drought regions was suggested. We need to make better links with the National Centre for Earth Observations (NCEO).

In Edinburgh there is some work looking at the 2005 drought and the impacts in Amazonia (David Galbraith).

The drought deciduous PFT was discussed. The issues are complex. Phenology is currently linked to soil moisture in TRIFFID and ED which is not necessarily correct.

Nutrient flows: pollution, water quality. Some work on this is going on within the Met Office (Pete Falloon).

Wetlands: JULES-LSH

FOOD

Crops: JULES-crop will be able to do yields as well as feedbacks of crops to climate (Tom Osborne, Josh Hooker, Tim Wheeler). There was some discussion about how to determine future crop distributions and it was suggested that a suitability approach may be best.

Need for engagement with the Integrated Assessment Modelling (IAM) community as they include information on land-use decision making.

Pests/Disease: The importance of this was highlighted but other than some work focused on dispersion at the Met Office it was thought this was an area lacking any focus presently.

Need for engagement of the disease/pest modelling community.

Pasture: No-one was aware of any work being done on pasture lands and productivity but it was thought that without too much model development this would be possible. Data of crop and pasture extent from 1700-2100 is available from the IAM community and will be used to represent land cover change within the Met Office AR5 runs (Chris Jones).

Need for engagement with social scientists – diversification of diet choice may increase area needed for pasture.

Irrigation: A scheme is available in JULES and the RCM.

Fertilizer: With the addition of FUN (Josh Fisher) and ROTHC/ECCOSE (Pete Smith, Spencer Liddicoat) it should be possible include fertilizers. This was thought to be very important.

Grazing animals: No known work being done here

Other land management: Some work being done related to timing of sowing dates by the crop modelling folks (Oli Sus, Tom Osbourne, Josh Hooker). Seasonal fluxes are very sensitive to this. Potential for assimilation of EO data to determine green-up of agricultural areas which can be related to sowing date.

ENERGY

Biofuels: Jules-crop has some biofuel PFT's. CEH and MO have been working on calibrating JULES for Miscanthus. This has been tested for a UK site and implemented globally (Chris Huntingford, John Hughes).

This could be used to start assessing the “payback time” of biofuels i.e. what are the true carbon costs of moving to biofuels with the associated land cover change that entails.

Renewables: Potential for work on Hydropower. There is a project in South Africa relating river flow to power (?Can't remember who said this). The Met Office has had involvement with the UK energy companies and used JULES for assessment of cable tolerance to predicted soil temperatures.

From a NERC sandpit came a proposal to runs 100 km (?) resolution in the UK to look at winds.

Urban: Feedbacks from energy use and changes in energy use to climate (Mark McCarthy).

ECOSYSTEM SERVICES

Deforestation: JULES can be used to inform to Reduced Emissions through avoided Deforestation and Degradation (REDD) debate. JULES has been run with land-use change scenarios from IAM models to look at the impact of LU change on the global carbon balance (Jemma Gornall). These land-cover change projections will be included in the AR5 runs.

The Met Office also has a project linked with CPTEC in Brazil to look at the feedbacks to climate from the Amazon rainforest e.g. recycling of rainwater and the presence of a low level jet that feeds water to the main agricultural provinces. The aim is to include scenarios of deforestation within an RCM run to look at the impacts (Gill Kay).

Water resources: There is a possible project with Conservation International (CI) looking at putting a price on the ecosystem services of the Okavango Delta/ Wetland in South Africa (Andy Wiltshire).

Engagement with people we work on the economic side of valuing ecosystem services.

Biodiversity: CEH have done some work on how to represent this in JULES. Rosie Fisher showed some theoretical work on the impacts of biodiversity at the last JULES meeting. The Amazonica project is looking at the sensitivity of JULES-ED to number of functional types (Steve Sitch). QUERCC is looking at the importance of plant traits. Should we include flexible PFT's?

The discussion came round to the importance of biodiversity – do we care about it in terms of global function. It was thought that we should focus on representing a few dominant species rather than capturing the full extent of biodiversity.

How do we engage with missing groups?

- 1) Through specific projects and funding.
- 2) Through LWEC (Living with Environmental Change) and ESPA (Ecosystem Services and Poverty Alleviation).
- 3) Improving links with the IPCC WG2 – getting our paper into this chapter.

- 4) Improved pull through of climate data to the impacts modelling community. JULES could be key to this. Need to ensure the output if driving data from GCMs.
- 5) Focus on the IAM community as they encompass many aspects we're interested in e.g. population, GDP, land-use decision making.
- 6) Terrabites – an EU funding opportunity for workshops and secondments with a section on land use and land cover change. Possibility for a work shop with the IMAGE or IIASA groups?
- 7) Better documentation of JULES use and development (who is doing what and where). This could be through the TWIKI page, a searchable section in the website or through documentation of user intent during application for the JULES license.

Attendees

First name	Surname	Organisation
Steven	Anthony	ADAS UK Ltd
Nigel	Arnell	Walker Institute
Richard	Betts	Met Office
Eleanor	Blyth	Centre for Ecology and Hydrology
Per	Bodin	Swansea University
Sylvia	Bohnenstengel	University of Reading
Ben	Booth	Met Office
Olivier	Boucher	Met Office
Keir	Bovis	Met Office
Andy	Brown	Met Office
Eleanor	Burke	Met Office
John	Caesar	Met Office
Ruth	Comer	Met Office
Peter	Cox	University of Exeter
Simon	Dadson	Centre for Ecology & Hydrology
Rutger	Dankers	Met Office
Terry	Dawson	University of Southampton
Imtiaz	Dharssi	Met Office
Marie	Doutriaux-Boucher	Met Office
John	Edwards	Met Office
Bernd	Eggen	Met Office
Richard	Essery	University of Edinburgh
Pete	Falloon	Met Office
Raquel	Garcia	University of Reading
Nicola	Gedney	Met Office
Jemma	Gornall	Met Office
Mariana	Gouvea	King's College London
Marianne	Hall	Swansea University
Richard	Harding	Centre for Ecology and Hydrology
Maggie	Hendry	Met Office
Josh	Hooker	University of Reading
Chris	Huntingford	Centre for Ecology and Hydrology
Joseph	Intsiful	Met Office
Chris	Jones	Met Office

Tim	Jupp	Exeter University
Zoran	Kapelan	University of Exeter
Catherine	Luke	University of Exeter
Bruce	Macpherson	Met Office
Camilla	Mathison	Met Office
Mark	McCarthy	Met Office
Rachel	McCarthy	Met Office
Jon	Moore	University of Exeter
Mo	Mylne	Met Office
Greg	O'Donnell	Newcastle University
Tom	Osborne	University of Reading
Federica	Pacifico	Met Office
David	Pearson	Met Office
Matt	Pryor	Met Office
Gabriel	Rooney	Met Office
Ed	Ryan	Sheffield University
Stephen	Sitch	University of Leeds
Pete	Smith	Aberdeen University
Allan	Spessa	NCAS Climate & the Walker Institute for Climate System Research
Sarah	Turner	Centre for Ecology & Hydrology
Junye	Wang	North Wyke Research
Tim	Wheeler	Walker Institute for Climate System Research
Mathew	Williams	University of Edinburgh
Andy	Wiltshire	Met Office