Hydrological extremes and feedbacks in the changing water cycle

NERC's Changing Water Cycle programme

Imperial College London
British Geological Survey
University of Reading
University College London

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NERC's Changing Water Cycle programme

Four years programme
£10m
Five projects already funded (~£5M)

Current South Asia call
£2.5M
Proposals under review

NERC's Changing Water Cycle programme

Four themes

Land-ocean-atmosphere interactions
Precipitation
Detection and attribution
Consequences of the changing water cycle

Other funded projects

Constraining the response of the hydrological cycle, land surface and regional weather to global change
(Oxford, CEH, Exeter) £1M

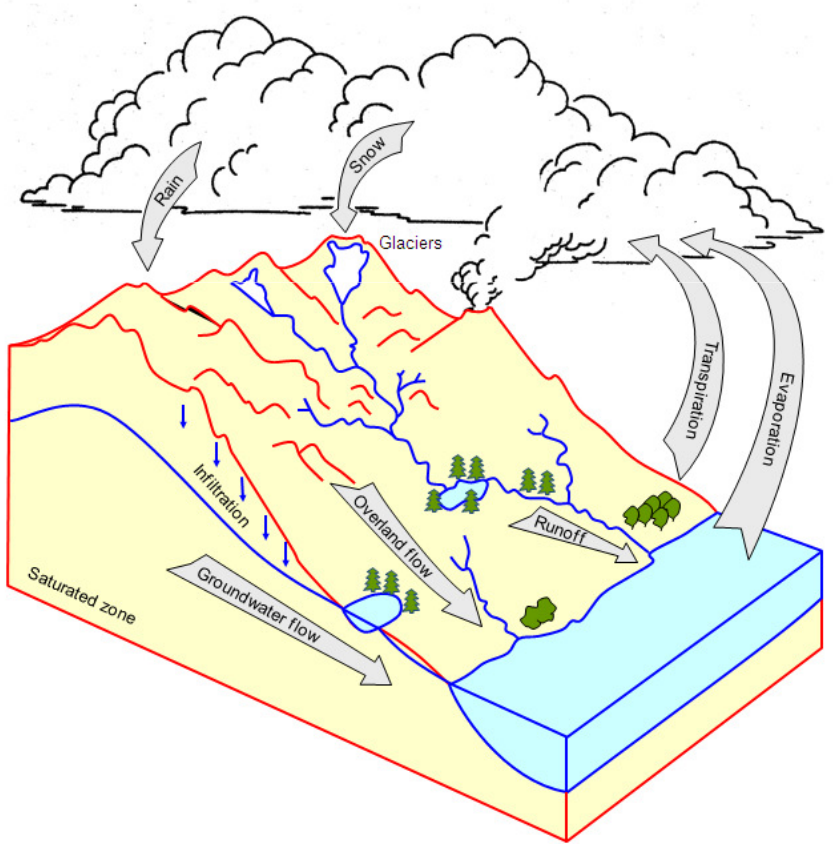
Hydrological cycle understanding via process-based global detection, attribution and prediction
(Reading, CEH, Southampton, Exeter, Edinburgh, East Anglia) £1.4M

Soil Water - Climate Feedbacks in Europe in the 21st Century
(CEH, Reading, Leicester) £0.8M

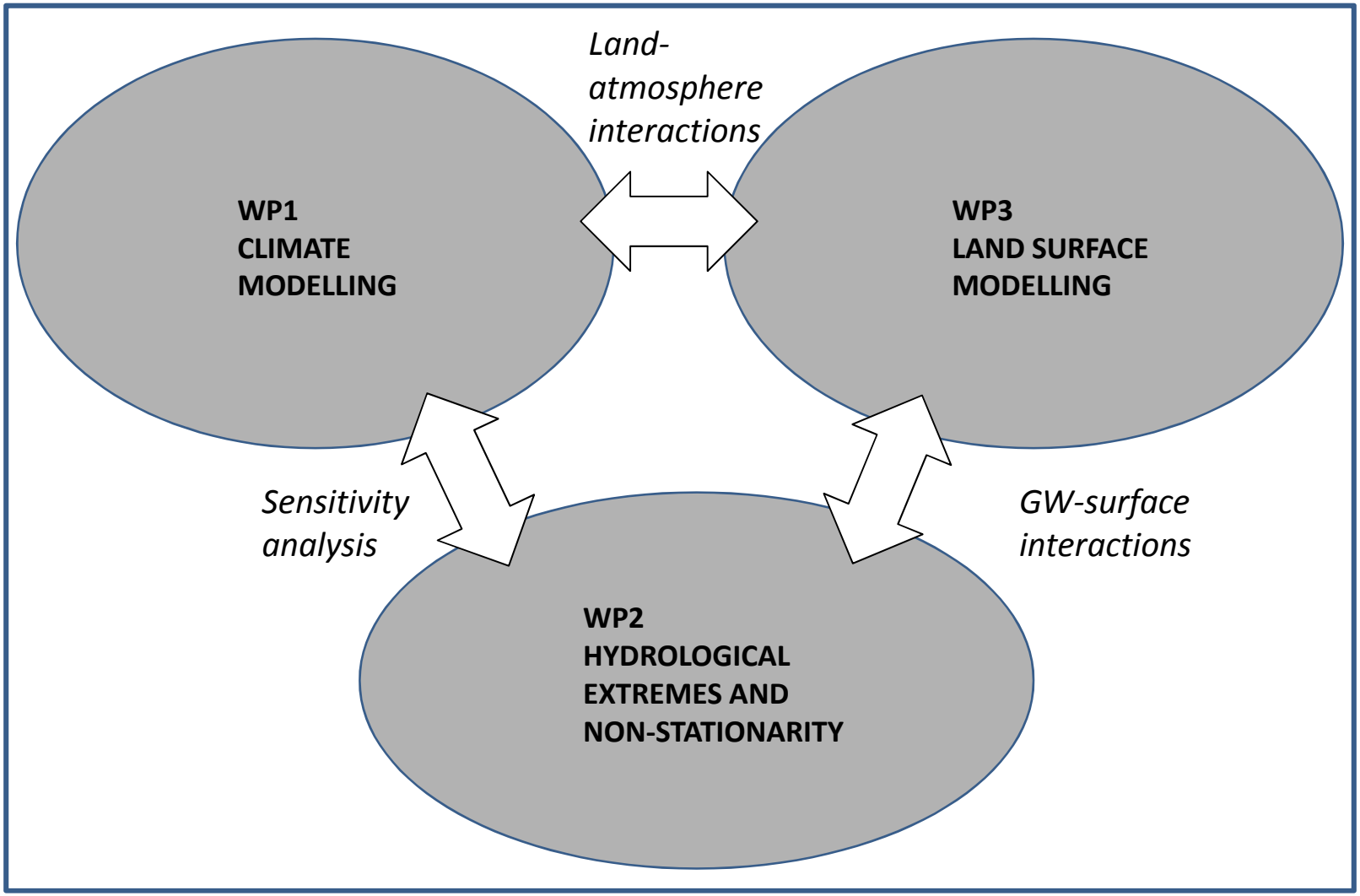
Using Observational Evidence and Process Understanding to Improve Predictions of Extreme Rainfall Change
(Newcastle, Exeter) £0.5M

Hydrological extremes and feedbacks in the changing water cycle – Overall project objectives

1. To improve climate modelling capability for hydrological applications
2. To improve hydrological models in terms of modelling future extremes and non-stationarity
3. And in terms of providing feedbacks to climate models



Hydrological extremes and feedbacks in the changing water cycle – work packages



WP1: Climate science and modelling

A. To identify hydrologically-relevant indices
B. To assess the value of current climate models
C. To improve downscaling techniques to exploit new-generation GCMs
D. To produce credible estimates of uncertainty

WP2: Hydrological extremes and non-stationarity

A. To incorporate small-scale process understanding into models
B. To develop methods of upscaling
C. To develop methods for modelling non-stationarity
D. To explore scenarios

WP3: Prototypes for next generation land surface-atmosphere models

A. To understand the feedback errors associated with current land surface models (JULES):

... errors associated with lower boundary conditions

... errors associated with GW & horizontal movement of water

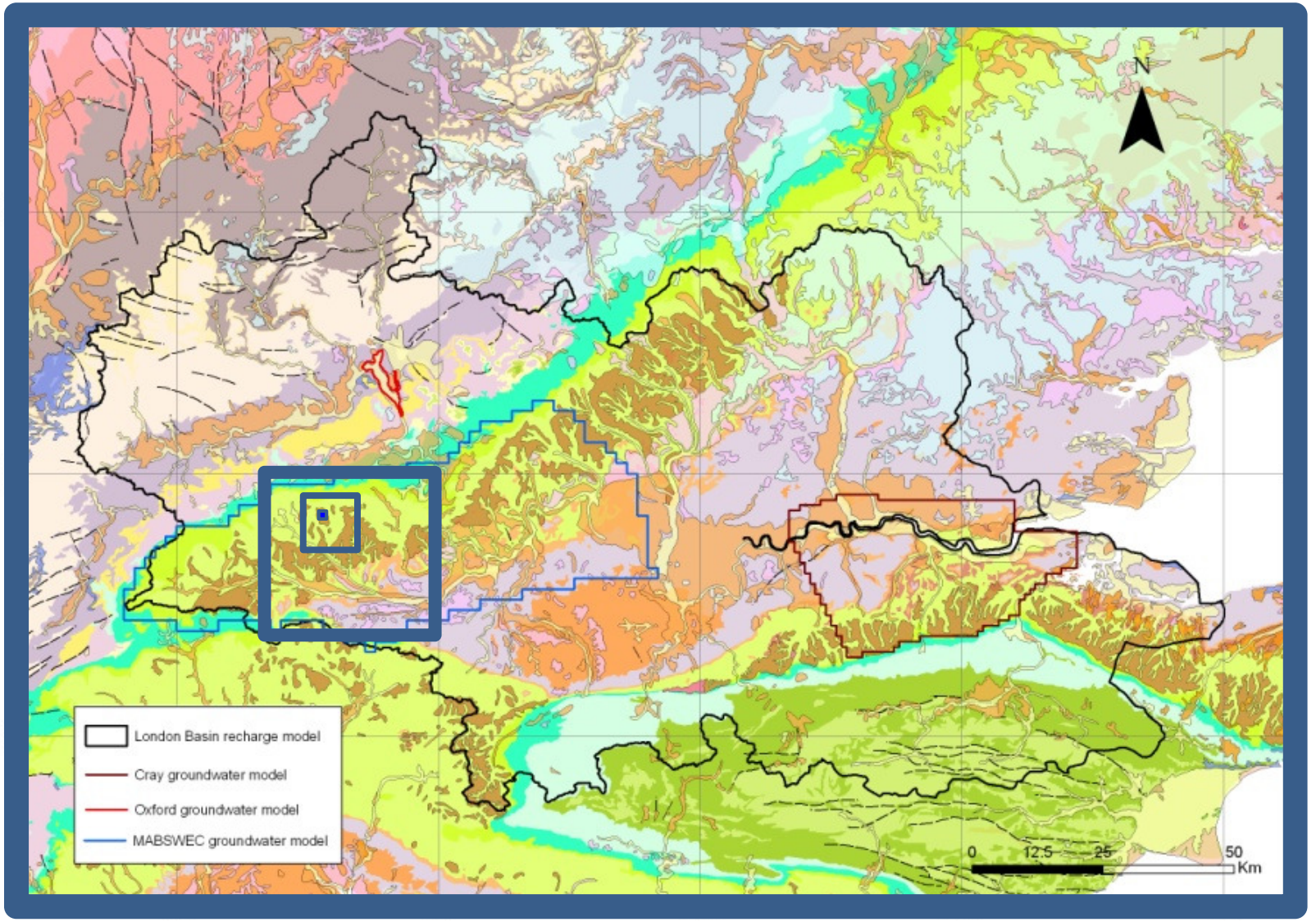
... errors associated with spatial heterogeneity

B. To implement suitable modifications to JULES.

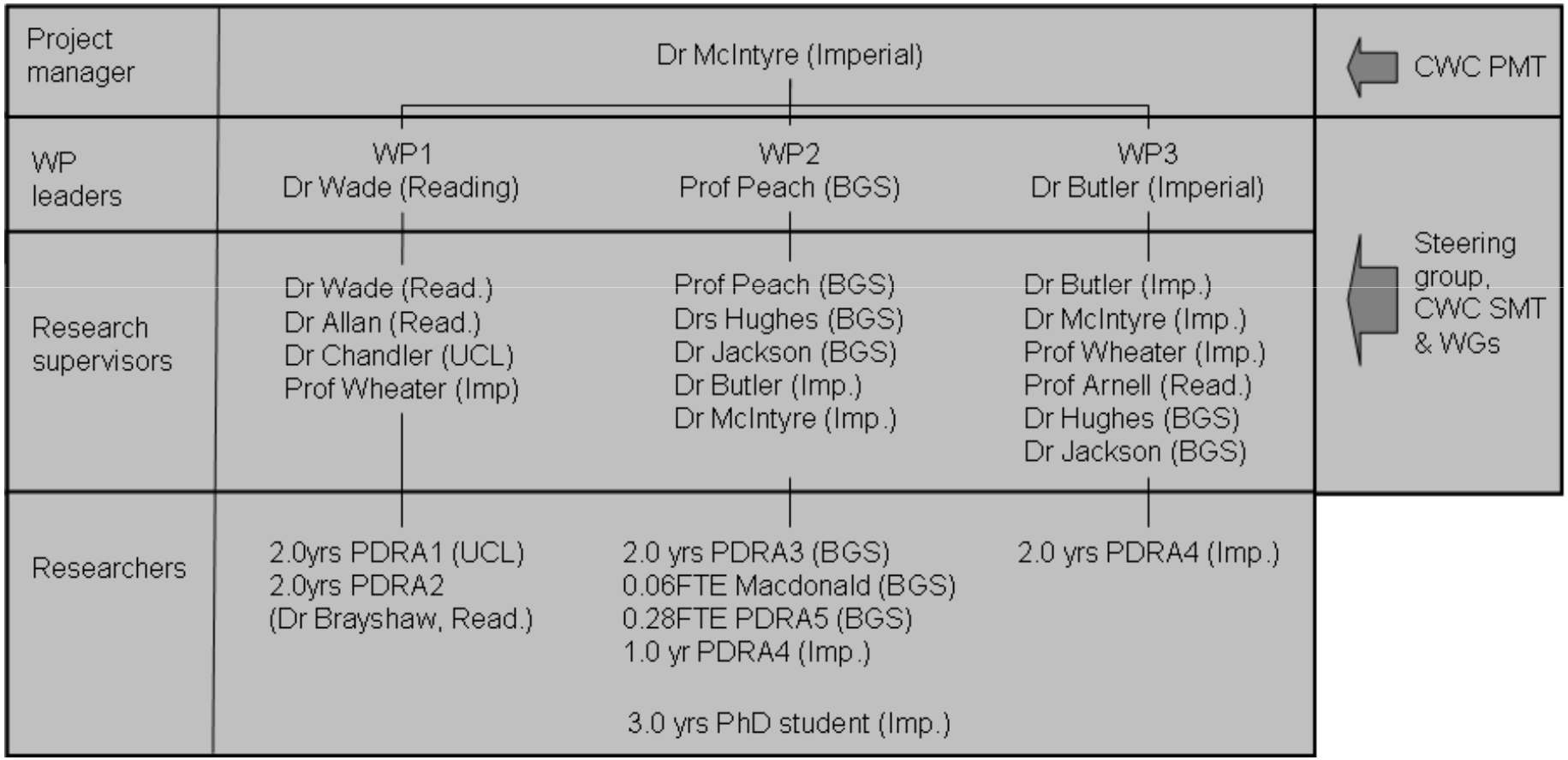
Tied studentship: Water resources on Isle of Wight

A. Isle of Wight makes an excellent stand-alone case study
B. PhD will tailor hydrological models for Isle of Wight, using science from WPs
C. And will use these models to assess water resources under climate change

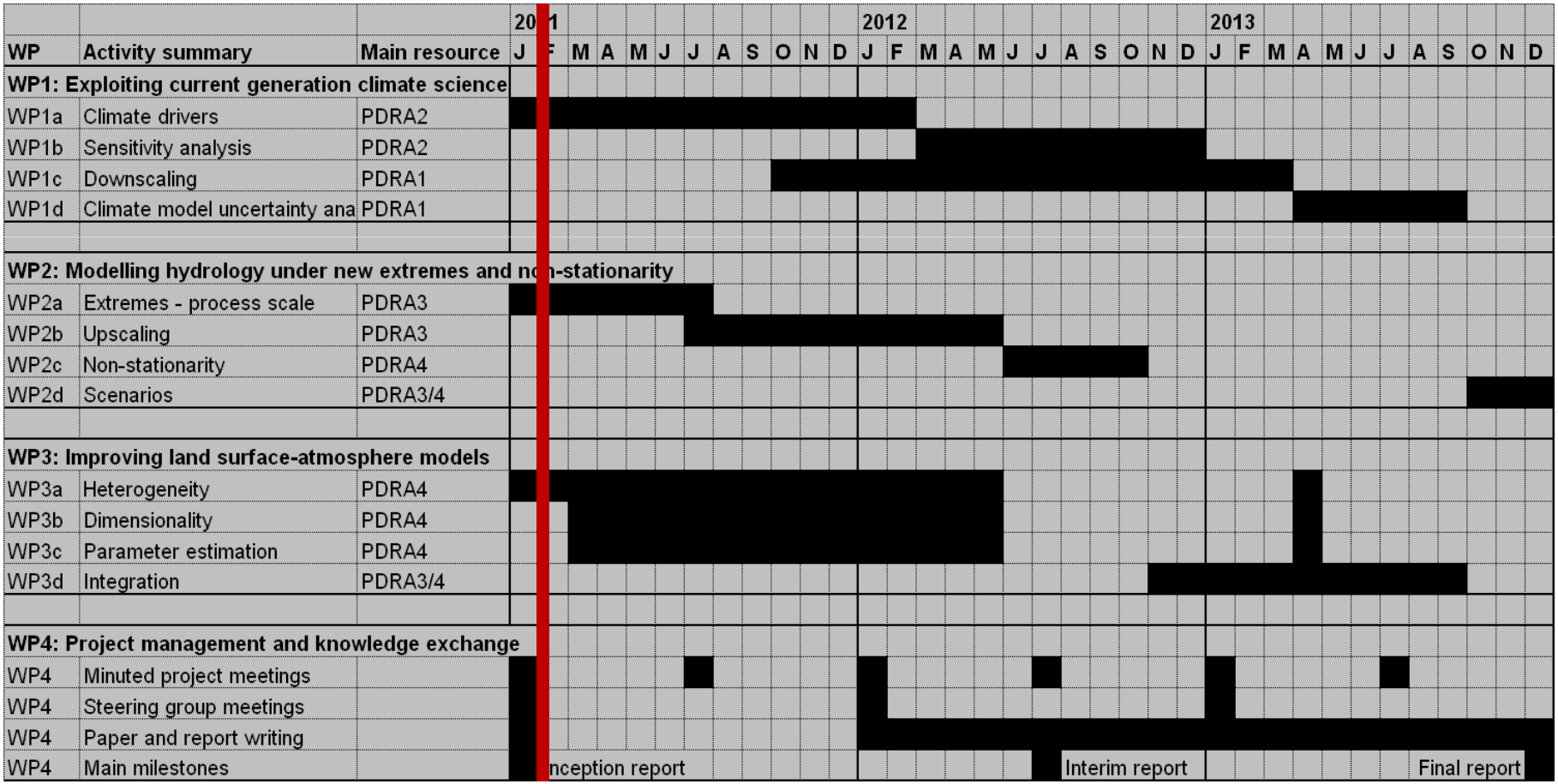
SCALE ISSUE


N
London Basin recharge model
Cray groundwater model
Oxford groundwater model
MABSWEC groundwater model
0
12.5
25
50
Km

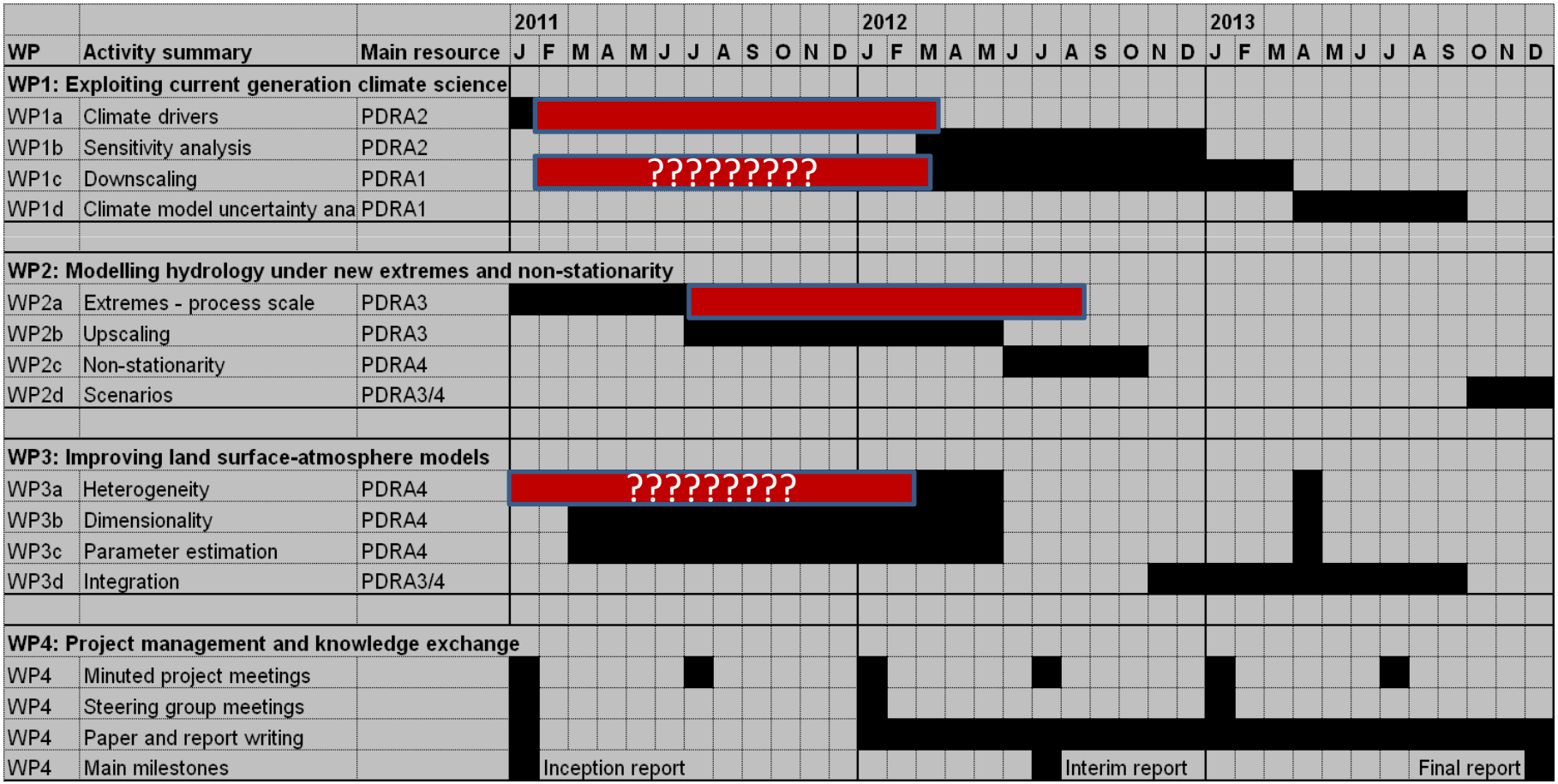
Research team and management structure



Programme (proposal)



Progress with research staff appointments



The Steering Group - representation

- Grantham/Walker Institutes
- CEH Wallingford (& Met Office)
- Environment Agency
- Thames Water
- Southern Water
- Veolia Water
- CWC Science Management Team

The Steering Group - role

- Any inputs you feel you can offer!
- Steering with respect to stakeholder research needs
- Integration with other R&D programmes
- Dissemination
- Uptake of research
- Scientific review

The Steering Group - meetings

- The proposal says:

  Jan 2011
  Jan 2012
  Jan 2013

- Regular project meetings

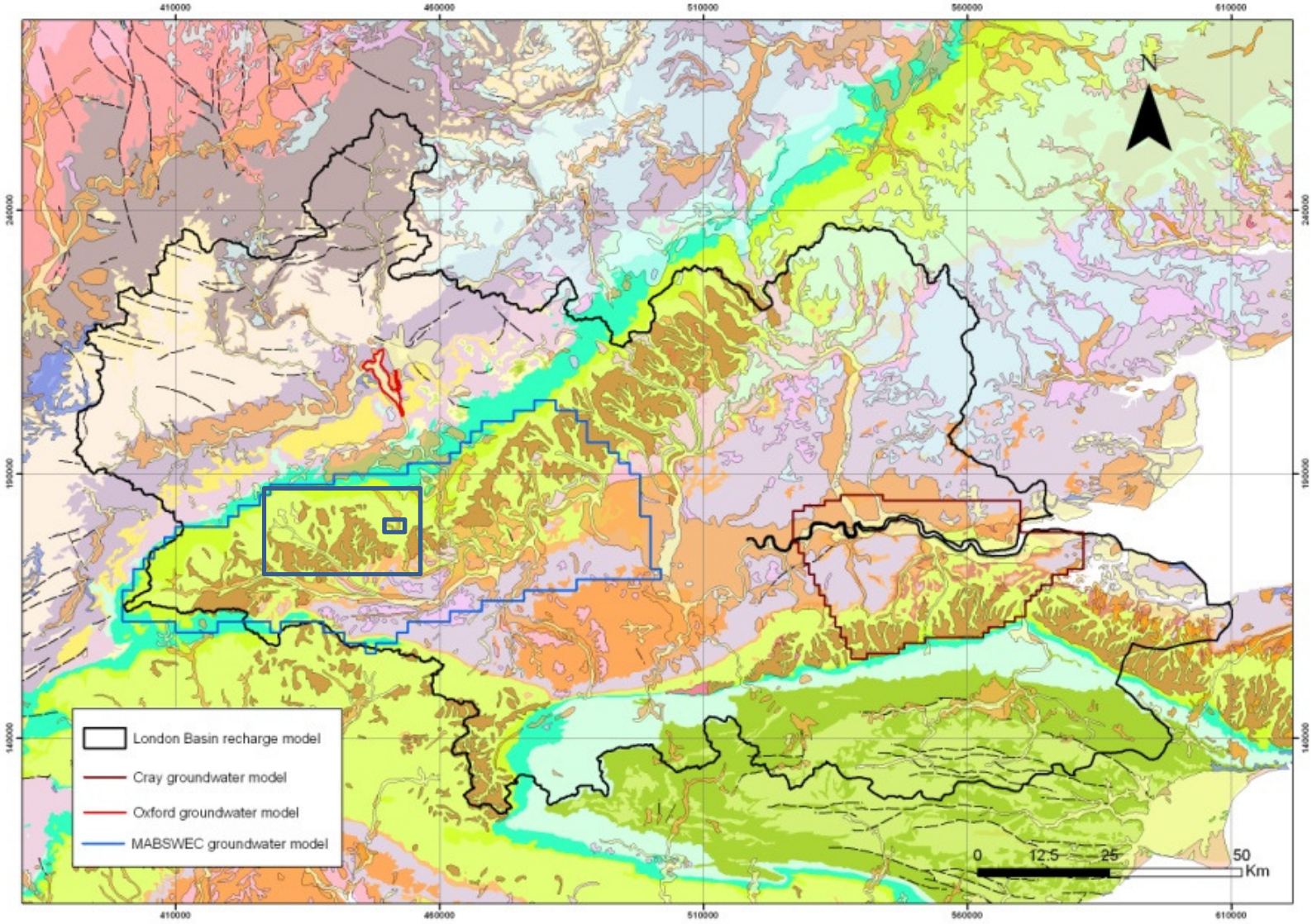
Today's agenda

- 13.30 Research presentations & discussion
  - Reading University
  - University College London
  - Imperial College London
  - British Geological Survey
- 15.30 Case study areas
- 15.50 Data management, deliverables and dissemination
- 16.10 Links to related research projects
- 16.30 Feedback from Steering Group
- 16.50 AOB & Date of next meeting
- 17.00 End of meeting

Case studies

- Thames
- Eden
- Isle of Wight

THAMES CASE STUDY



THAMES CASE STUDY

Catchment scale (~10000km2):	Thames to Teddington
Sub-catchment(~100-1000km2):	Lambourn to Welford; Kennet to Theale; Colne Cotswold Jurassics
Grid/sub-grid (~1m2-100km2):	Oxford alluvial plains Frilsham-Grimsbury Wood-Trumpletts farm area; Warren Farm recharge site; Borehole array at Westbrook Farm; Boxford wetland sites; Thames/BGS borehole sites

THAMES CASE STUDY - DATA

- EA flow gauge network (~50 stations, including daily data from 1883).
- Met Office - MIDAS Land Surface Stations data (from 1853).
- NERC's LOCAR data sets: including weather stations, recharge sites, boreholes, flow gauges, HYDRA site
- Additional BGS/Thames Water/EA/Three Valleys groundwater data
- NSRI soil maps: HOST and soil hydraulic data sets
- Land cover LCM2000
- Geology maps
- NCEP climate data, IPCC data

THAMES CASE STUDY – AVAILABLE MODELS

- Geology: BGS GSI3D
- Groundwater: Thames Water/BGS MaBSWeC model, ZOOM3QD
- Subsurface: Imperial/BGS 1&2D unsaturated zone hill-slope models
- Hydrology: Reading/Imperial INCA models from the LOCAR programme; Imperial's RRMT toolkit
- LSMs: JULES
- Rainfall: UCL's GLIMCLIM software; Imperial's Kennet GLM
- Climate: Walker Institute GCMs/RCMs

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DATA AQUISITION AND MANAGEMENT

What we will do:

1. Use existing freely-available data
2. Purchase a limited amount of data
3. Maintain a meta-database (data and models)
4. Store model files for any published/key model results
5. Have a ‘data manager’
6. Consult with CWC Science Management

What we will not do:

1. Field work
2. Store model outputs
3. Maintain a central database with all project data

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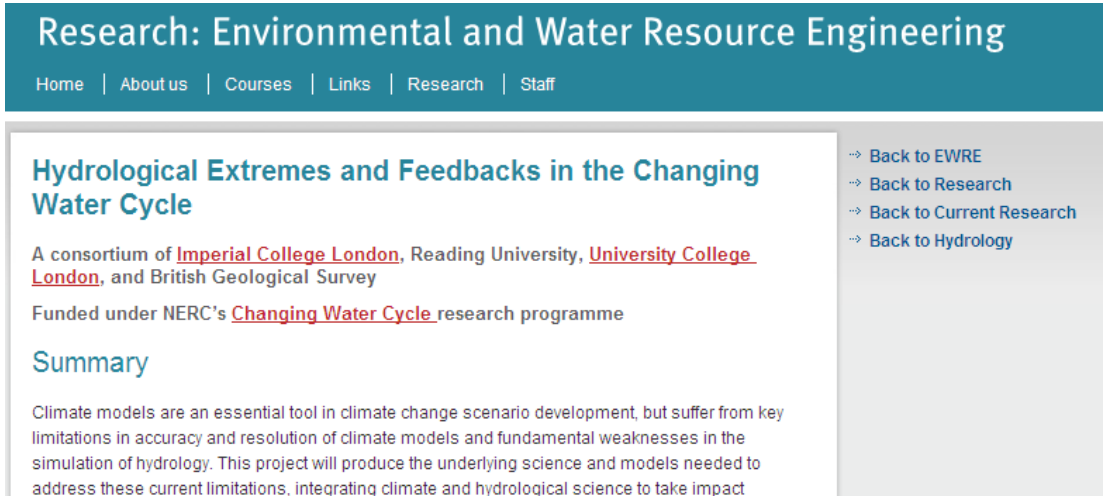
WEBSITE

Project web-pages will be hosted on Imperial College website

Links to partners & CWC
Project summary
Project reports & other outputs
Meta-data



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DELIVERABLES AND DISSEMINATION

1. Meta-data base
2. Software/open-source code (where possible)
3. Inception Report
4. Interim Report
5. Final Report

6. Journal publications
7. Meetings, conferences, etc

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Links to relevant projects and programmes

1. Other CWC Projects / Storms
2. FREE
3. FRMRC2
4. DEFRA-EA DTC (Eden)
5. Grantham / Walker Institute projects
6. CEH / Met Office JULES groups
7. CSIRO, University of Saskatchewan & GEWEX
8. EU Inter-reg hydro-chemistry Chalk & Granite CLIMWAT (Brighton, Dr Salima)
9. LWEC projects
10. EA/UKWIR/BGS Future flows in GW (Glenn Watts, CJ).

Project meeting

- Programme for today
- Appointments
- Case studies specification
- Field trip
- Website
- Inception report
- Meeting dates
- AOB

Inception report

- Summary [Neil – as proposal]
- Research staff appointments [PIs to email Neil]
- List of project team [Neil]
- List of steering group [Neil]
- Any changes so far to proposed programme of work [PIs]
- Case study specification [Imperial/BGS]
- List of deliverables [Neil – as proposal]