Hydro-JULES
Next Generation Land Surface and Hydrological Predictions

Work Package 3: Surface hydrology and soil moisture

WP lead: Nick Reynard

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

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NERC SCIENCE OF THE ENVIRONMENT

Improving surface water hydrological models

- Soil hydraulics
- Soil moisture
- Runoff generation schemes
- River routing
- Inundation
- Nutrient transport processes
- Anthropogenic influences

Task 3.1

Simon Dadson, Eleanor Blyth, Bob Moore, Vicky Bell……

Improve model representation of infiltration, soil hydraulics and runoff generation

- Starts 2019-20
- What is the best representation of soil hydraulics for large-scale hydrological modelling in the UK and overseas?
- Non-saturated flow
  - Darcian and non-Darcian flow
  - Scale and location dependencies
- Representation of frozen or weathered soil processes

Task 3.2
Doug Clark, Vicky Bell, Simon Dadson, Steve Cole,
Ramesh Ponnambalam, Toby Marthews, Helen Davies……

Improve river routing and inundation mechanisms

- Starts 2018-19
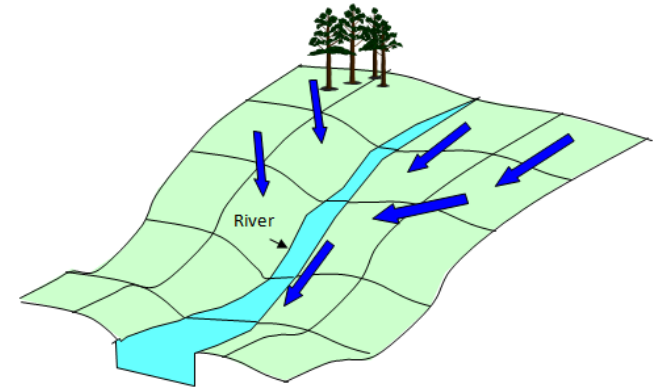
- What are the best routing schemes for national-scale hydrological modelling?

- Develop and implement routing codes suitable for variable direction and resolution applications
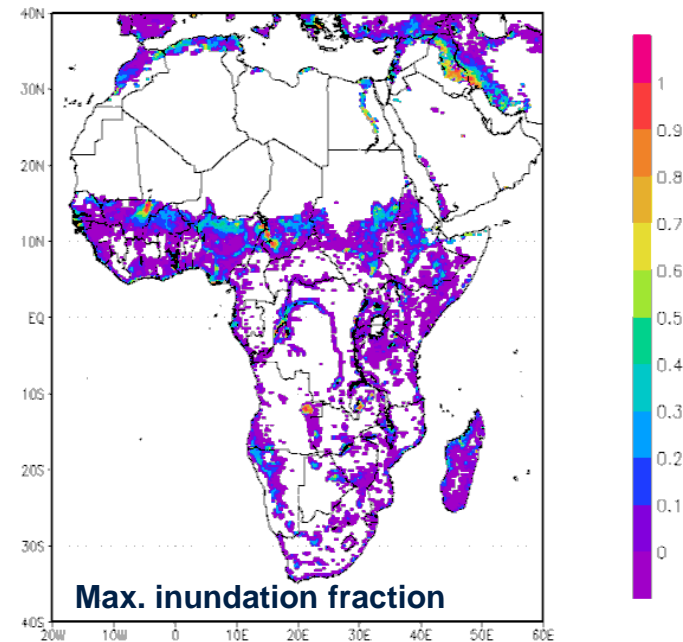
Task 3.2 (cont'd)

Doug Clark, Vicky Bell, Simon Dadson, Steve Cole, Ramesh Ponnambalam, Toby Marthews, Helen Davies……

Improve river routing and inundation mechanisms

- Investigate methods to diagnose inundation extent in models

Max. inundation fraction
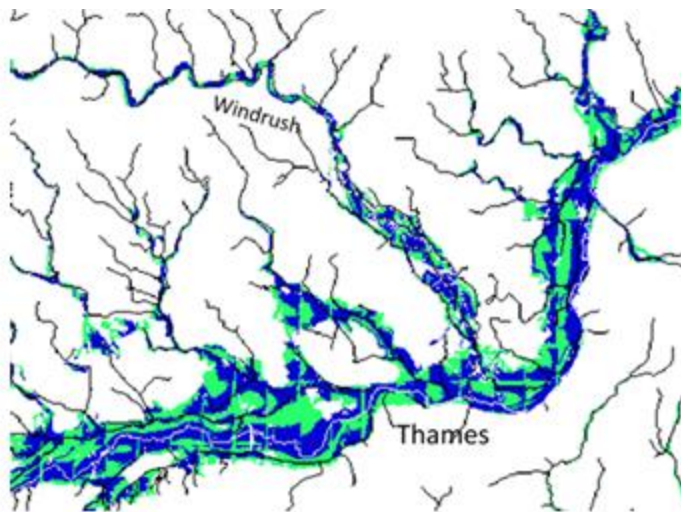
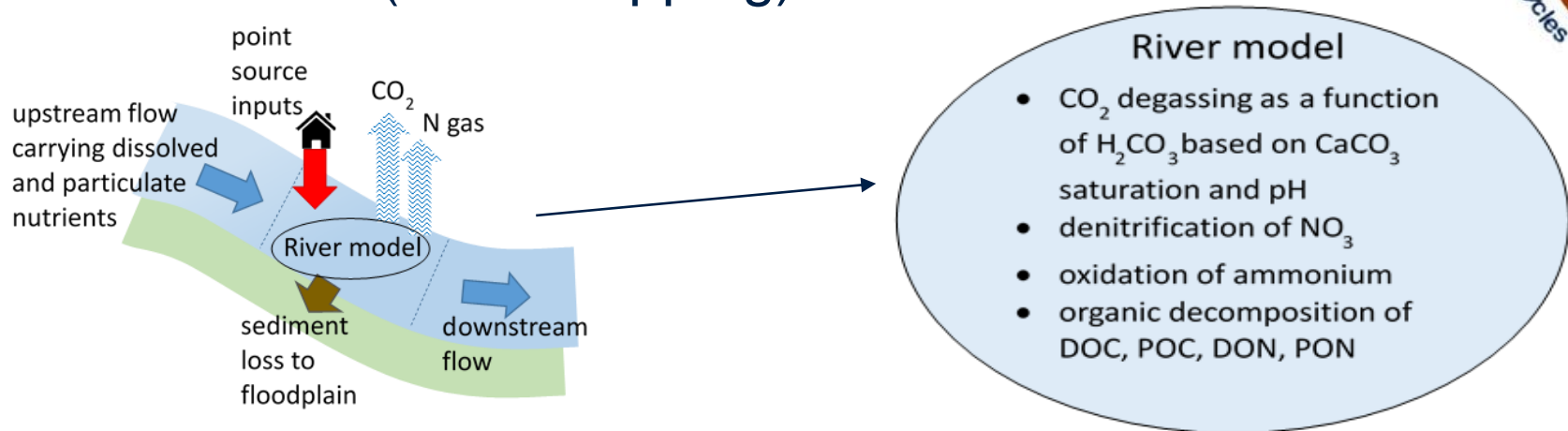Modelled inundation extent

100 year flood extent

- Scales (global to local?)

- Feedbacks
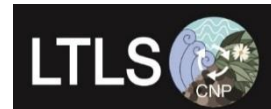
- Validation/assimilation of EO data

Task 3.3

Vicky Bell, Doug Clark, Rhian Chapman…

Enhance model representation of nutrient transport along river pathways

- Starts 2020-21

- Build on the LTLS-IM (Long Term Large Scale - Integrated Model) developed by the Macronutrients consortium (PI: Ed Tipping)

point source inputs

CO_2 N gas

upstream flow carrying dissolved and particulate nutrients

River model

sediment loss to floodplain

downstream flow

River model

- CO_2 degassing as a function of H_2CO_3 based on $CaCO_3$ saturation and pH
- denitrification of NO_3
- oxidation of ammonium
- organic decomposition of DOC, POC, DON, PON

Schematic of LTLS-IM in-river model processes

Bell et al. (in prep) Long-Term and Large-Scale simulations of macronutrients (C, N and P) in UK freshwater systems.

Task 3.4

Virginie Keller, Nathan Rickards, Ramesh Ponnambalam…

Include anthropogenic influences on the water cycle

- Starts 2018-19

- Impact of managed water systems on the hydrological cycle

- Framework (data and models) to represent anthropogenic water demand, crop water use, abstractions, irrigation, and impoundments

Task 3.4

Include anthropogenic influences on the water cycle

- Progress to date:
  - Literature review of data sources and approaches
  - Assessment of models implementing anthropogenic influences
  - Data gathering of data for the characterisations of influences in the UK