Developing regional scale hydrodynamic models

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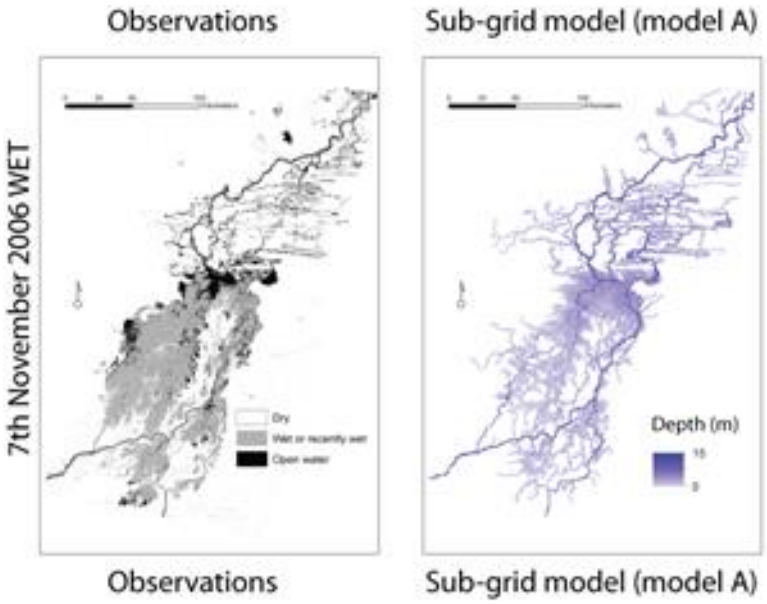
Project description:



There is increasing interest in simulating river and wetland hydrodynamics at very large scales and understanding how such systems might respond to external forces, such as climate and urbanisation. This interest is primarily driven by the need in both government and industry (e.g. insurance) to manage the risk posed by very large regional scale natural disasters, such as flooding and drought, both now and under future climate scenarios. Fundamental science that advances our understanding of these systems through the estimation of variables such as river discharge is also needed.

Recent developments in high performance computing and numerical methods have made it possible to simulate hydrodynamics over large areas at previously impractical resolutions [Neal et al., 2012]. However, significant uncertainties relating to model structure and sources of errors remain. Furthermore, observations of these systems are typically sparse in space and time or from indirect remote sensing platforms [Alsdorf and Lettenmaier, 2003]. This necessitates the development of advanced methods to evaluate these data and assimilate them with the hydrodynamic models.

Recently the University of Bristol have been working on a modelling framework for simulating the River Niger in West Africa, with a focus on the dynamics of the complex Niger Inner Delta wetland system (Figure 1)[Neal et al., 2012]. The PhD will develop new data sets to force this modelling framework at regional scales, with a particular focus on driving the model with outputs from land surface schemes and remote sensing data. There will also be the opportunity to investigate the potential for assimilating both in situ and remote observations with model simulations in order to more accurately simulate river dynamics and estimate discharge.

References:

Alsdorf, D. E., and D. P. Lettenmaier (2003), Tracking fresh water from space, Science, 301(5639), 1491

Neal, J., G. Schumann, and P. Bates (2012), A subgrid channel model for simulating river hydraulics and floodplain inundation over
large and data sparse areas, Water Resources Research, 48(11), W11506.