Pantanal Workshop
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Modelling hydrology and N transport in Scotland

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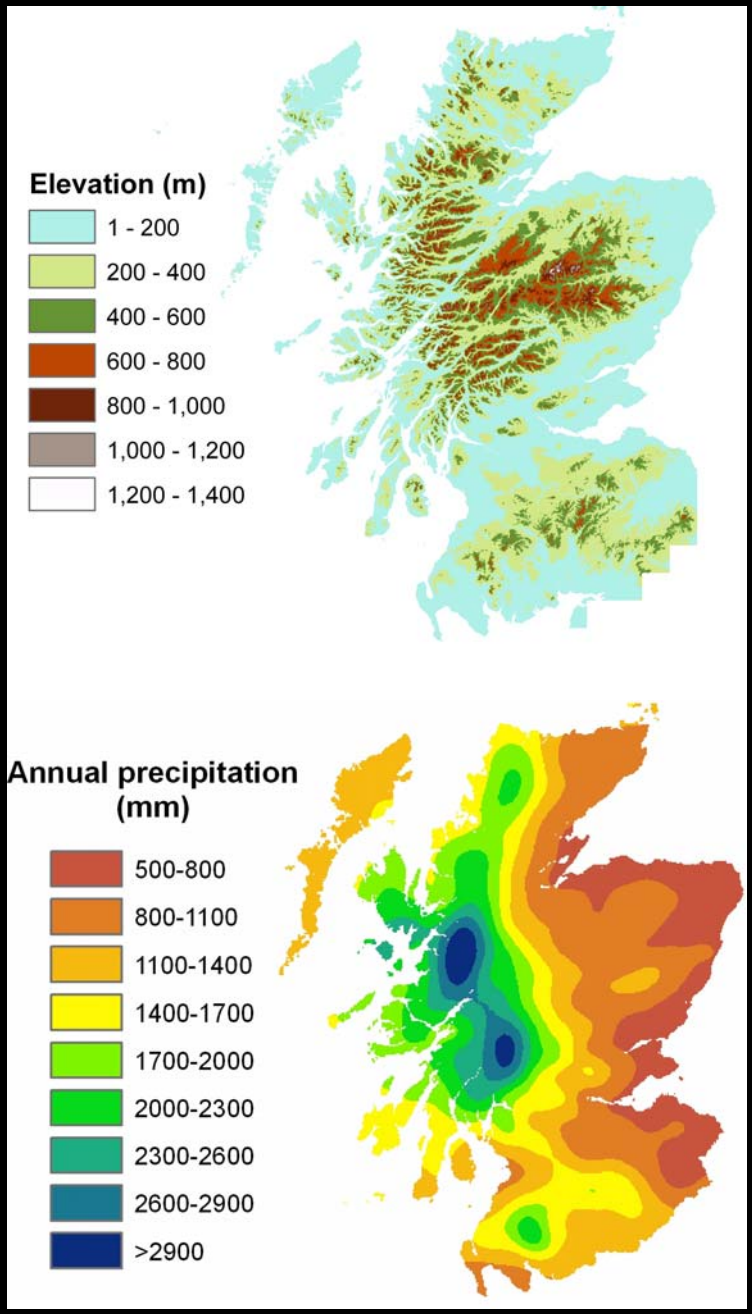
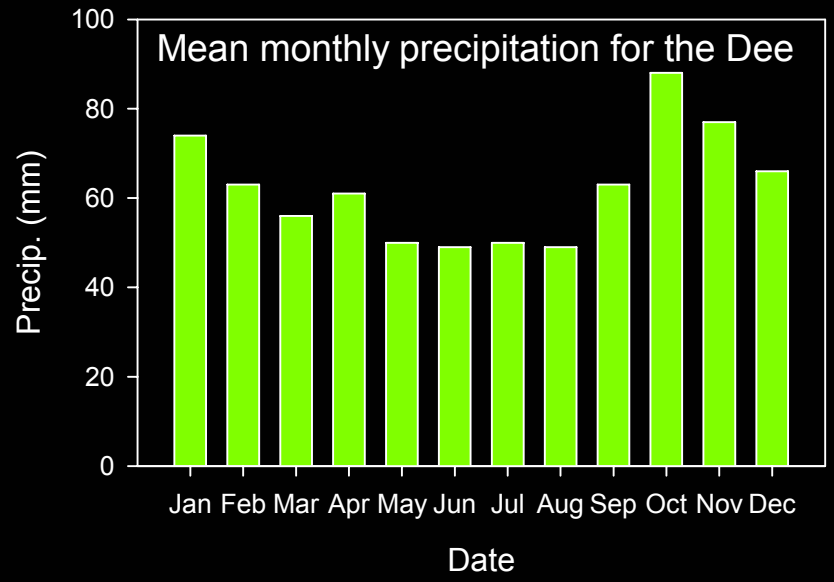
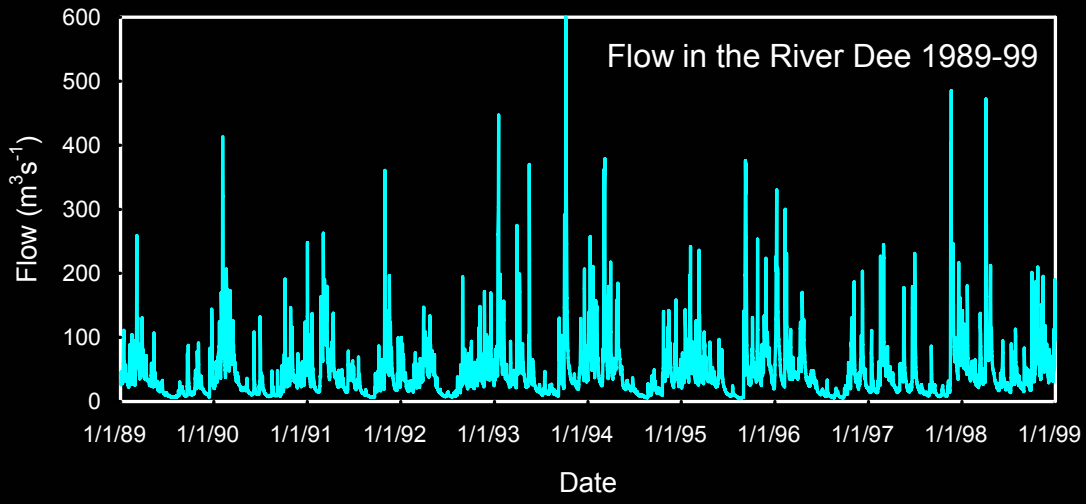
Outline

- Introduction – key processes
- National scale modelling
- Catchment scale modelling
- Tracer studies

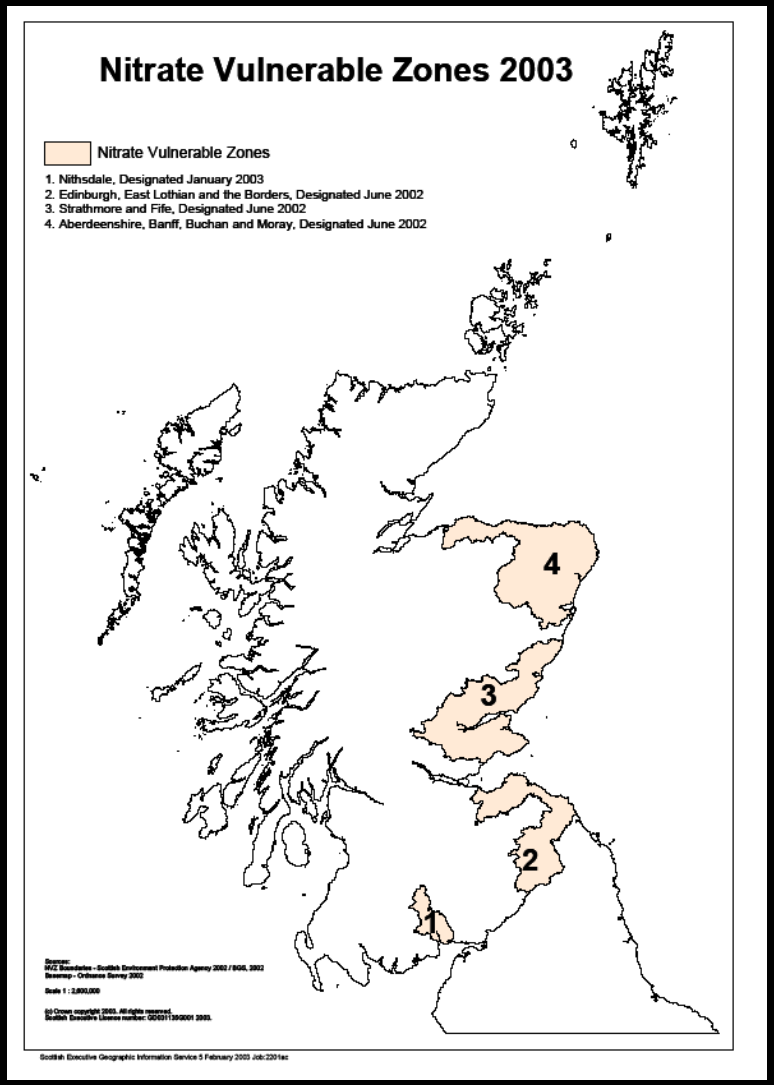
Hydrology in Scotland

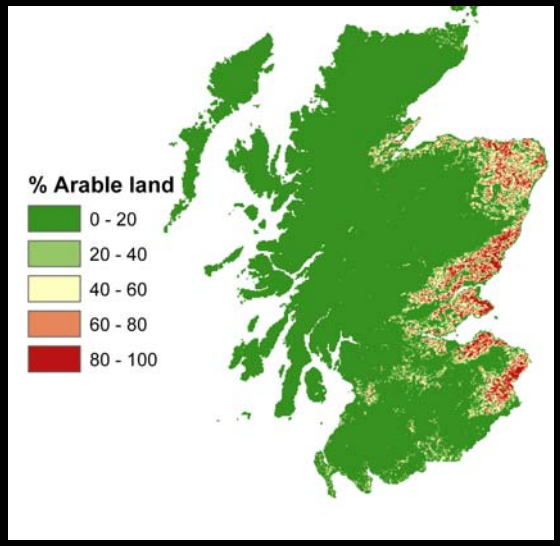




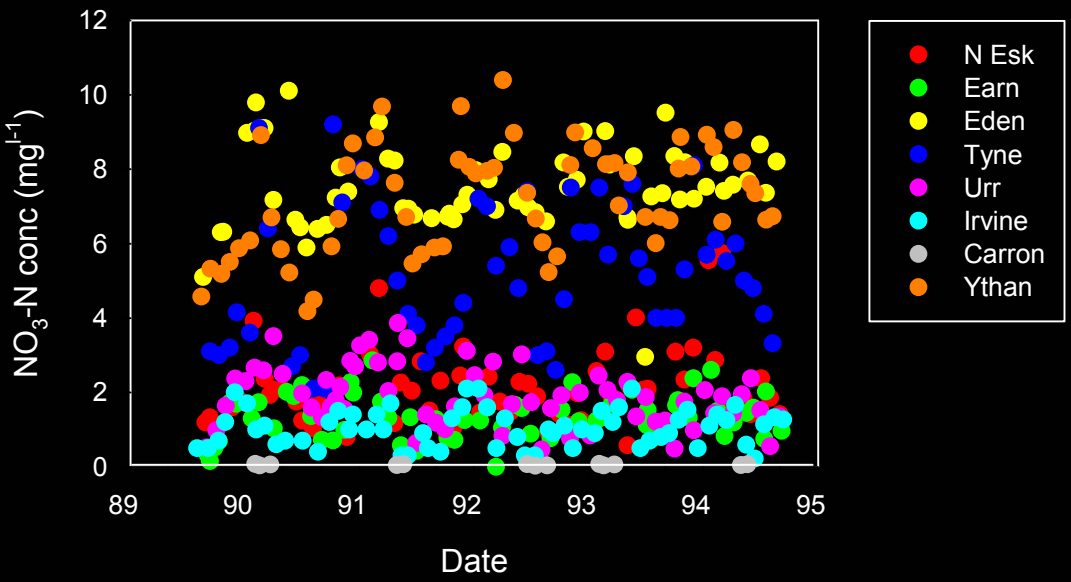


Nitrogen in Scotland

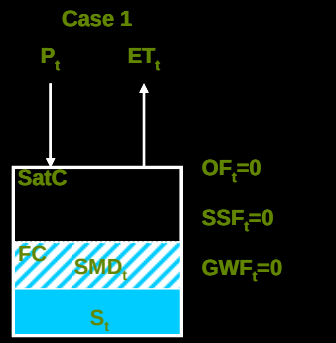


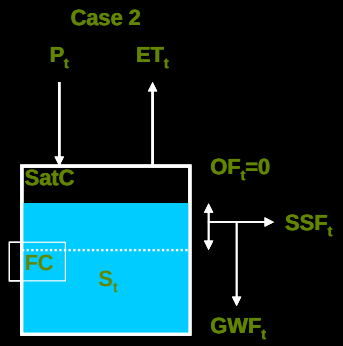


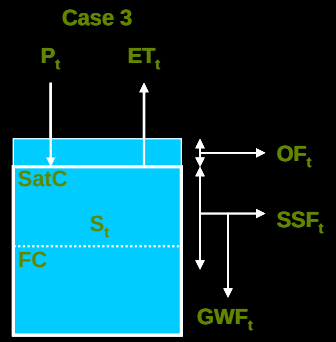
N concentrations in 8 Scottish catchments

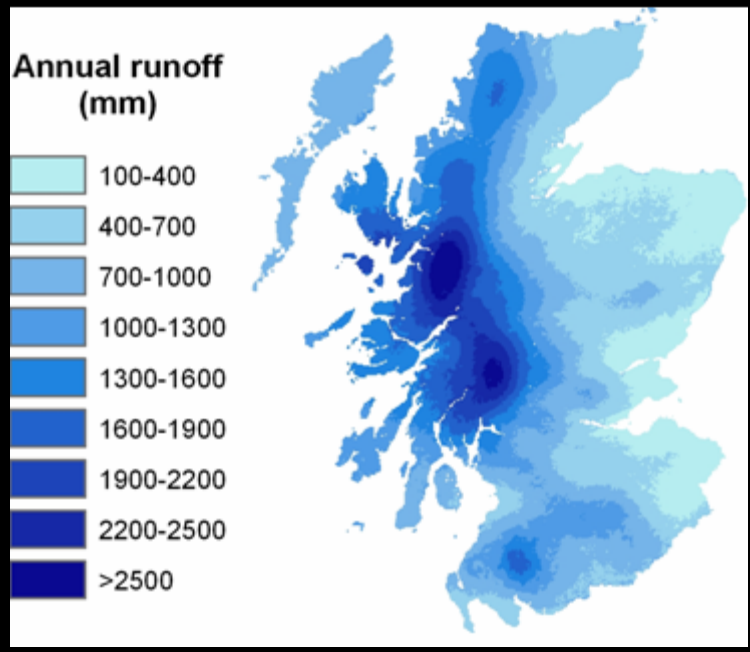


National Water Balance Model







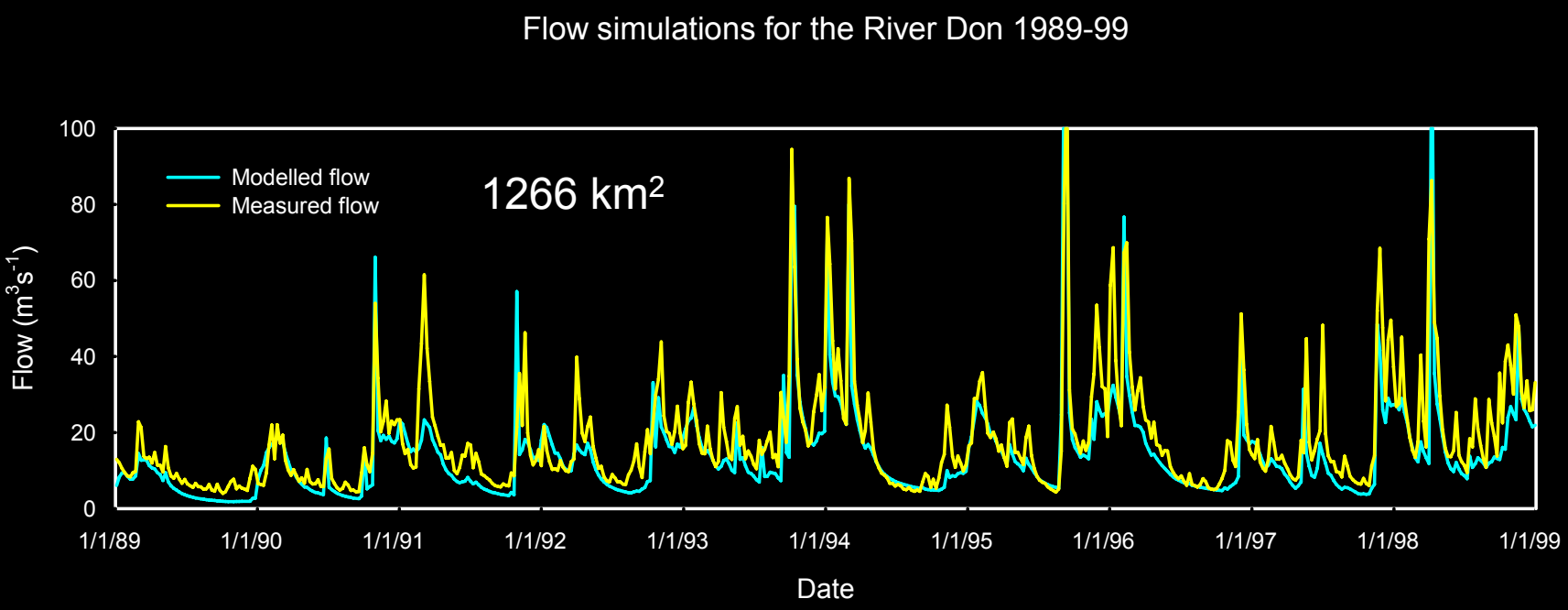


- Applied nationally at 1km^2 spatial resolution with a weekly time-step

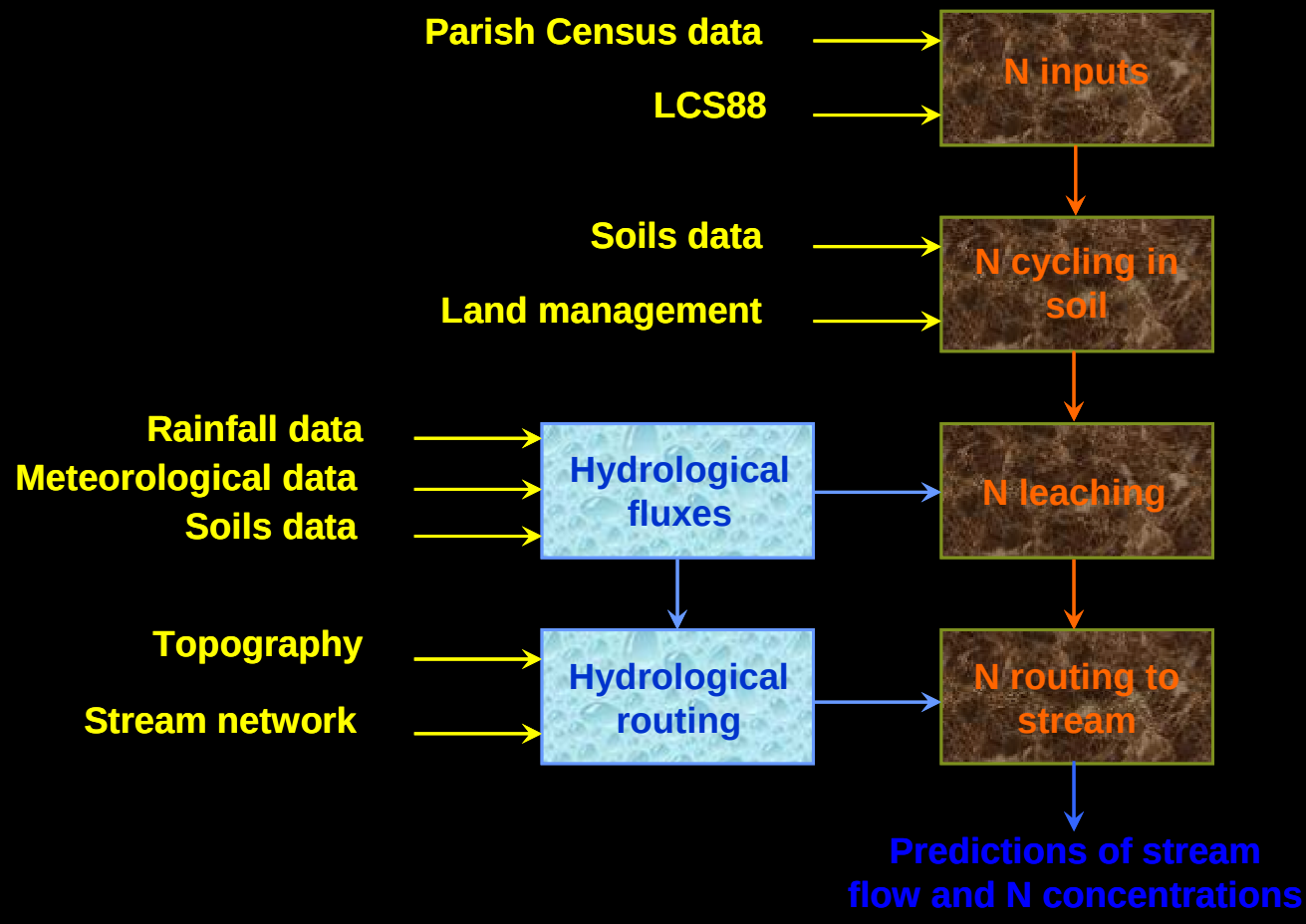
- Required Datasets:
  - Precipitation, ET, DEM essential
  - Soils, land cover, geology useful

National Water Balance Model

- Runoff can be aggregated across any defined catchment area to give time-series simulations for large catchments

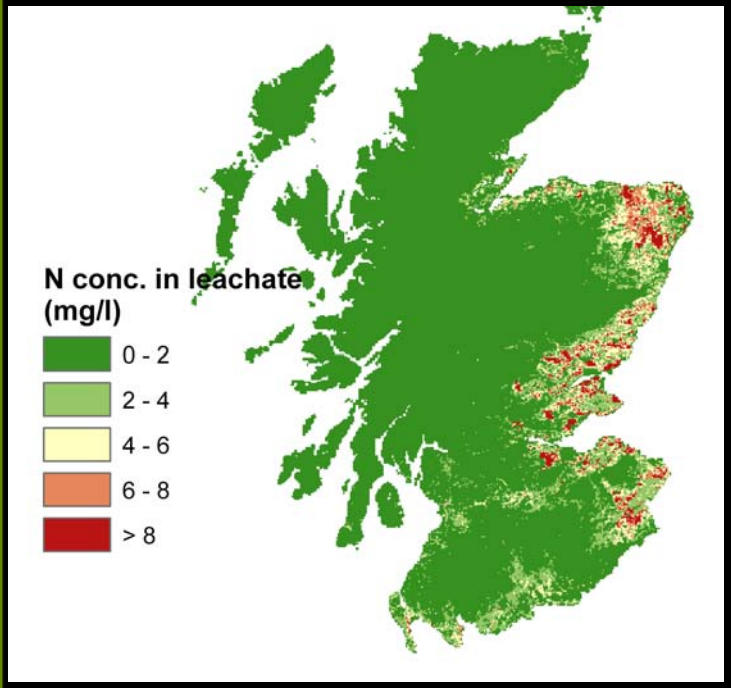


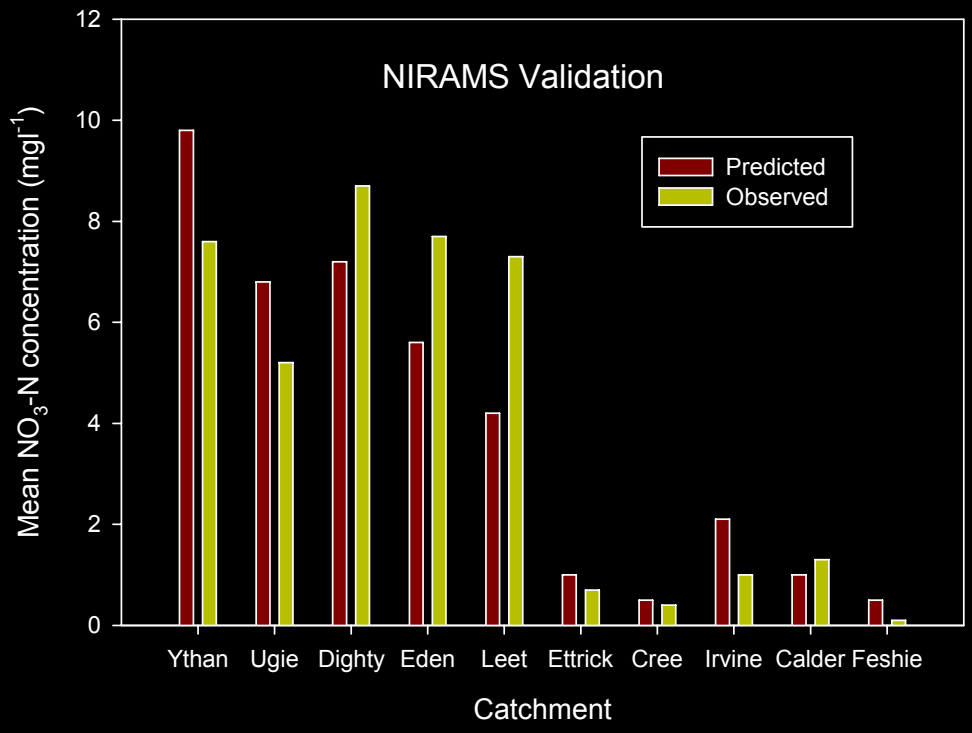
NItrogen Risk Assesment Model for Scotland



NIRAMS results

- Model predictions are adequate for identifying which catchments are most at risk from diffuse pollution by N

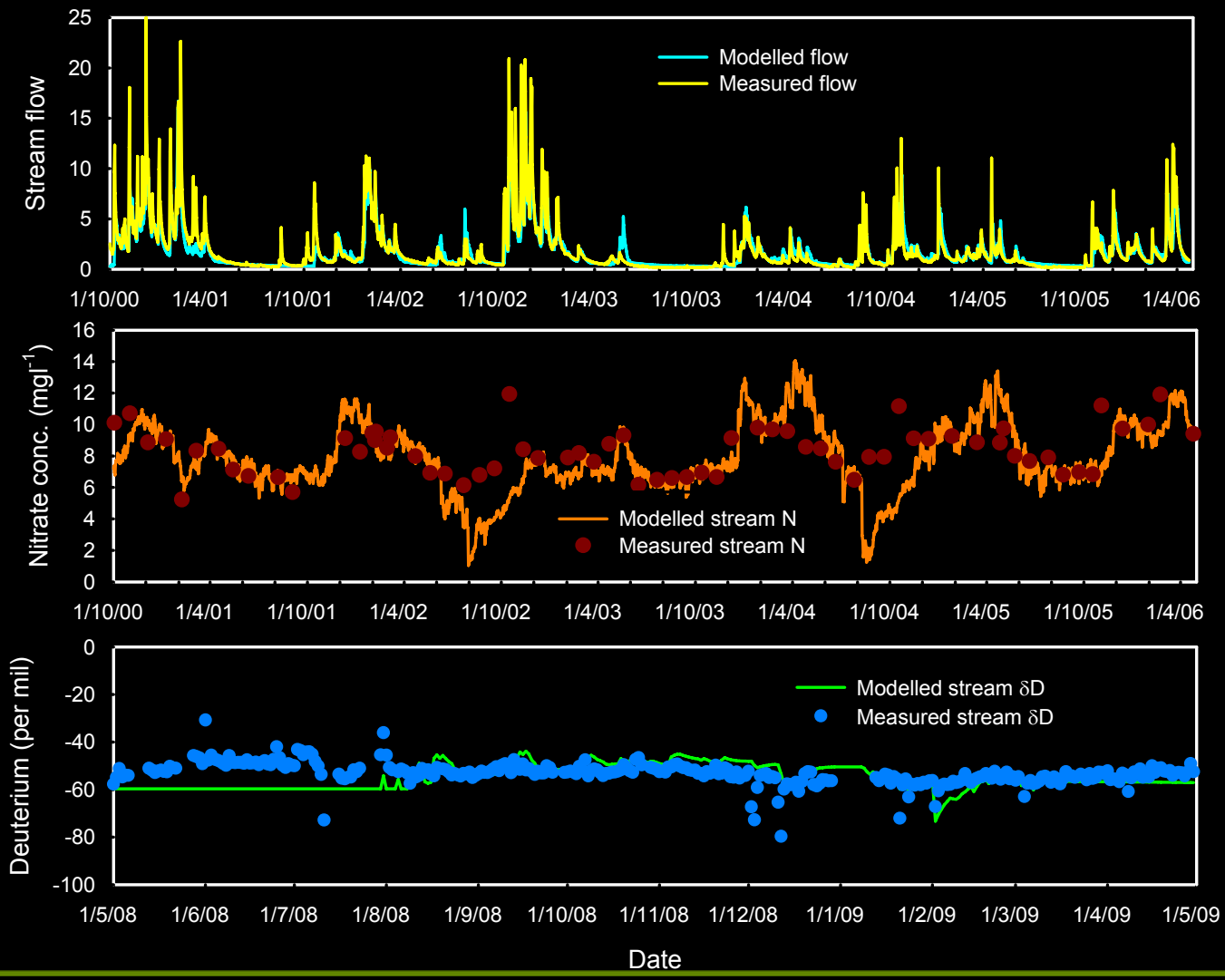




Catchment scale modelling - STREAM

- Similar approach to national scale, but more detailed runoff routing and uses finer spatial and temporal resolutions
- 4 potential runoff mechanisms: infiltration excess, shallow sub-surface storm response, deep sub-surface runoff, regional groundwater
- Transport of solute tracer associated with flows
- Associated N model with time varying N balance and some additional processes (mineralisation, de-nitrification)

STREAM simulations – Lunan catchment



Natural tracers

- Permit analysis of integrated behaviour at catchment scales
- Hydrochemical tracers such as alkalinity, Si or DOC can help define sources of water and flow pathways
- Isotopes of water, $\delta^{18}O$ and δD, can provide information on mixing processes and help characterise sources of water over large spatial scales
- Atmospheric tracers such as CFC, SF_6 or ^{14}C can be used to date older groundwater sources

Groundwater dating