NUTCAT-2050

Estimating Nutrients in Catchments to 2050

A multi-model uncertainty assessment of phosphorus transport using high frequency data

TERENO International Conference 30th September 2014

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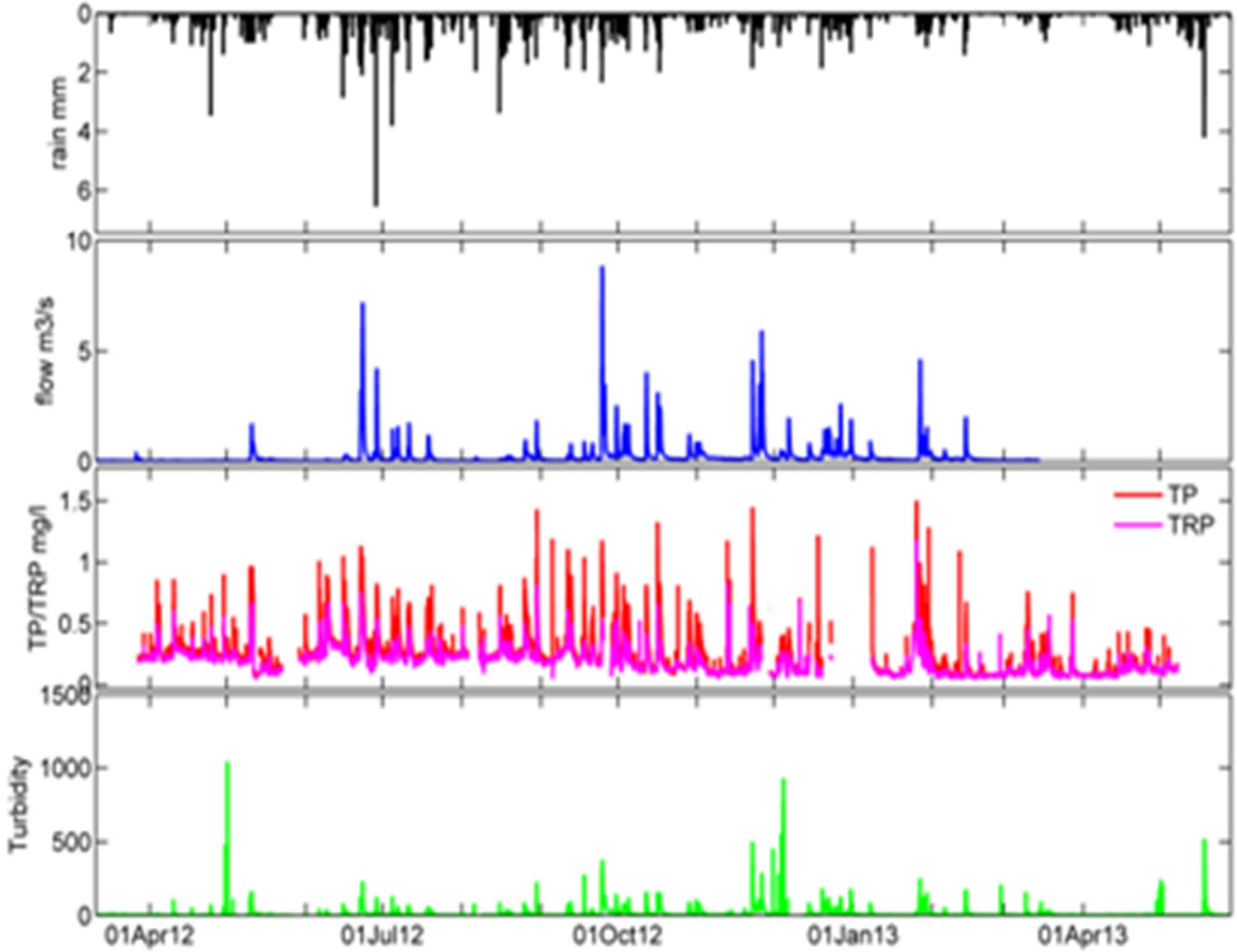
Phosphorus and water quality

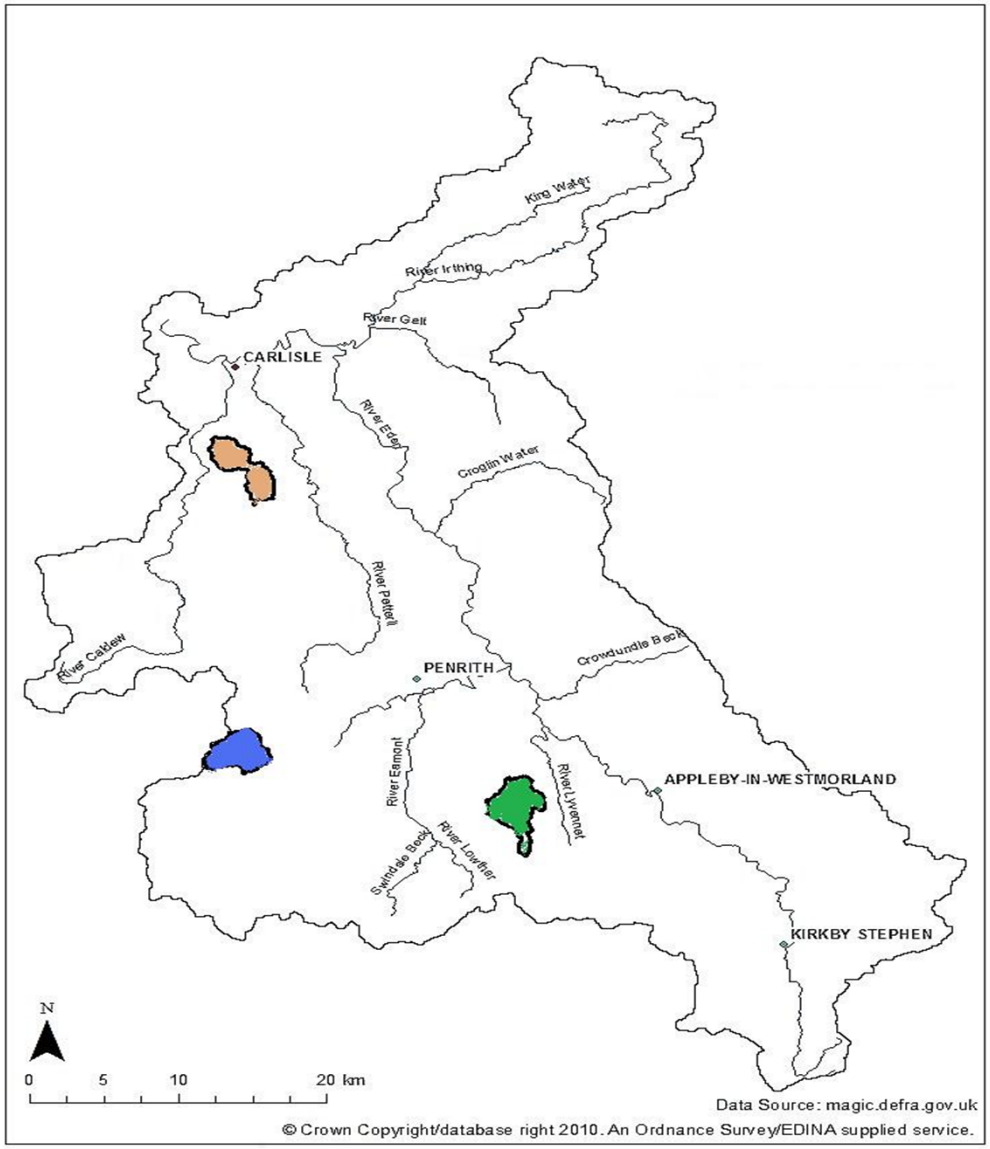
- Phosphorus (P) in rivers results in poor water quality (eutrophication)
- How will P transfer respond to future change?

Aim: How well do current water quality models predict P transfer in non-stationary environments and what is the uncertainty?


rain mm
0
2
4
6
flow m3/s
10
5
0
TP/TRP mg/l
1.5
1
0.5
0
TP
TRP
1508
Turbidity
1000
500
0
01Apr12
01Jul12
01Oct12
01Jan13
01Apr13

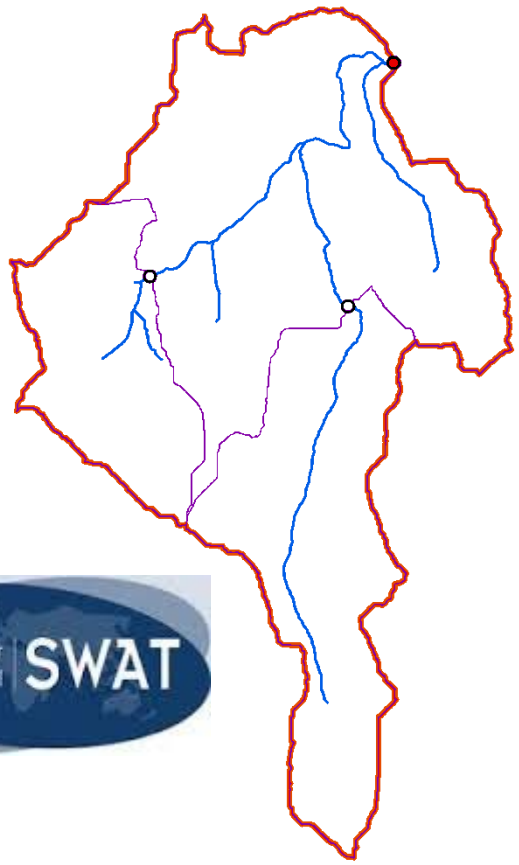
The River Eden Catchment

- 3 small headwater catchments (10 km^2)
- High resolution rainfall, discharge and turbidity data at 9 sites (15 mins)
- High resolution phosphorus data at 2 sites (30 mins)

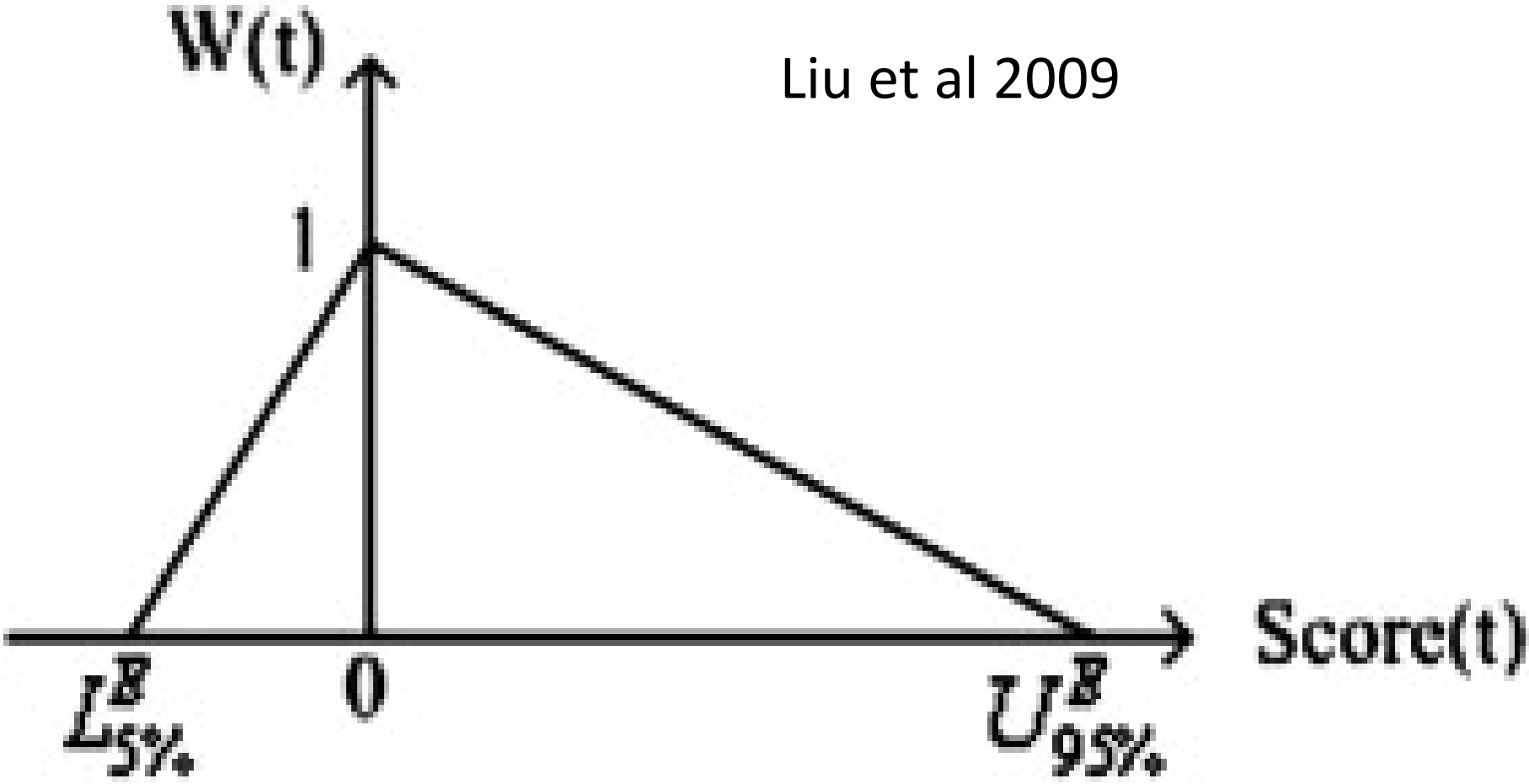


The Soil and Water Assessment Tool (SWAT)

- Semi-distributed process based model.
- Watershed delineated Digital Elevation Model (DEM) data.
- Hydrological response units (HRU) defined by soil type, land type and slope.



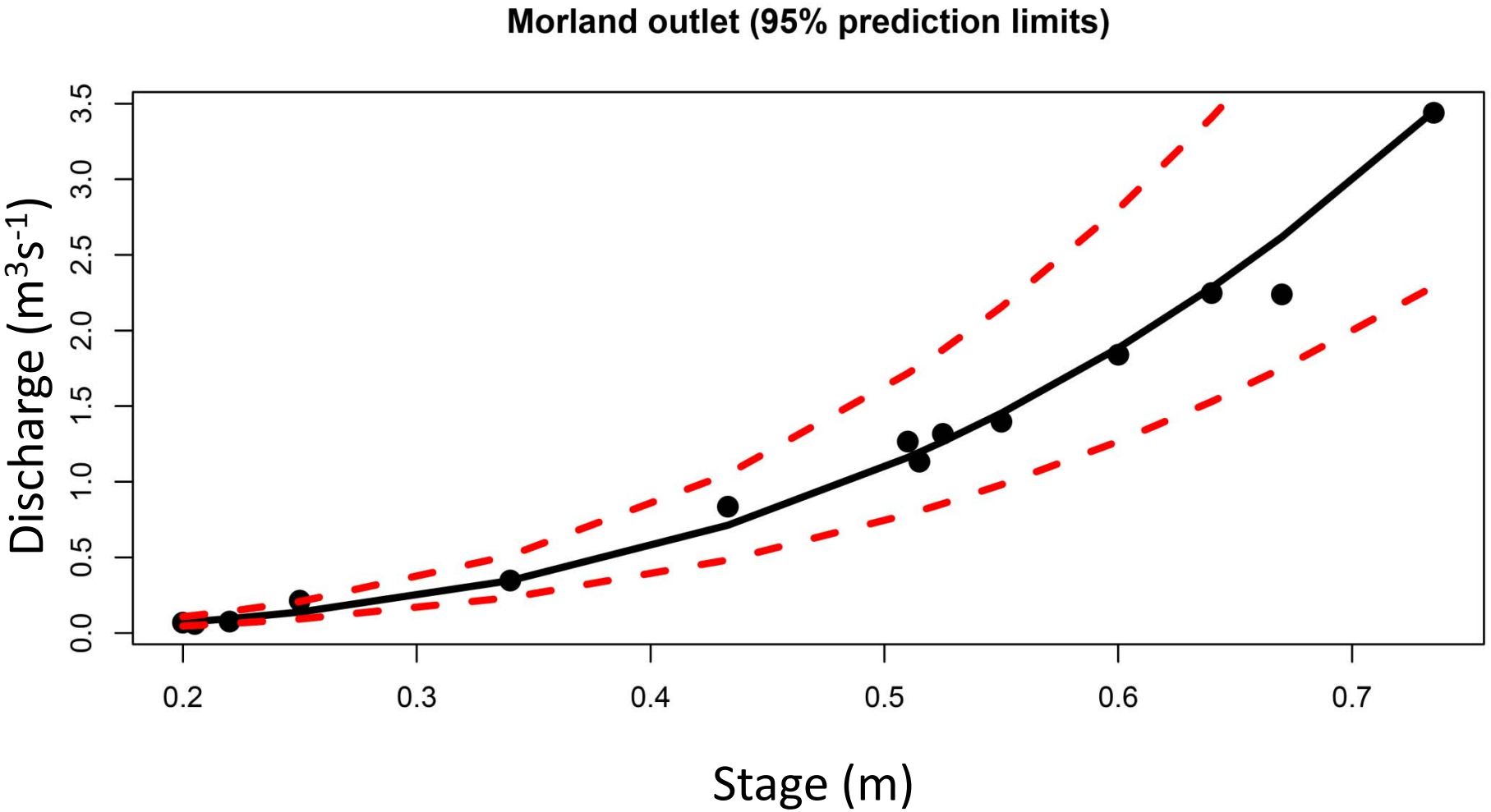
Morland catchment in the Eden , delineated using 5m NEXTMAP data.



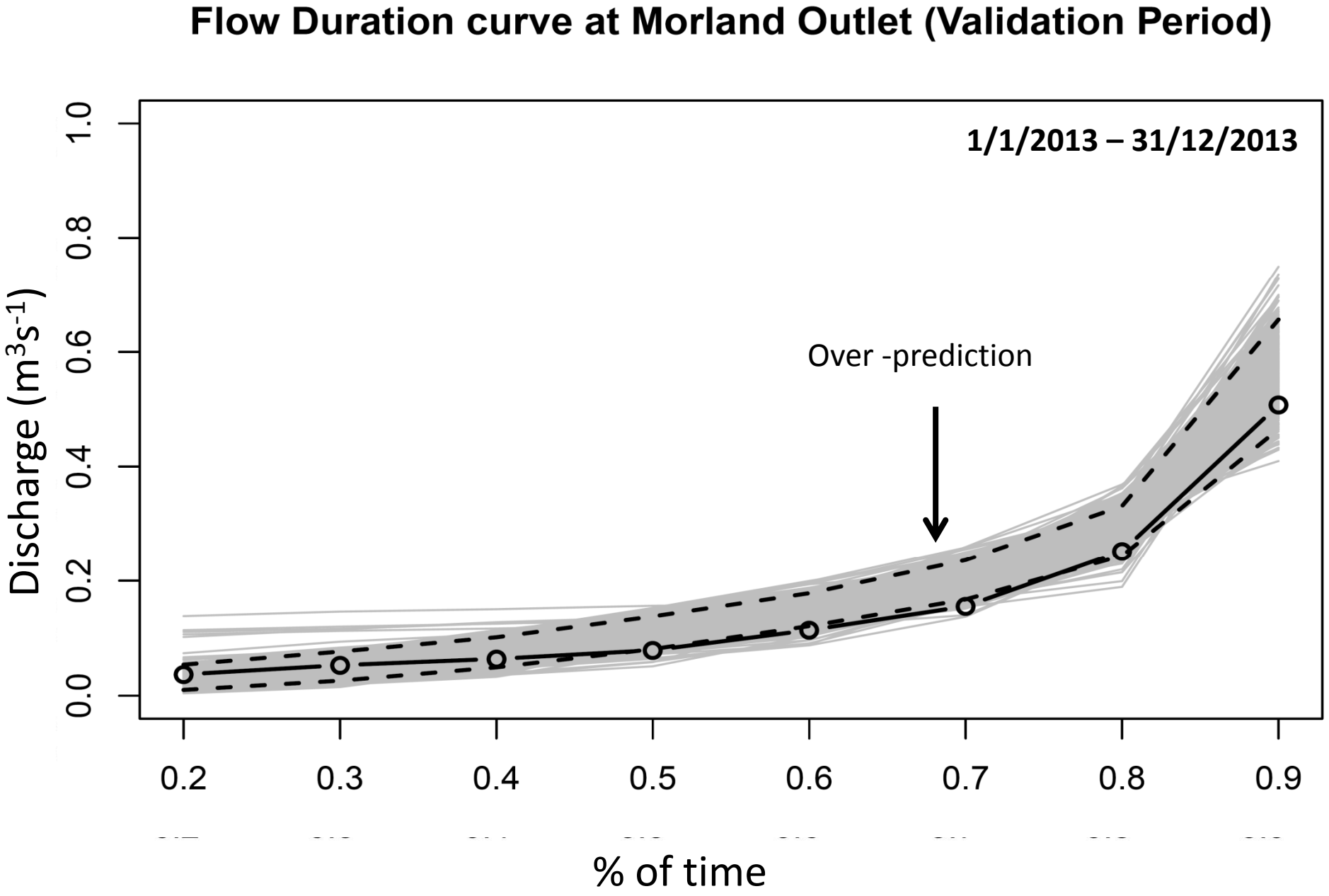
Liu et al 2009

Preliminary Results

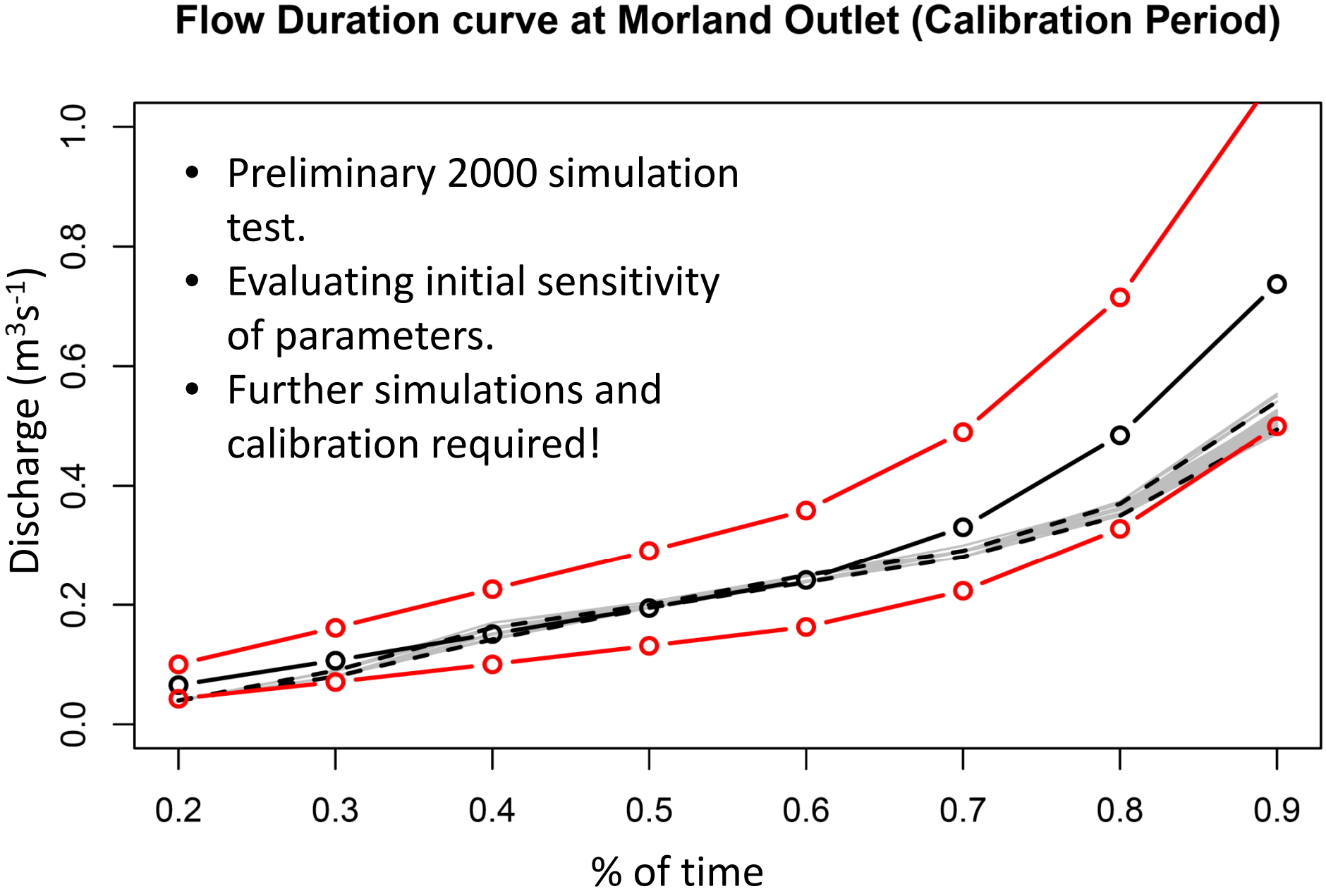
- 10000 SWAT simulations on Morland
- 19 parameters varied



SWAT


Flow Duration curve at Morland Outlet (Validation Period)
1/1/2013 – 31/12/2013
Over -prediction
Discharge (m^3s^{-1})
0.0
0.2
0.4
0.6
0.8
1.0
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
% of time

HYPE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0.8
0.9
% of time
• Preliminary 2000 simulation test.
• Evaluating initial sensitivity of parameters.
• Further simulations and calibration required!

Conclusions

- SWAT model performs well at Morland outlet with 499 behavioural simulations out of 10000
- Model demonstrates equifinality
- Important to first evaluate model hydrology – important implications for P transfer processes?
- More simulations required in calibration to adequately sample parameter space

Next Steps

- Set limits of acceptability for water quality measures. E.g. load duration curve quantiles
- Perform model calibration and validation on remaining sub-catchments within the Eden
- Apply GLUE method to other water quality models (e.g. HYPE)

Thank you

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For further information, please visit our website:
http://nutcat2050.org.uk/