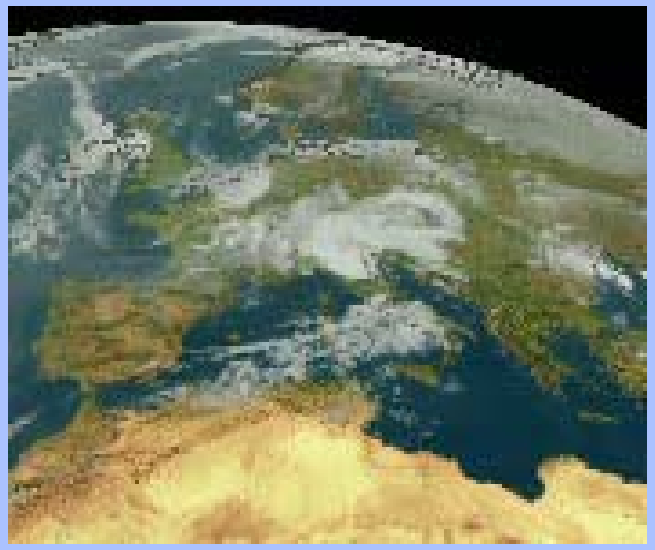
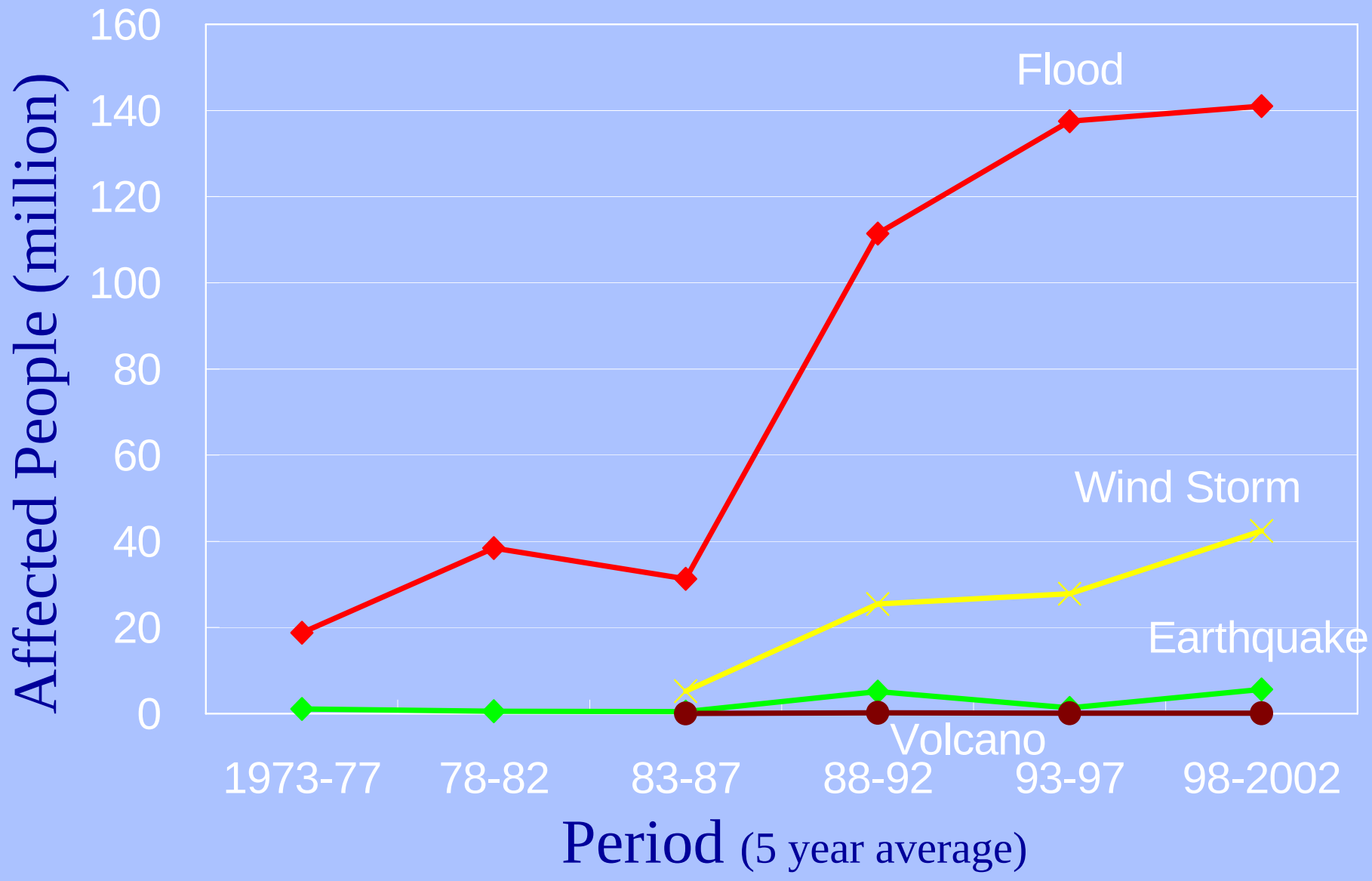
Lessons learned and improved technologies for real-time flood forecasting and warning



Jacob Høst-Madsen, M.B. Butts, C. Skotner, H. Madsen, H. Garsdal
DHI Water & Environment

Increasing Natural Disasters



Source: World Disasters Report, International Federation of Red Cross and Red Crescent Societies

What are the goals?

Forecasting information must be:

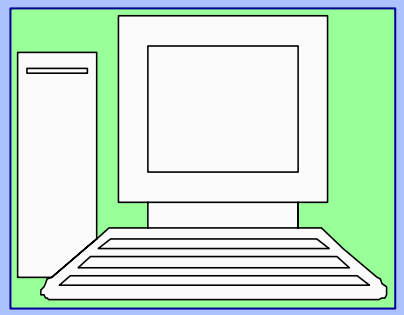
- **Fast**
- **Accurate**
- **Reliable**
- **Relevant and timely**
- **Easy to understand**

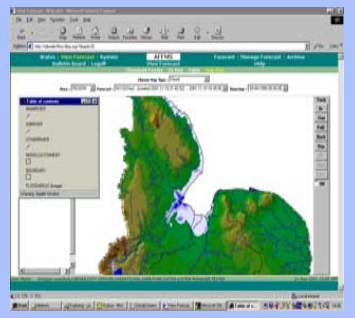
And decision support must be offered!

Event

Decision support system

Dissemination





Lessons learned and trends from many recent applications

> 40 practical real-time flood forecasting application

Lessons learned and trends from many recent applications

- Strong demands on dissemination
  - Fast
  - Accurate
  - Reliable
  - Relevant and and timely
  - Easy-to-understand

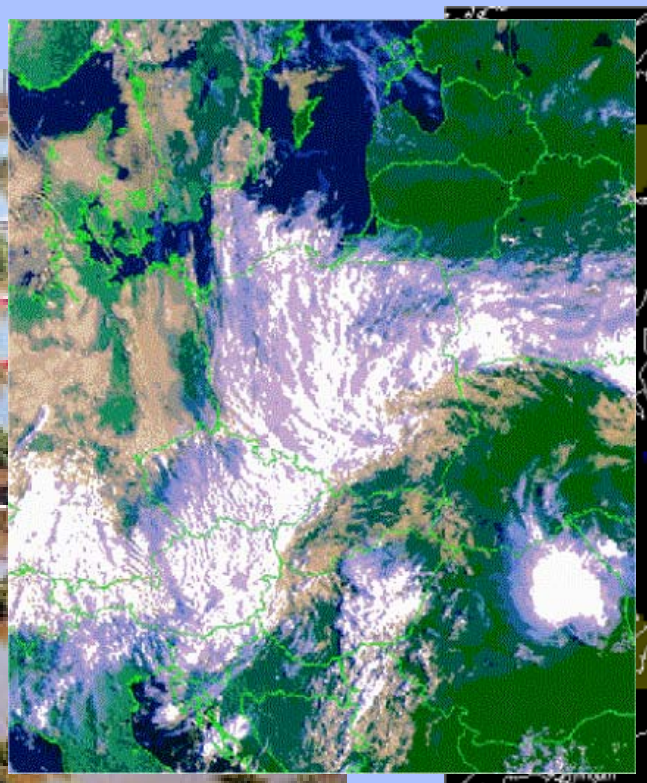
All relevant to MRC!

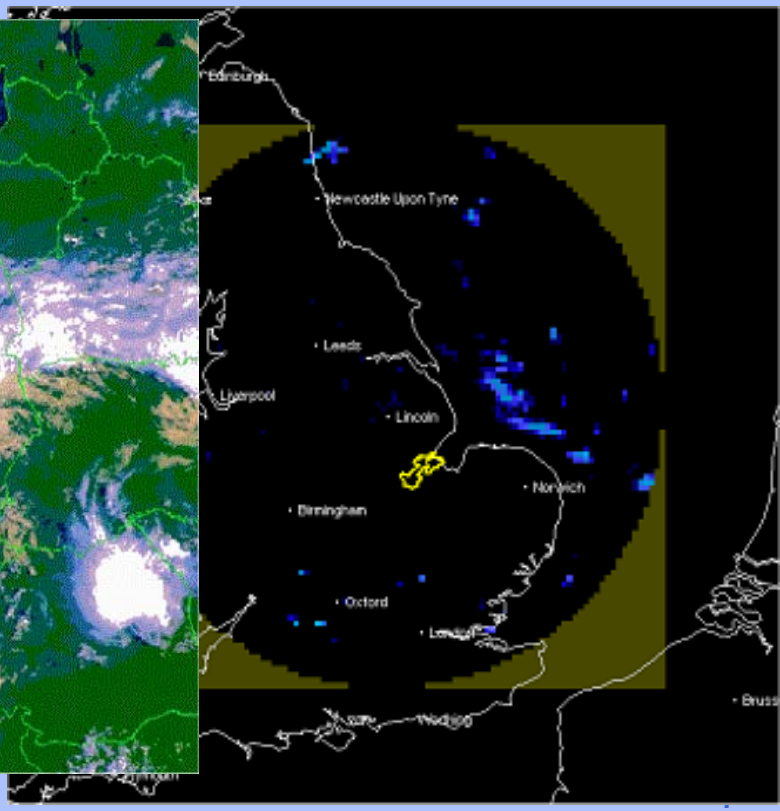
  - Advanced data assimilation
  - Use of spatially distributed data powered by GIS
  - Medium term forecasting capabilities
  - Decision support facilities
  - Web technology and cell broadcasting for dissemination
  - Added value through the multi-purpose use of the models

The FLOODRELIEF project

REaL-tImE Flood Decision Support System Integrating Hydrological, Meteorological and Radar Technologies

www.projects.dhi.dk/floodrelief





Uncertainty - Motivation

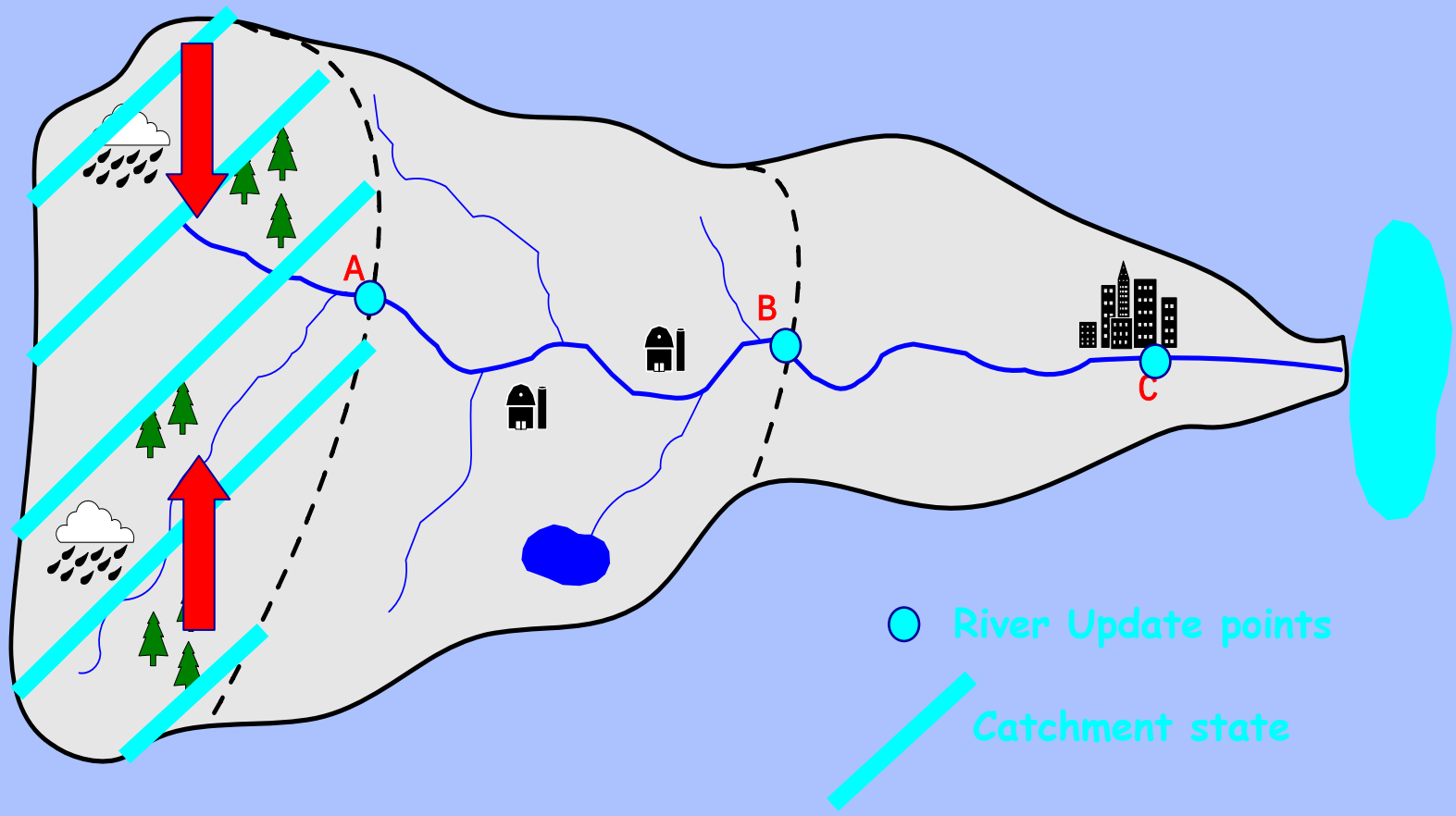
Uncertainty is inherent in the flood forecasting process. There are several challenges for the decision support:

- Quantify the uncertainty sources
- Evaluate the impact of the different sources on the flood forecast accuracy
- Provide this uncertainty information in a manner that can be understood by operational forecasts and decision makers
- Evaluate the impact of the uncertainty on the decision making and management options

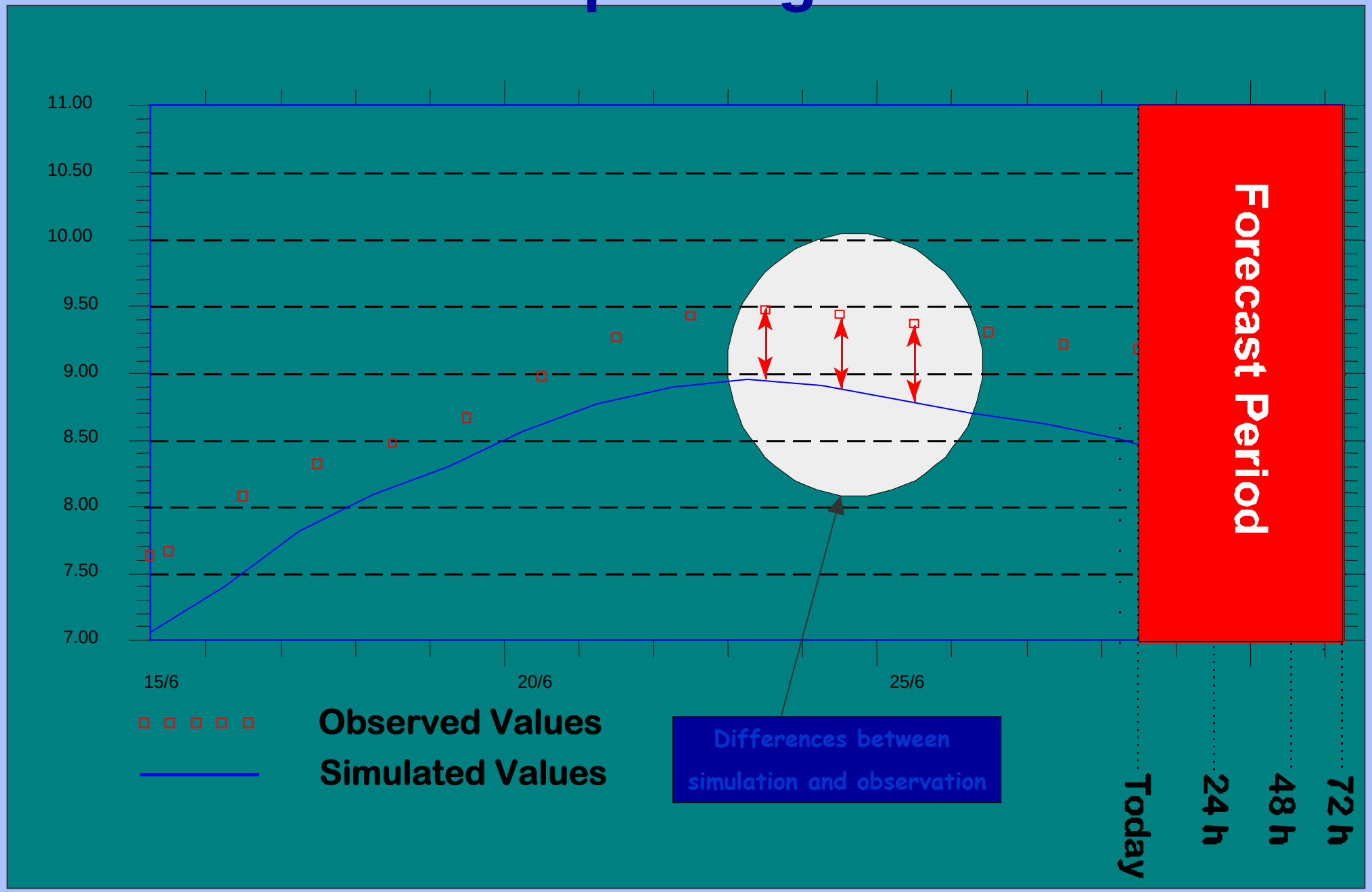
Ensemble Kalman Filter

Uncertainty Sources

Uncertainty in catchment rainfall – updating in both the catchment and the river system



Automatic Updating



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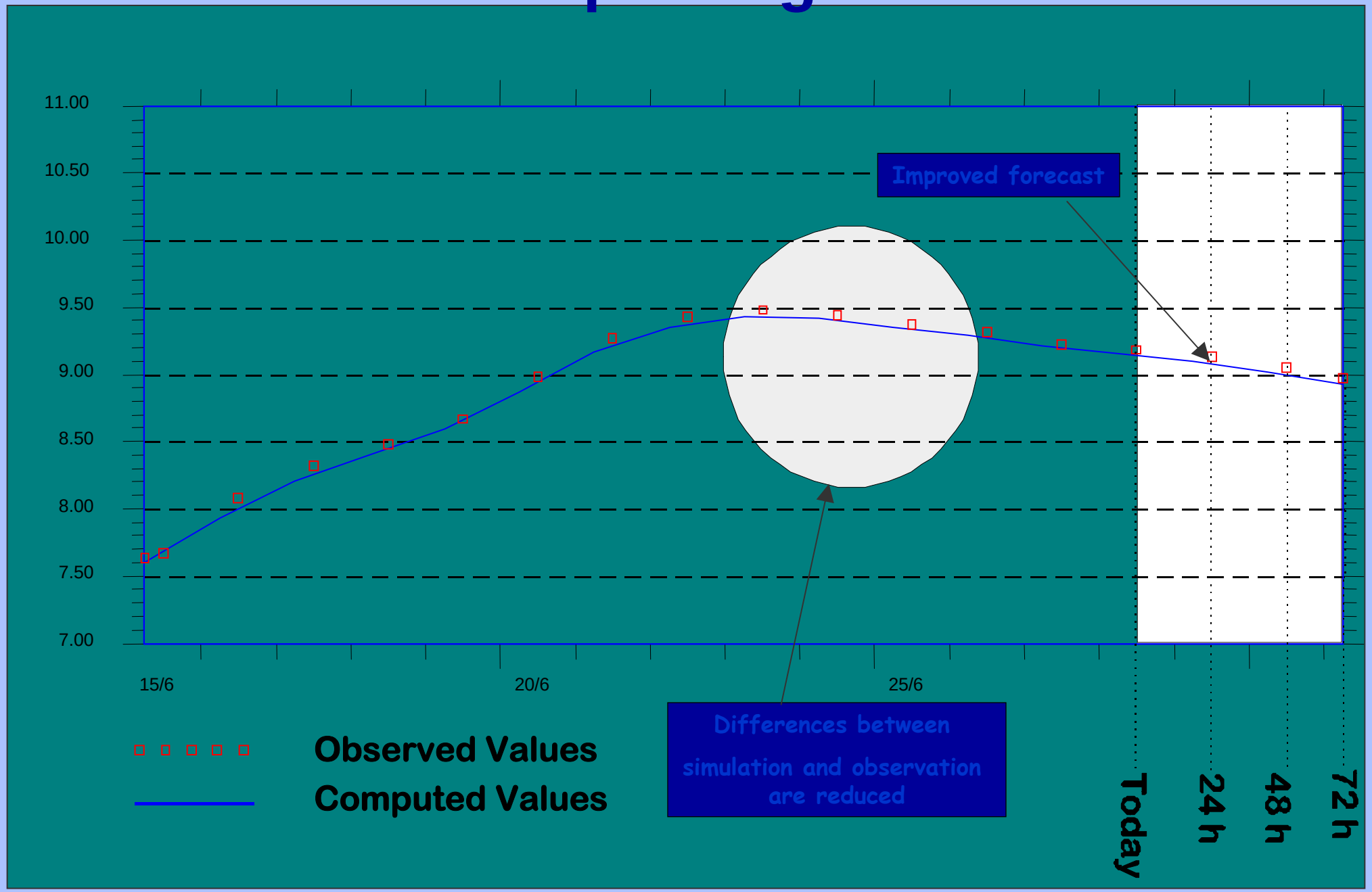
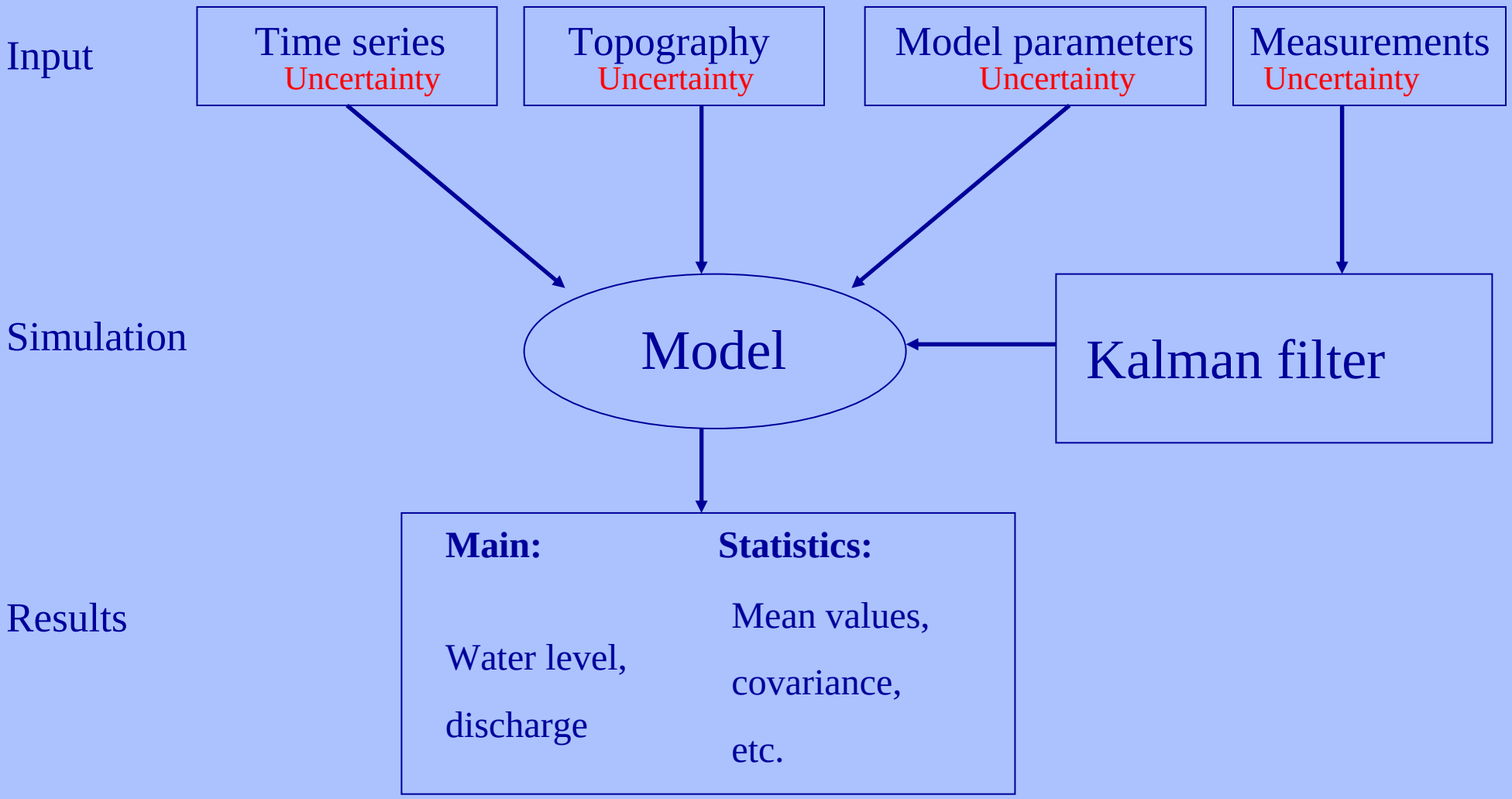


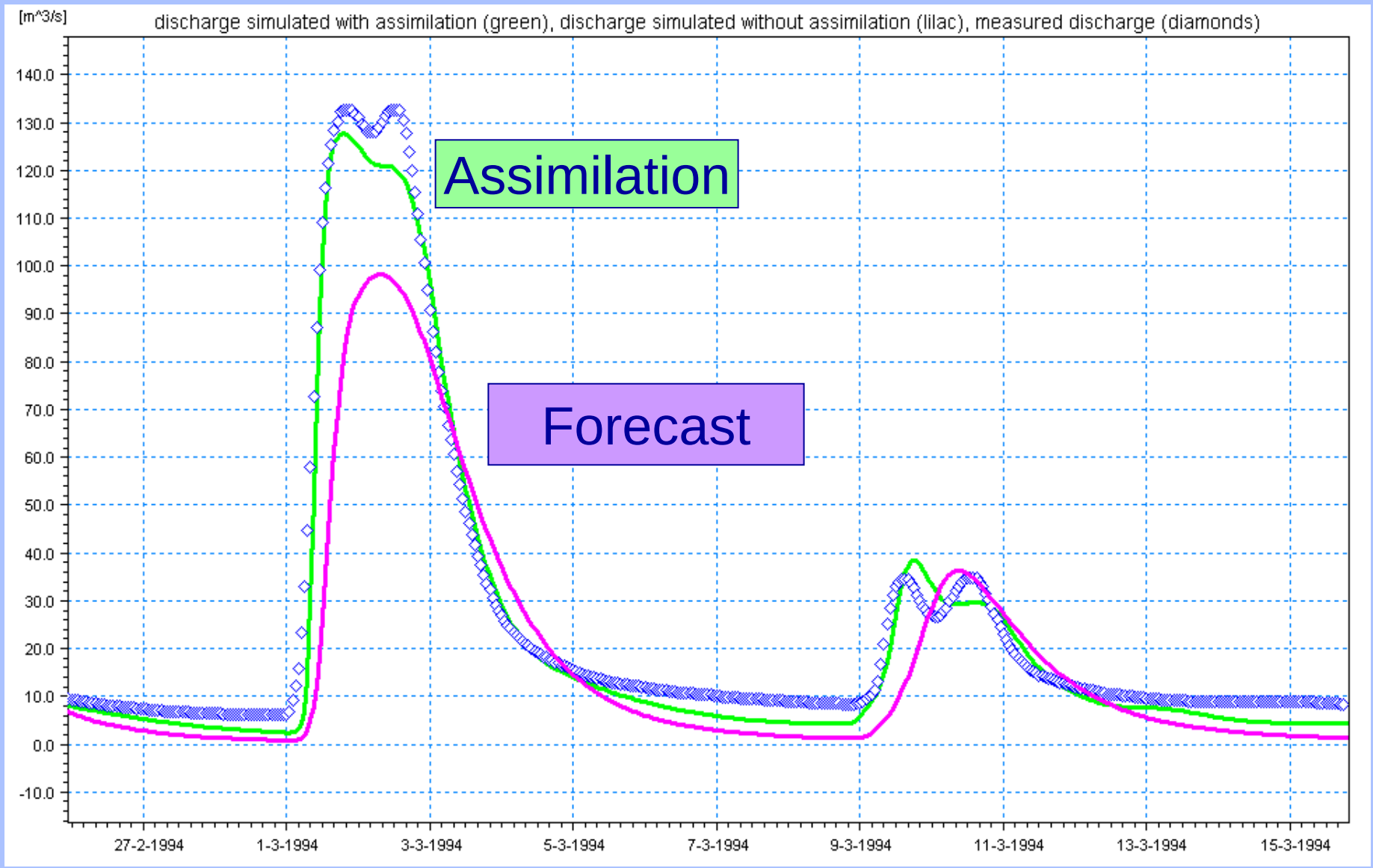
Current

Data assimilation

~~Traditional~~ model simulation

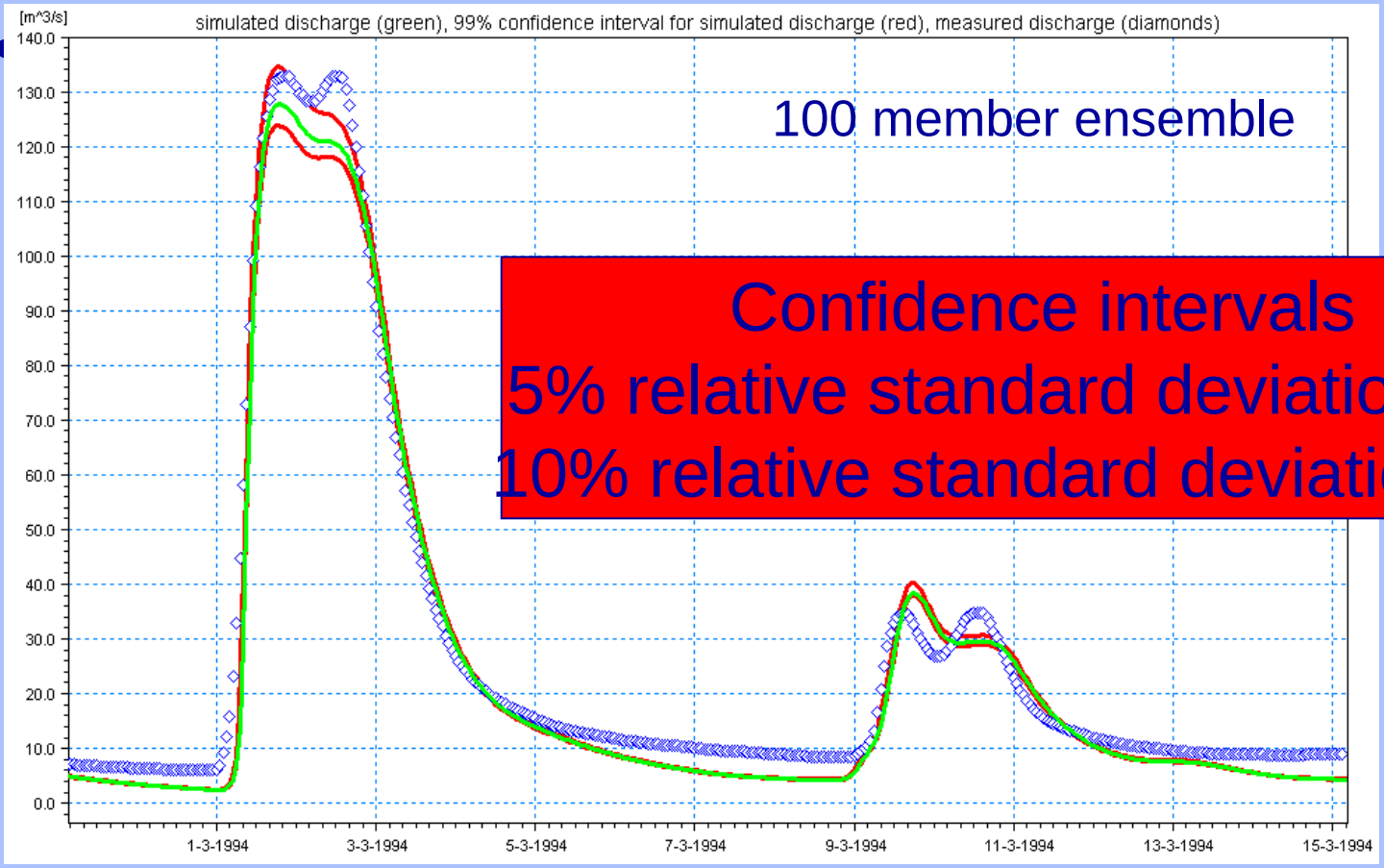


Obtain better results!

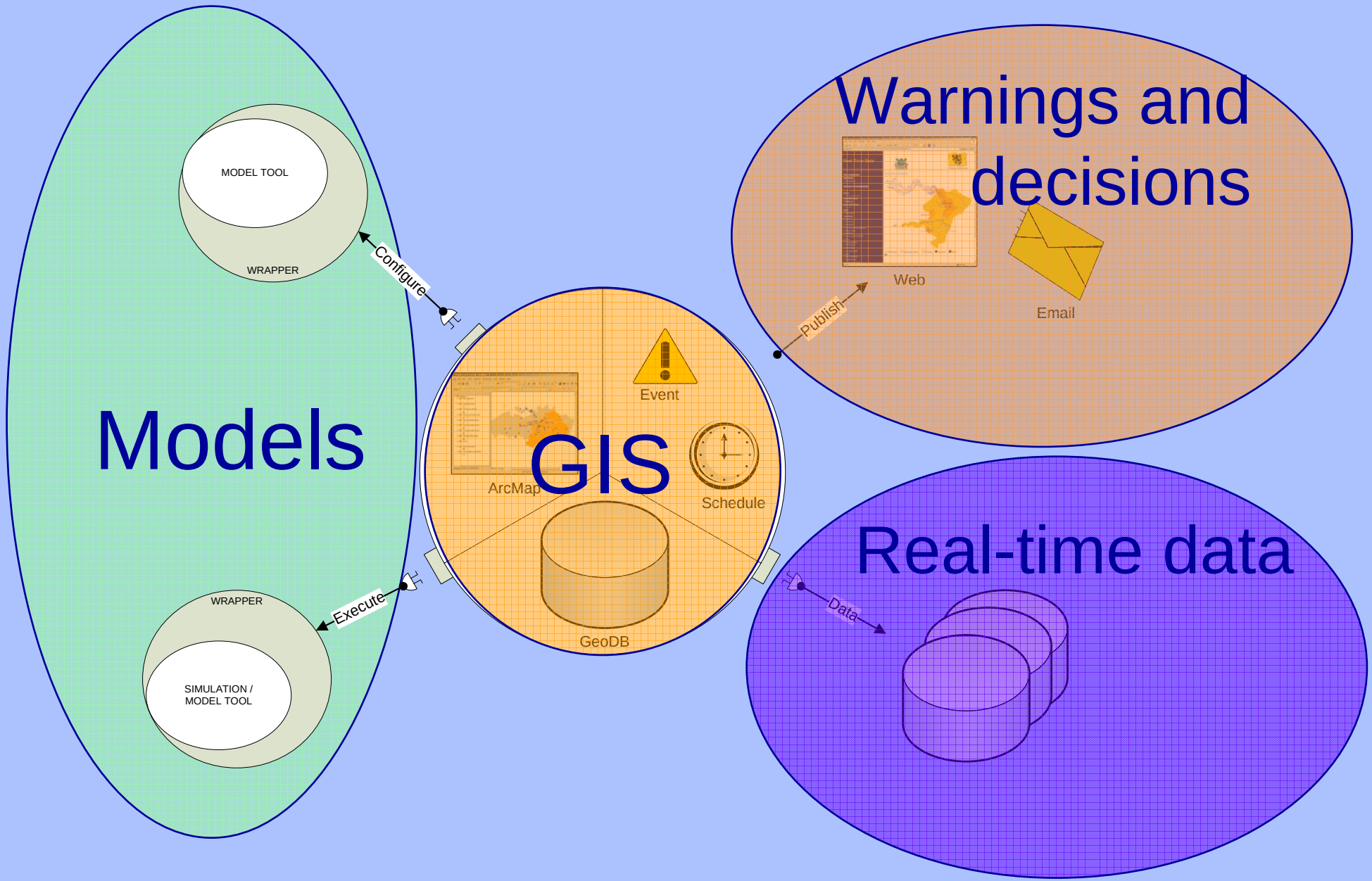


Ensemble flood forecasting

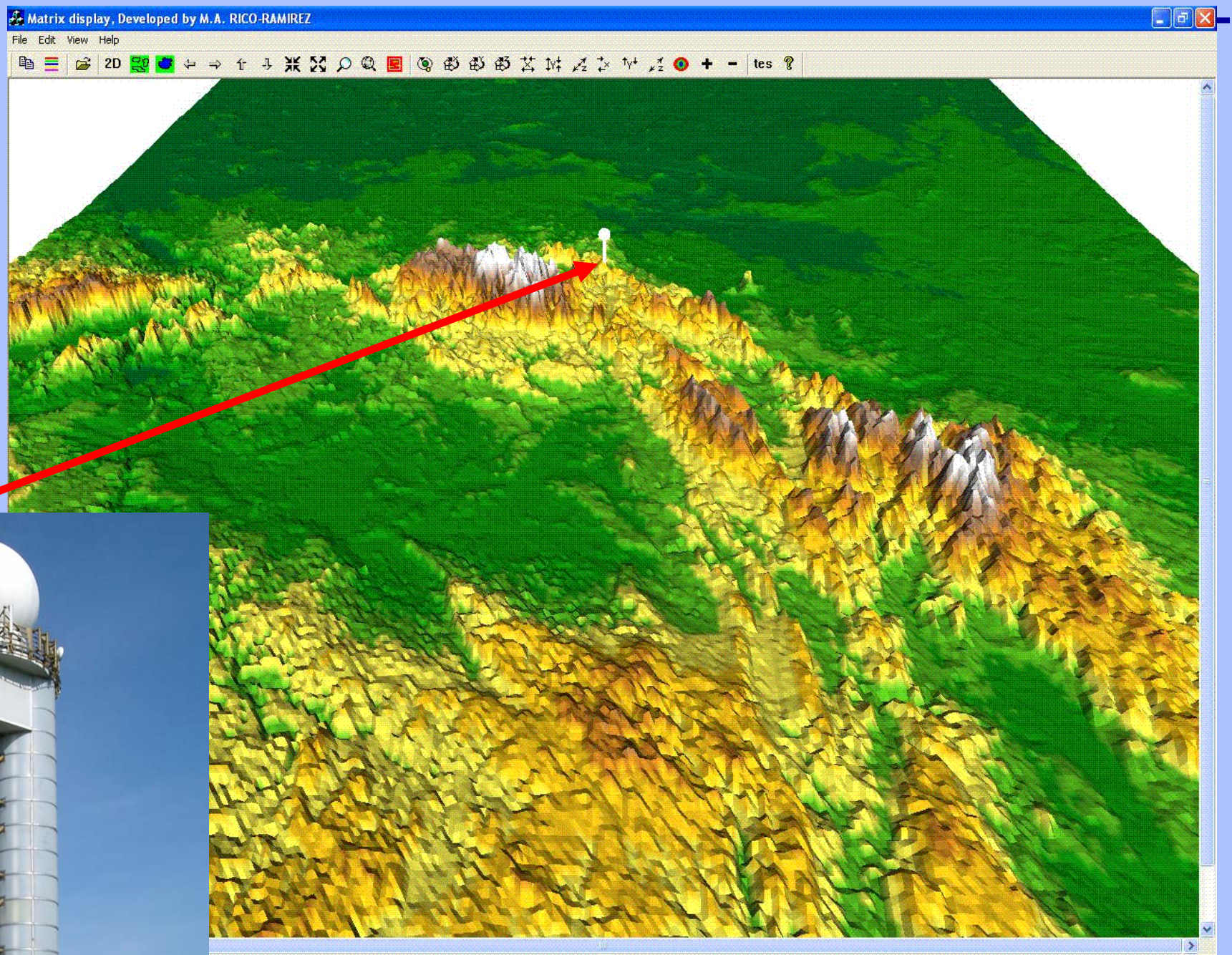
- Can be used with different sources of uncertainties
- Straight forward with deterministic models
- Widely used in meteorological forecasting



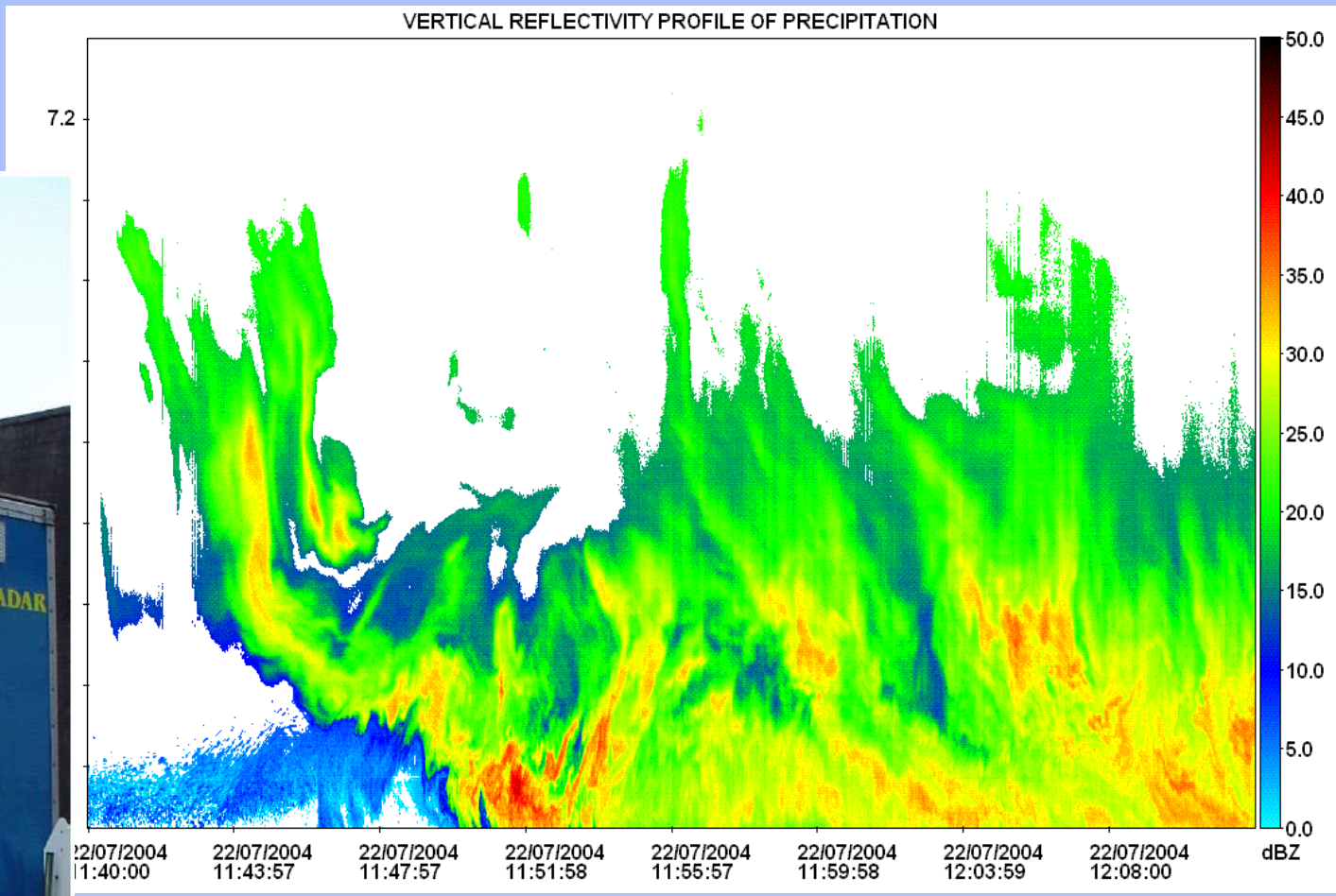
Forecasting shell developments



Weather Radar - Poland



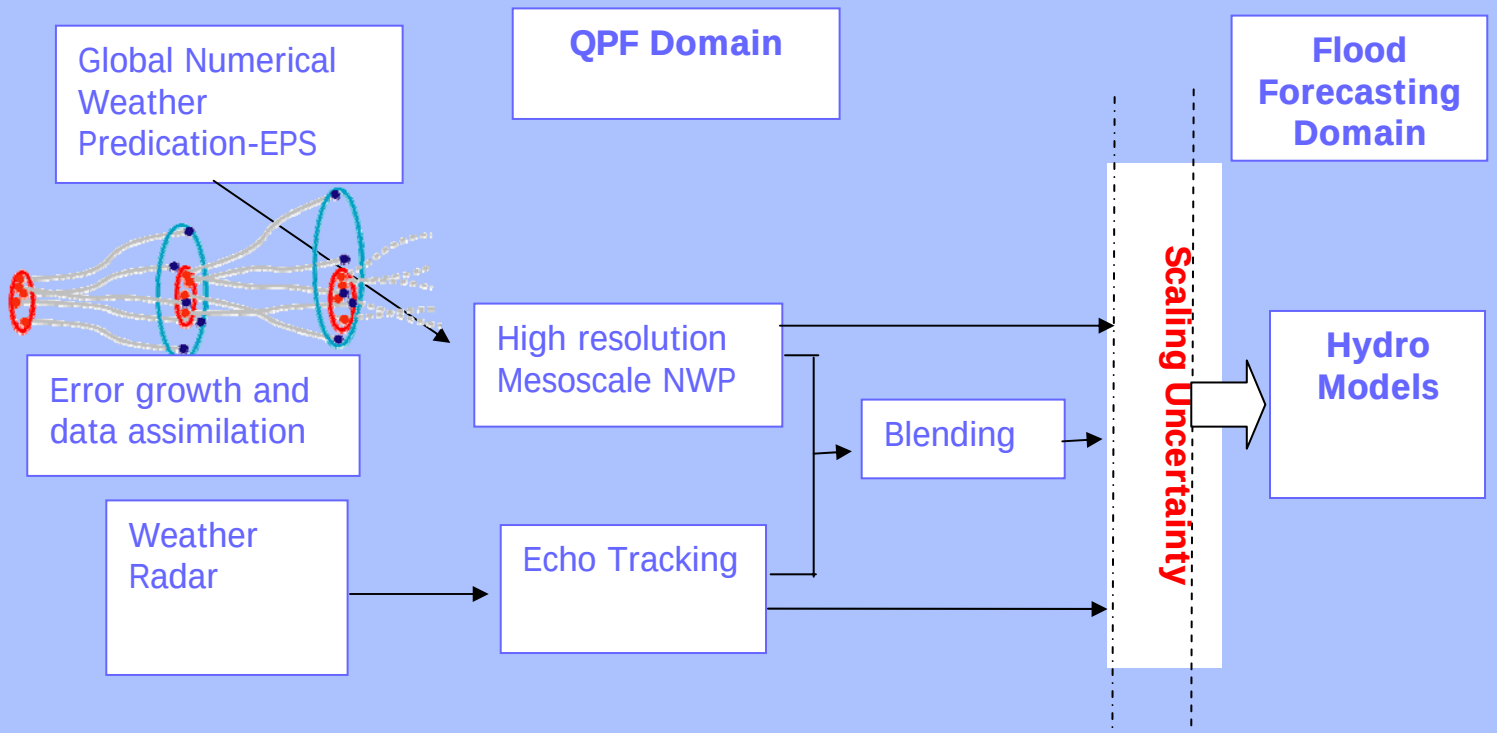
Vertically Pointing Radar - UK



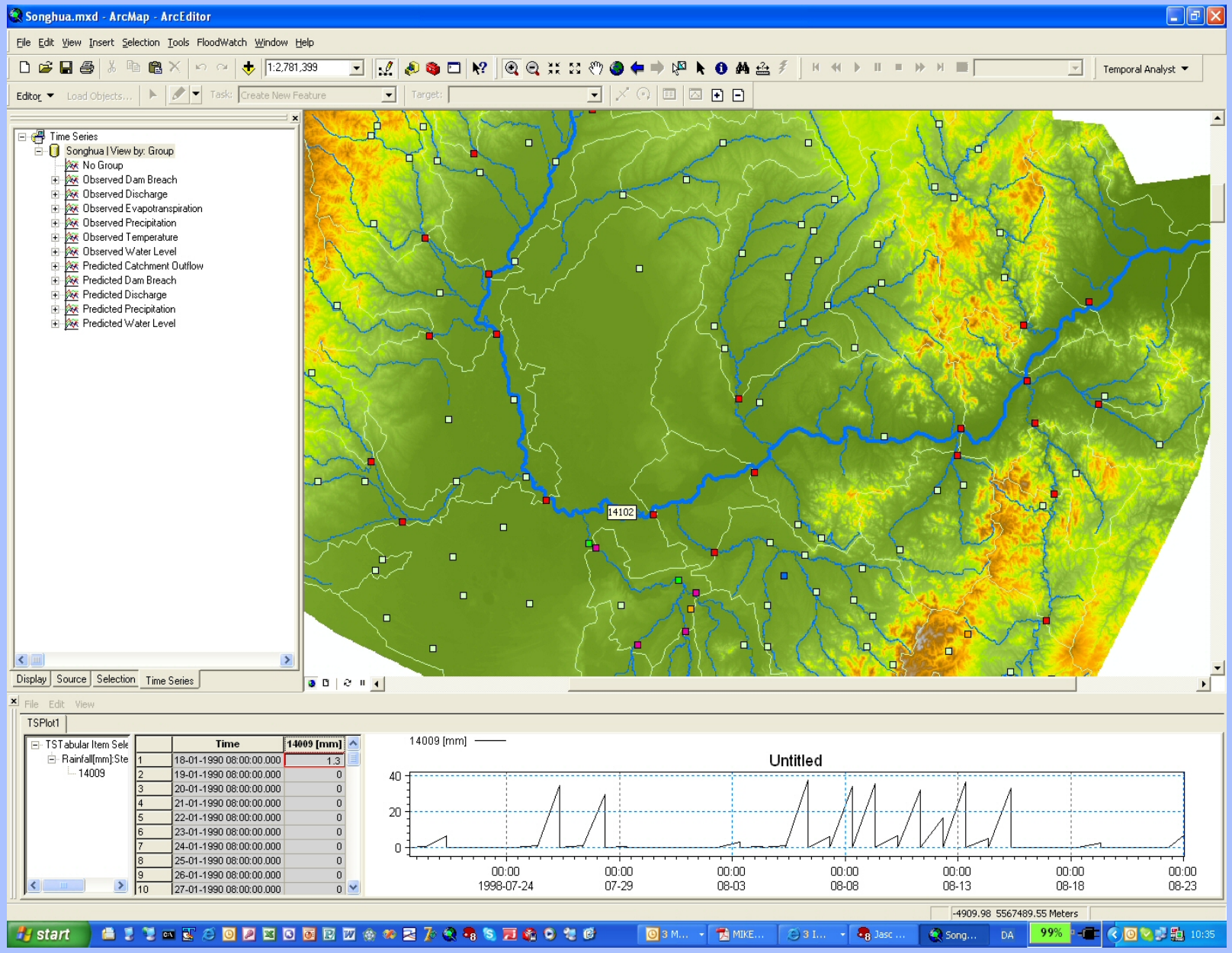
Source: Prof. Ian Cluckie, Water and Environmental Management Research Centre, University of Bristol

The WEMRC-X-band Vertically Pointing weather Radar

QPF in a ‘modern’ flood forecasting system

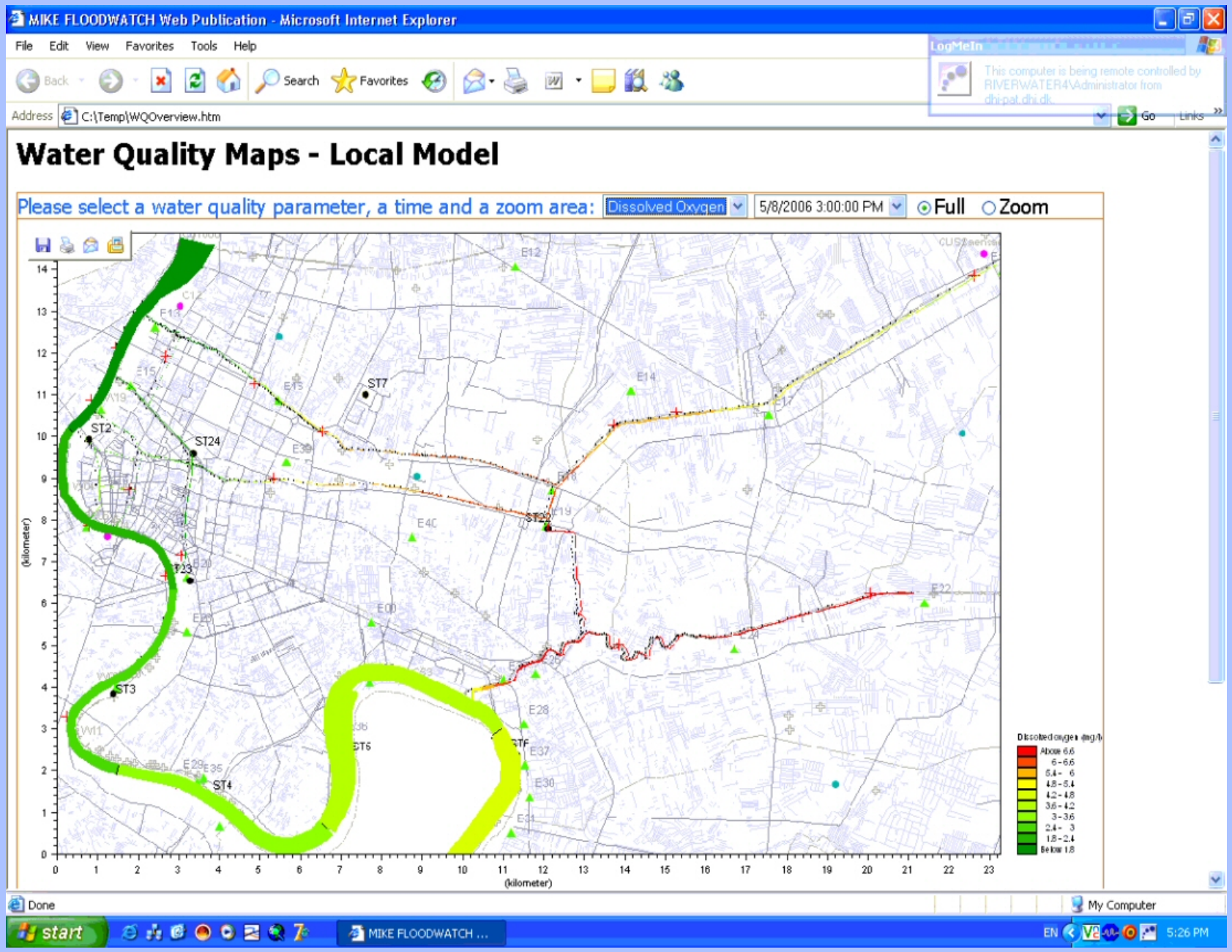


Decision support in the Songhua River Basin

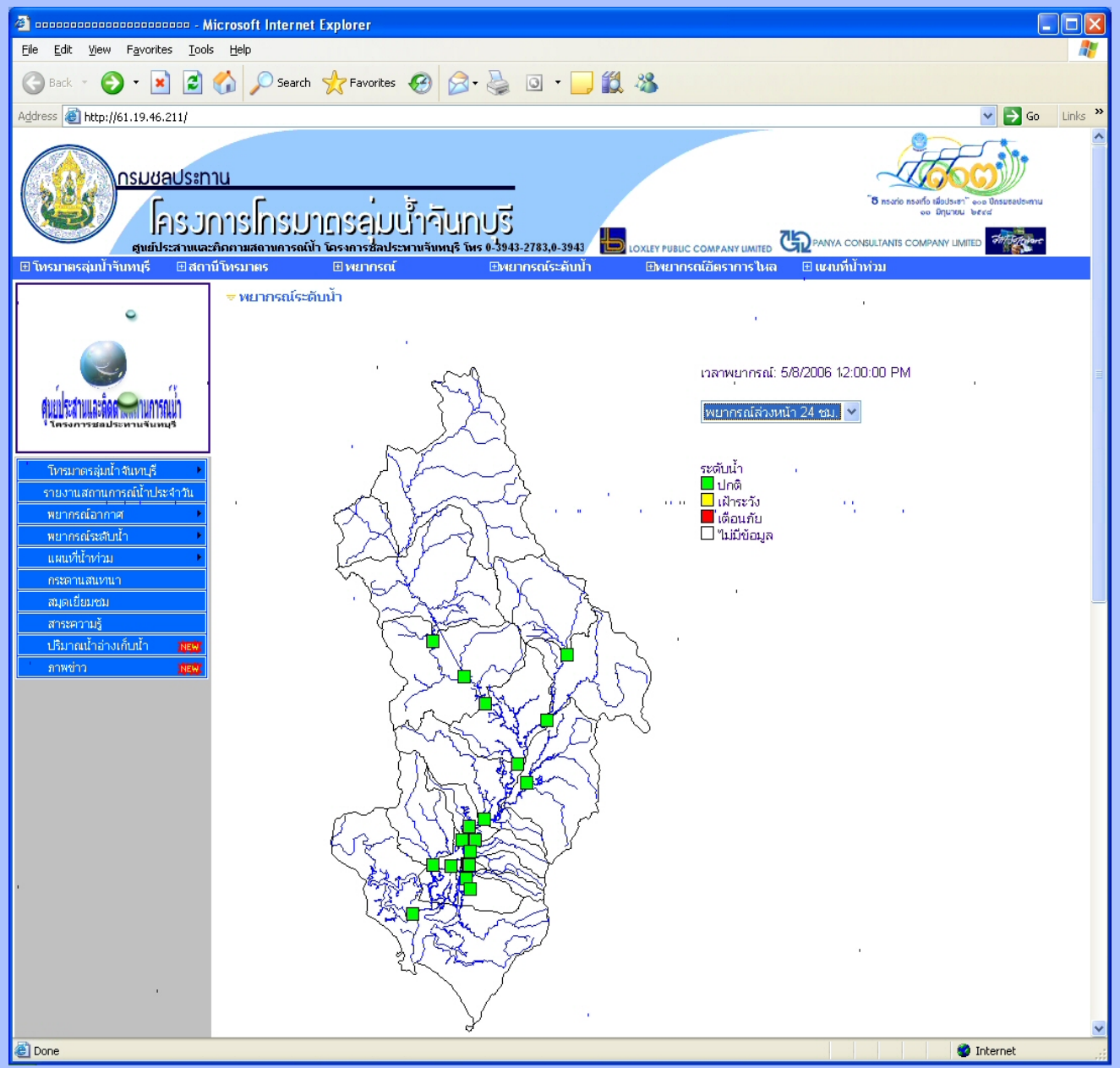



三峡梯级水库调度自动化系统 - [三峡枢纽信息图]
NARI
文件(F) 查看(V) 枢纽信息 流域水情 实时监视 预报信息 系统信息 报讯水情 数据查询 数据维护 报表系统 水库调度 窗口(W) 帮助(H)
整图显示
Three Gorges Dam Inflow Forecasting System
银杏沱
135.46m
太平溪
135.54m
伍相庙
135.50m
凤凰山
135.49m
自动气象站
23.05° C
138.43°
0.80m/s
0.2mm
2 different shiplocks
7 flushing gates
3 debris gates
26 turbines of different make
66 spill ways divided into 4 subgroups
入库流量 53000 立方米/秒
出库流量 48300 立方米/秒
全厂有功 491.65 万千瓦

Bangkok – Flood and water quality forecasting



Thailand - Chantabury



The potential of flood forecasting models.....

- Flood forecasting
- Water quality modelling/forecasting
- Drought forecasting
- Design
- Flood mapping
- Risk Assessment
- Sediment
- Irrigation
- .....
- .....

Get more from your investment!!

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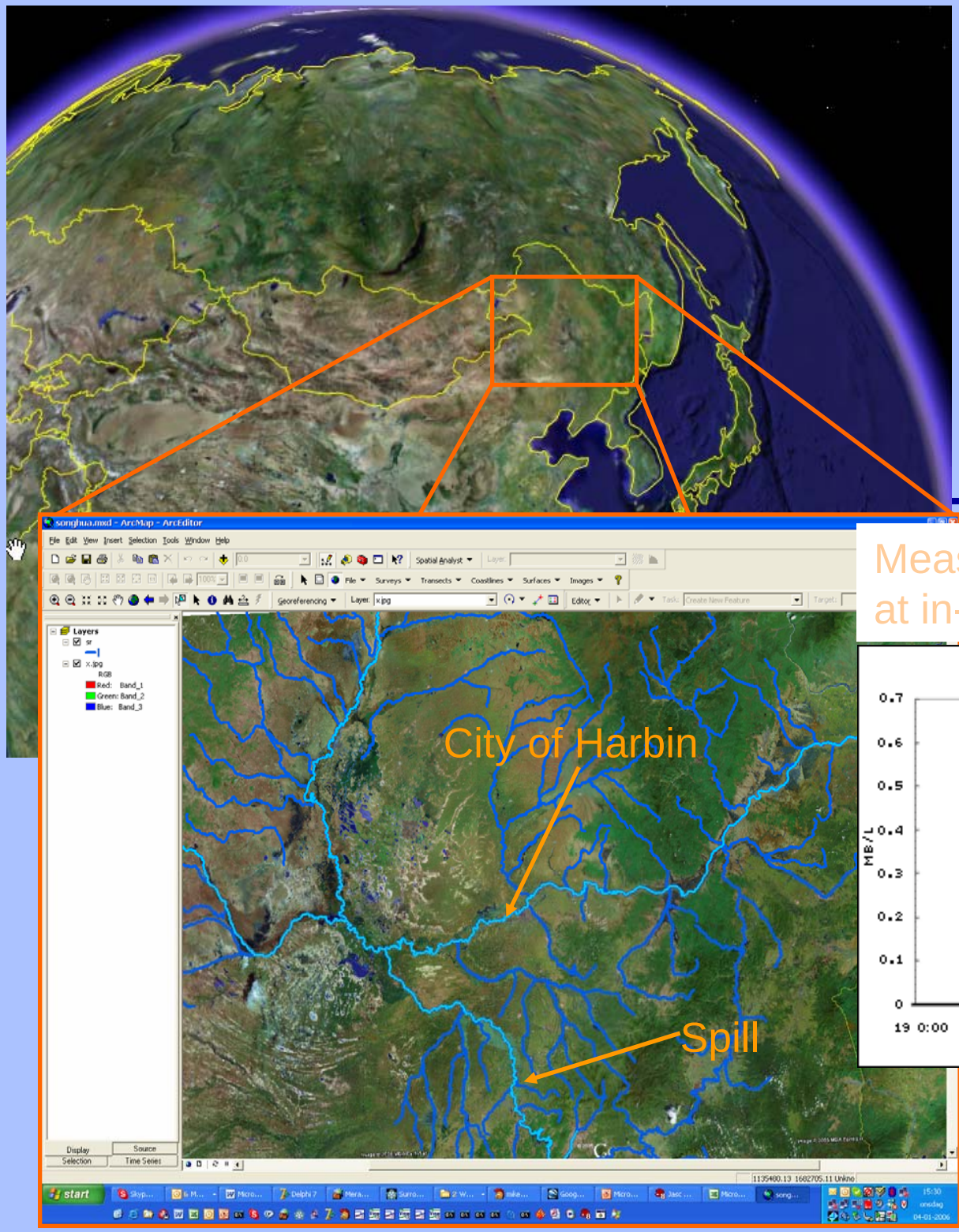
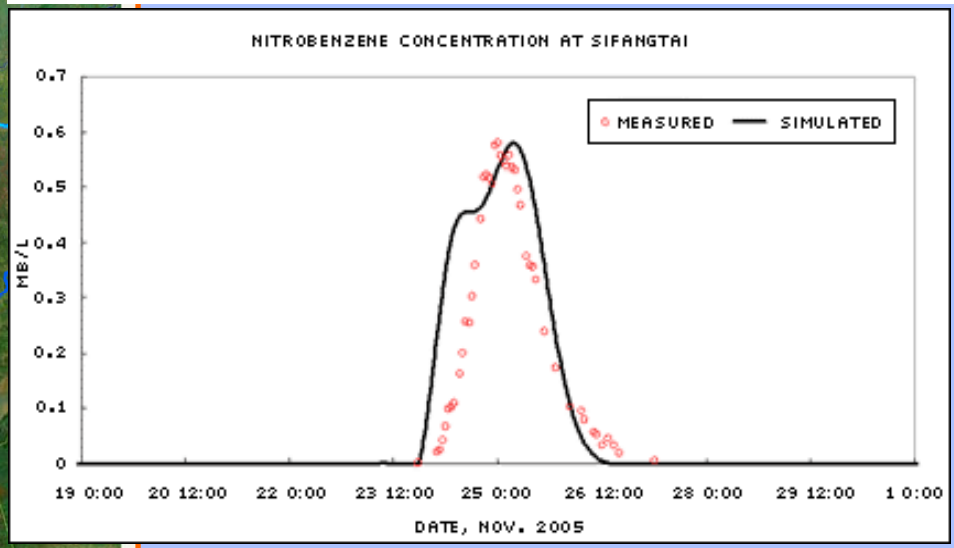
An actual example: Simulation of Chemical Spill in Songhua River, China



Measured vs simulated concentrations at in-take for Harbin water supply



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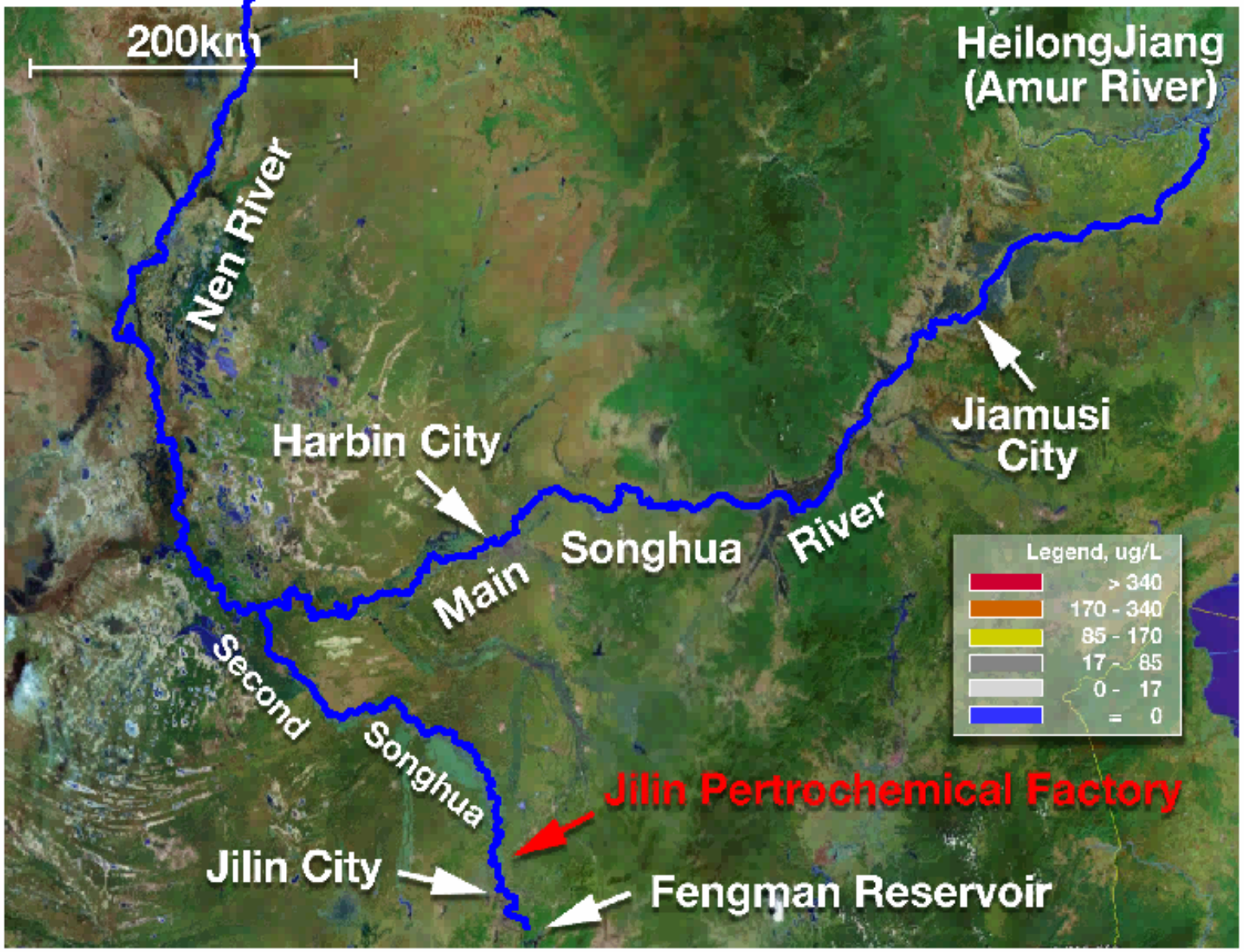
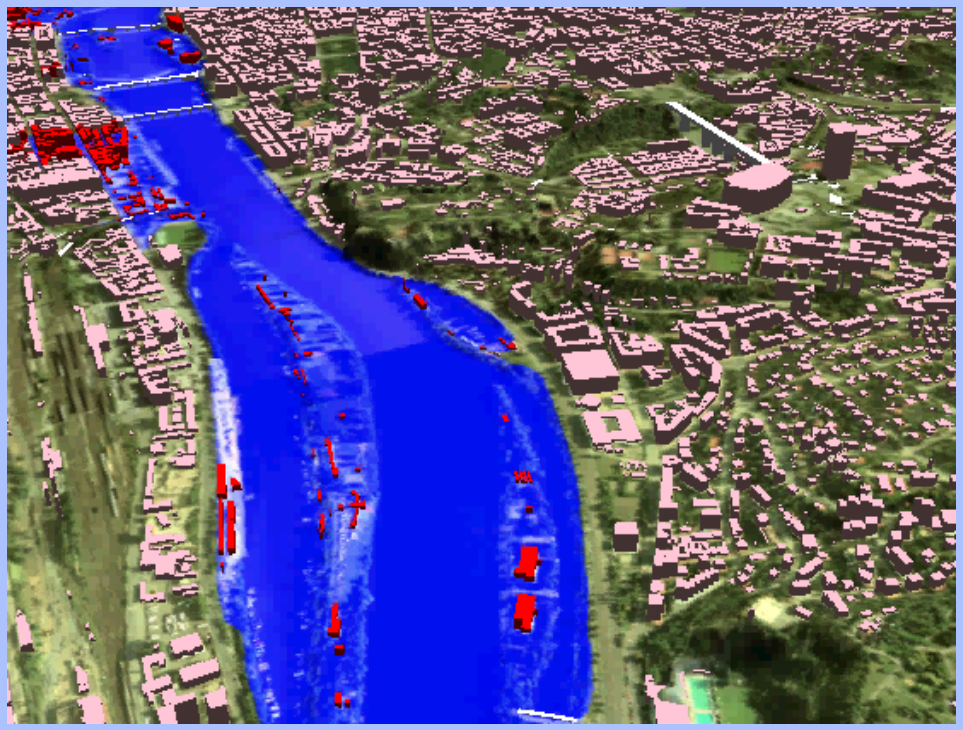


Thank you for your attention



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