Temperate Forest Regions

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Questions

- How can predictive approaches be **improved** ?

- How can information gleaned from data rich regions be **applied to data sparse** regions ?

Definition of data sparse

- only **1 – 2 years of Q** data
- only **1 or 2 stations** in basin (no relations possible)
- measuring stations **400 km apart**
- **stations nearby** in similar region
- only **remote sensing** available
- **inhomogeneity** of data series. Data overlap
- depends on **type of region**
- depends on **representativeness of scale variability**

How can predictive approaches be improved?

Improve prediction of extremes

- using **geomorphological approach**, e.g. 100 year flood reconstruction via hydraulic radius
- **aggregated simple quantification** of mean annual Q
- measurements / **observations**
- use of **tracers**
- determination of **age of trees** along floodplain
- take **land cover/ land use** more into account

Problems of predicting extremes…

- **Rain on snow events**. Melt processes not well understood Limitation of data and models. Problems of simulation. Often based on proxy records, constants and gestimates. Operational models do not exist.
- **Predicting tail distribution** of flood event
- **Communicating flood to stakeholders**. Apply simple warning methods (e.g. telephone)
- **Management issues** often not included in model (dams)
- Problems of data transfer in **transboundary catchments**

Problems of predicting extremes..

- Lack of **knowledge on rapidity of response**
- Lack of knowledge on **evolution of extreme event** under **modified conditions** e.g. urbanization, pine beetle attack (because slow process)
- How to **parameterize** special cases**,** diseased forest
- **Human impacts**, effects of grazing of different types of herds on Juniperus forest
- **Synchronization** or not of rainfall/snowfall

Problems of predicting extremes…

- **Evolution** from glacier to snow to rain dominated regime? How do models cope?
- **Climate change impacts** on water availability from receding glaciers
- **Process evolution** e.g. increase in debris flows or landslides instead of floods
- **Process threshold**/ interaction

Landcover Change

- remote sensing only last 10 – 20 years
- Practioners approach rational: regional curves
- Numerical experiments, simulations
- Simple evacuationplans: height of Q /. Flooded areas

Roughness

- Very important variable but many assumptions. Measurements via LIDAR or terrestrial laser scanners. Rating curves via surveys

Droughts

- **Long term** trends
- how **resilient** is forest to climate change (British Columbia/Alps **trees dying from water stress)**
- Data needed to identify drought stress. **More process understanding** required
- Requires **interdisciplinarity**: hydrologists, ecologists, geologists and corresponding data. Ecological data often missing. **Bio-geo-climatic** units useful.
- Create physically based lumped models. **Different scenarios and basins** to choose from
- Interaction between **groundwater and surface water** / soil moisture only possible for data rich regions

Ecohydrological models

- **Optimize** use of vegetation
- **Understand interaction** soil/vegetation
- Often **lack of process understanding**,
  (e.g. impacts of clear cutting on discharge)
- Use data rich sites with **ET** and **interception** data to simulate processes with minimal number of meteorological stations

Evaporation and Evapotranspiration challenge

- Estimations, general **classes**
- Problems of **availability of validation data**. Monthly versus daily scale
- Possibility of **regionalization** in space and time e.g. PRISM
- **extend water balance** from data rich to data sparse
- can **model radiation** for monthly data for **ET**, cloud cover problem, possibly derived from weather satellites
- **Actual** versus **potential evapotranspiration** (possibly from scentillometer). Global estimations of ET 1 km grid. Important in semi-arid regions.
- **Climate change**. Long term. Future conditions? **Assumptions** concerning **vapour pressure**

Interception

- Problem of **measurement**
- Differences between **rain and snow interception**
- Neither enough **process understanding** nor **model integration**
- **Sensors, photography**

Condensation

- Specific environment (Galapagos, Tenerife)
- How do you know whether it is important
- Use of indigenous knowledge (temporal / spatial)

Data sparse regions

- **Cannot answer complex** questions
- Management decisions **do not require complicated equations**
- **How to forecast impacts** if only one meteorological station? Only some guidance values.
- Scientists often asked **how to reduce uncertainty** of forecast
- Question of **time involved** with relation to improvement. Threshold reached. Question of best location.
- Have to tolerate **irreducible uncertainty**
- **Social adaptation** necessary

Climate change

- Problem that models **do not model stomata dynamics** and **interactions** with CO_2

- **Small scale basic research** - how embedded into model ?

- How to **bridge the gap** between experimentalists, modelers and practioners ?