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?

- 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 estimates. 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**
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
remote sensing only last 10 – 20 years

Practitioners approach rational: regional curves

Numerical experiments, simulations

Simple evacuation plans: height of Q /. Flooded areas
- Very important variable but many assumptions.
  Measurements via LIDAR or terrestrial laser scanners.
  Rating curves via surveys

Roughness
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
Problem that models **do not model stomata dynamics** and **interactions** with CO\textsubscript{2}.

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

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