Group 1: Semi-arid and arid regions

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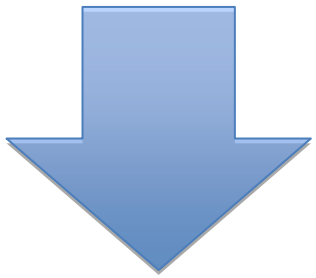
Wednesday: how can the various approaches for hydrol. prediction be implemented in semi-arid and arid regions given the availability of met. and catchm. data and current understanding of hydrology



A few basic definitions…

Semi-arid: a (sub-polar) region that receives precipitation at or below potential evapotranspiration

Warm

Cold

Approaches

- Empirical (e.g SCS CN and, yes, the rational method)
- Statistical (frequency analysis, autoregressive models, etc.)
- Hydrologic models
  - conceptual
  - physically based

What is a prediction?

- Streamflow in space and time
- Groudnwater levels, available volume
- Soil moisture

  – Fluxes and states

Some considerations specific to semi-arid and arid climates

- Groundwater usually very important if not unique water source
- Can’t separate short term from long term
- Most water comes from other climatic regions (either natural or man-made)
- Contributing area highly variable between events or years.

… more considerations

- Extreme variability in time and space of meteorological forcings (related question: is remote sensing an approach or a data source?)
- surface water/groundwater interaction

About approaches: 1) empirical methods

- OK for small scale, short term: it is usually for these conditions that these methods are developed, in the first place
- It might be possible to valide, improve, adapt them to local conditions when possible
- Not OK for long-term, large scale problems because of nonlinearity and moisture deficit uncertainty

2) Statistical methods (regression, geostatistics, stochastic time series, etc.)

- OK for large scale and long-term, at annual time steps
- Reasonable performance for data-gap filling (hindcast)
- Regionalization encouraged (remember: data rich areas)
- OK for capturing time variability, but caution required due to nonstationarity

2) Statistical cont'd.

- In arid regions: problems at the tails because distributions quite skewed
- Geospatial techniques
  - OK for temperature, radiation
  - Not OK for short-term precipitation (events), OK for long-term

3) Hydrologic models: conceptual

- e.g. HSPF, SWAT, HMS
- NOT for GW evaluation at local scale nor short term
- Inadequate for surface/GW interactions
- Poor performance in flashy streams
- Practical for planning purposes; caution when transfering parameters to ungauged basins

4) Hydrologic models: physically based

- e.g. MIKE-SHE, MESH, WADFLOW, CRHM, MODFLOW (?)
- Data hungry -> OK if data rich (related: is it possible to have a data rich semi-arid/arid region?)
- Energy balance VERY important in our regions
- Usually flexible in their implementation (modular nature)

4) Physically based, cont’d.

- Continuous simulation: variability in contributing areas
- Require dedicated and ad-hoc data collection campaigns -> scaling issues