Tropics & Sub-Tropics

How can predictive approaches be improved:

Data Sparse Situations

1. Protocol for catchment function diagnostics and model setup.

- Use of a decision tree as a preliminary stage to modelling.
  - Form of decision tree?

- Sequences in modelling (posssibly iterative)
  - Basic process understanding.
  - Data assessment and compilation.
  - Model choice.
  - Model parameterisation.

2.1 Basic process understanding.

- Available information to assist:
  - Topography and general catchment conditions (Google Earth & others).
  - Topography (slopes and elevations).
  - Lands use data & soils data (FAO)
  - Climate data (various sources).
  - Regional streamflow data (GRDC).
  - Satellite imagery at different times of the year.
  - Links to data rich regions of a similar type.
- How to interpret this information?
  - Identifying the differentiating processes.
  - Identifying major processes & linkages.
  - May need some guidelines for this process.

2.2 Examples of interpretation

- Identifying main processes and flow paths.
  - Clues for GW influences in stream flow data.
  - Landcover and topographic data to identify existence and extent of wetlands & floodplains.
  - Slope variations and drainage structure.
  - Vegetation data to help soils interpretation, interception and evaporation dynamics (NDVI).
  - Homogeneous versus mosaic of veg. types helping to inform spatial variation of processes.

2.3 Adequate process understanding?

- Informed by objectives of the study (?).
- Yes
  - Move onto next phase.
- No
  - Focused field campaign.
    - Focused on process understanding gaps.
    - Always limited by available resources.

- Finally should be trying to identify uncertainties in process understanding.

3.1 Data assessment & compilation

- Physical catchment property data:
  - Appropriateness of information:
    - E.g. soil types and depth
  - Spatial variations with respect to scale of modelling.
- Hydrometric data:
  - Precipitation, evaporation, etc.
  - Spatial and temporal resolution of available data.

3.2 Additional data required?

- How to determine if additional data are required?
  - Informed by end purpose and objective.
  - Informed by model choice (chicken & egg problem).
- Can existing data be processed further?
  - Disaggregation for example.
- How to determine what data are required?
  - Progressive removal of data in data rich regions and assessment of model performance.

3.3 How to get additional data

- Focused field campaign (short term):
  - Collecting essential data.
  - Also informed by uncertainties in process understanding.
  - Substituting space for time.
- Initiate longer term additional monitoring:
  - Design informed by preliminary model results.

4.1 Model choice

- Informed by:
  - Process understanding.
  - Special processes needed for inclusion:
    - Spatial/temporal resolution.
    - SW/GW interactions.
    - Stream flow routing.
    - Wetlands and lake storage.
    - Development impacts.
  - Data availability.
  - Purpose and objectives of modelling.

5.1 Model parameterisation

- What is the best approach?
  - Should be linked to process understanding.
  - Can be achieved in different ways.
    - Donor catchments (similarity approach).
    - Regionalisation.
    - Direct estimation from physical basin properties.
- How to include uncertainty?
  - Must be included in all approaches.
  - Use of constraints and feedback loops to reduce uncertainty (‘valibration’).

5.2 Including uncertainty

- Ensemble approach
  - Based on expressions of uncertainty in both parameter estimations and hydrometric data.
    - Process uncertainty feeds into parameter uncertainty.
  - Assumption that we do not know the real answer.

5.3 Constraints & their use

- Regionalised observed data used to establish hydrological signatures.
- Limited field campaign data.
  - Identifying boundary conditions.

- Feedback loops to parameter estimation:
  - Identify behavioural parameter sets and reduce the uncertainty ranges.