Tropics & Sub-Tropics

Data Rich Situations
1. Differentiating the Tropics

- **Humid tropics**
  - High rainfall intensity and depth
  - Strong seasonal rainfall regime
  - Seasonally hydrophobic soils
  - High surface runoff components (?)
  - High sediment loads

- **Semi-arid tropics**
  - ?
2. Issues

- **General**
  - Data availability and reliability.
  - Lack of centralised water resource management (in many areas).
  - Ecological water requirements.

- **Humid Tropics**
  - Large scale land use change – afforestation to agricultural:
    - Changes in seasonal distribution of runoff and effects on water use (social, ecological, effluent dilution, etc.).
    - Feedback loops to climate modification(?)
2. Issues (cont’d)

- Semi-arid tropics:
  - Drought frequency prediction.
  - Longer time scales (decadal).
  - Yield from water resources schemes (reservoirs).
  - Combined use of surface and ground water.
3. Data rich areas

- Not many for humid tropics:
  - Limited to a small number of well resourced areas:
    - Hawaii, Puerto Rico, Costa Rica, NE Queensland, Borneo, parts of Brazil (possibly).

- Semi-arid tropics:
  - Australia, S.W. USA, N. Mexico, South Africa, Brazil.

- Most areas are data scarce or data poor.
4. Requirements

- Process understanding:
  - Lack of studies worldwide.
  - Interception loss.
  - Cloud forests in marine tropics (sensitive to global warming).
  - Veg.–Atmos & Atmos–Soil interfaces and effects on infiltration and runoff under changing land use (given very high rainfall intensities).
  - Vertical water balance – canopy evap, soil storage, GW storage, water use by trees and rooting depths.
  - Surface water – ground water interactions are important in semi-arid tropics.
5. Meeting requirements

- Landscape classification and identifying required thematic layers (DEM, landcover, etc.).
- Monitoring of state variables.
  - Particularly sub-surface environment.
- Estimating mean residence times and flow paths thro’ environmental isotope tracing.
- Limited gauging campaigns at start of wet season (need many resources).
5. Meeting the requirements

- Protocol for catchment function diagnostics
  - Infiltration data linked to soil types.
  - Interception characteristics.
  - Sub-surface conditions.
  - Surface – GW interactions.

- Use of a decision tree as a preliminary stage to modelling.
  - Based on the protocol.
6. Answering the question

- Most of the data rich areas are very small headwater catchments.
- Conceptual modelling approaches are applicable and appropriate:
  - Are we getting results for the right reason?
- Many approaches difficult to implement reliably given available data and understanding.
- Scale transfer problems:
  - Need a range of scales to achieve up-scaling effectively.