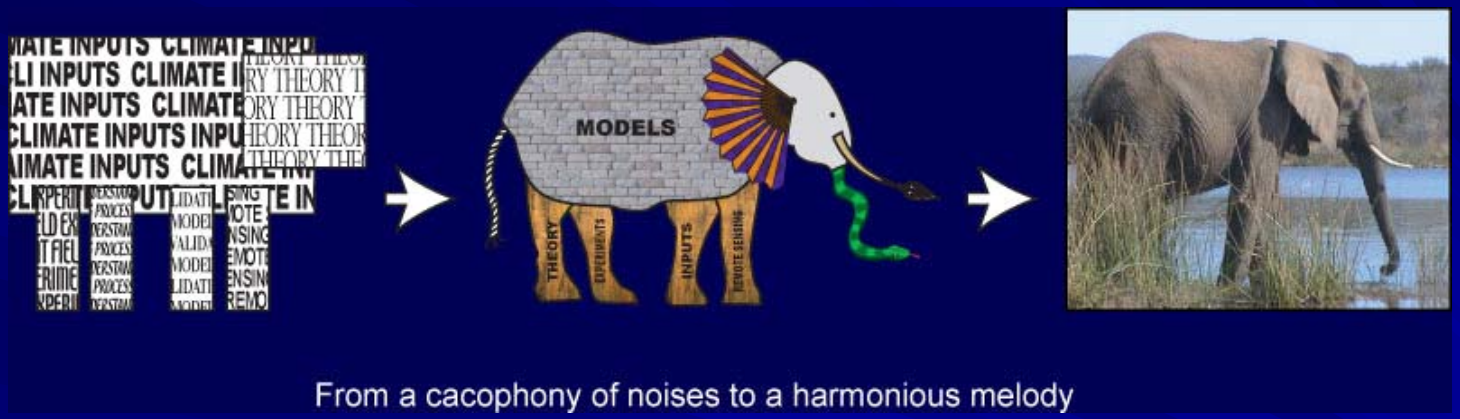
Perspectives on PUB – the 4th Biennium (2009-2011)



From a cacophony of noises to a harmonious melody

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PUB Approach

- PUB is a revolutionary movement to improve hydrological prediction in regions where streamflow measurements do not exist or are sparse.
  - Reduce calibration
  - Prediction based on understanding
  - Compensate for lack of streamflow gauge
- PUB is also a vehicle to transform hydrology by improving the scientific basis of hydrology
- PUB is a way to make international efforts in hydrology relevant to local needs, especially in the under-developed world.

PUB Progress

- Substantial progress on many PUB themes
- Some early examples of success in prediction in ungauged basins
- Expansion of PUB activities through working groups and national groups
- Work on compilation of progress in PUB Benchmark Report

Strengths

- PUB Streamflow Benchmark Report
- Scientific rigour
- Development of new methods for comparisons, classification, and diagnostics
- Development of new theory
- Consideration of regionalisation approaches
- Parameter estimation
- Uncertainty quantification
- Consideration of issues relevant to well gauged regions
- Improvement of application of existing models and methods

Challenges

- Defining the appropriate use of sparse gauge observations
- Integration of inductive and deductive methods in practice
- Limitations of the usefulness of regionalisation efforts in ungauged regions

Areas of Focus for 4th Biennium

- Communication with scientific community and dialogue with applications community
- Inclusion and analysis of regional efforts and varying perspectives
- Incorporation of process variability and emergence into new predictive approaches and structures.
- Improvement of model realism and reduce conceptual approaches
- Utilisation and assessment of new measurement and information technologies for basin inputs and characterisation
- Development of improved models that reflect recently improved hydrological understanding.

Opportunities

- Approaches relevant to the full range of regional PUB conditions in the world
  - Regionalisation not possible or appropriate in ungauged regions
  - Cold, arid regions, mountains, droughts receive scant attention and require coupled water and energy balance approaches
- Rapid climate, land use and consumption change requirements for hydrological prediction
  - Non-stationarity, changing model structure and parameter requirements, changing regional behaviour
- Prediction of the Hydrological Cycle – multiple endpoints to prediction
  - Without better understanding and constraint of general hydrological prediction we cannot advance the Science and miss on great opportunities for PUB: soil moisture, hydroecology, groundwater, glaciers
- Sharing approaches with global hydrology models and hydrological land surface schemes and incorporating these into PUB.
- Overemphasis on parameter prediction using statistical means rather than appropriate model structure and data use and physically based approaches.
  - Lack of incorporation of better understanding of process behaviour, patterns and scale emergence in model development

Challenges

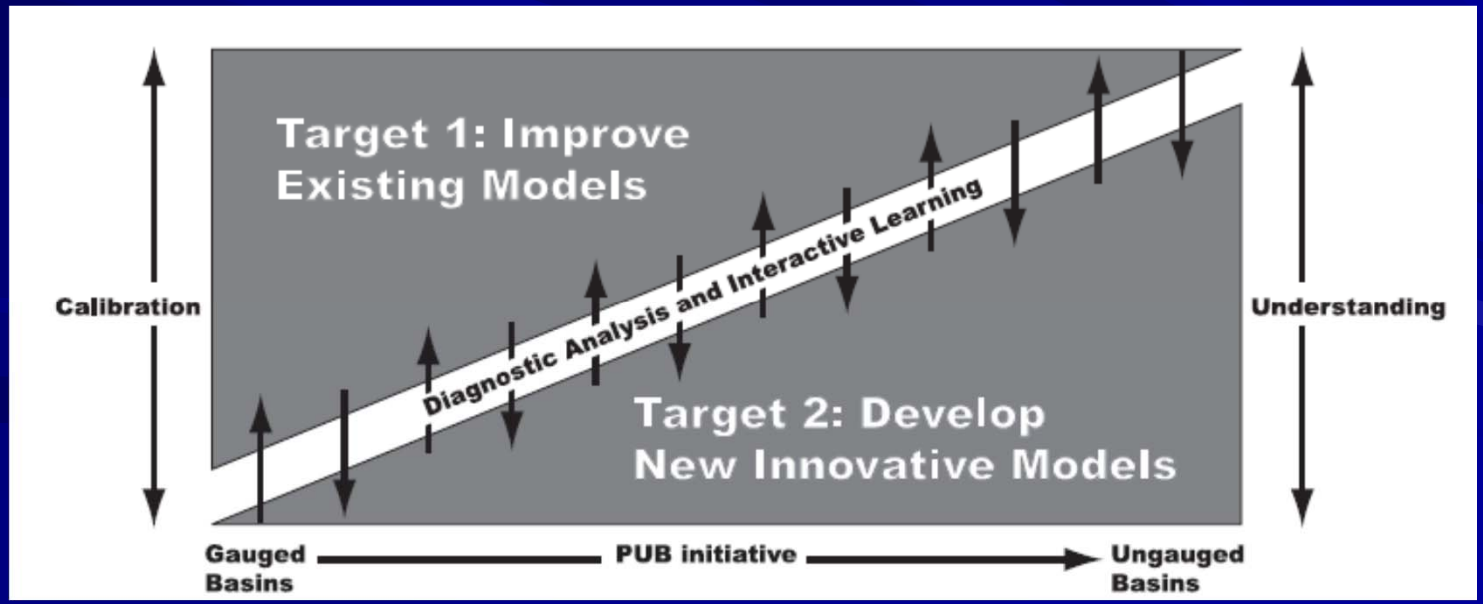
- Universal hydrological theory - runoff is the leftover process and “why” differs everywhere.
- Uncertainty estimation is important but does not itself improve prediction or achieve PUB.
- Over-reliance on single objectives for assessment of prediction – do not forget the catchment.
- Do not assume that we have adequate information on rainfall, snowmelt and icemelt inputs to basin to predict streamflow.

PUB 4th Biennium

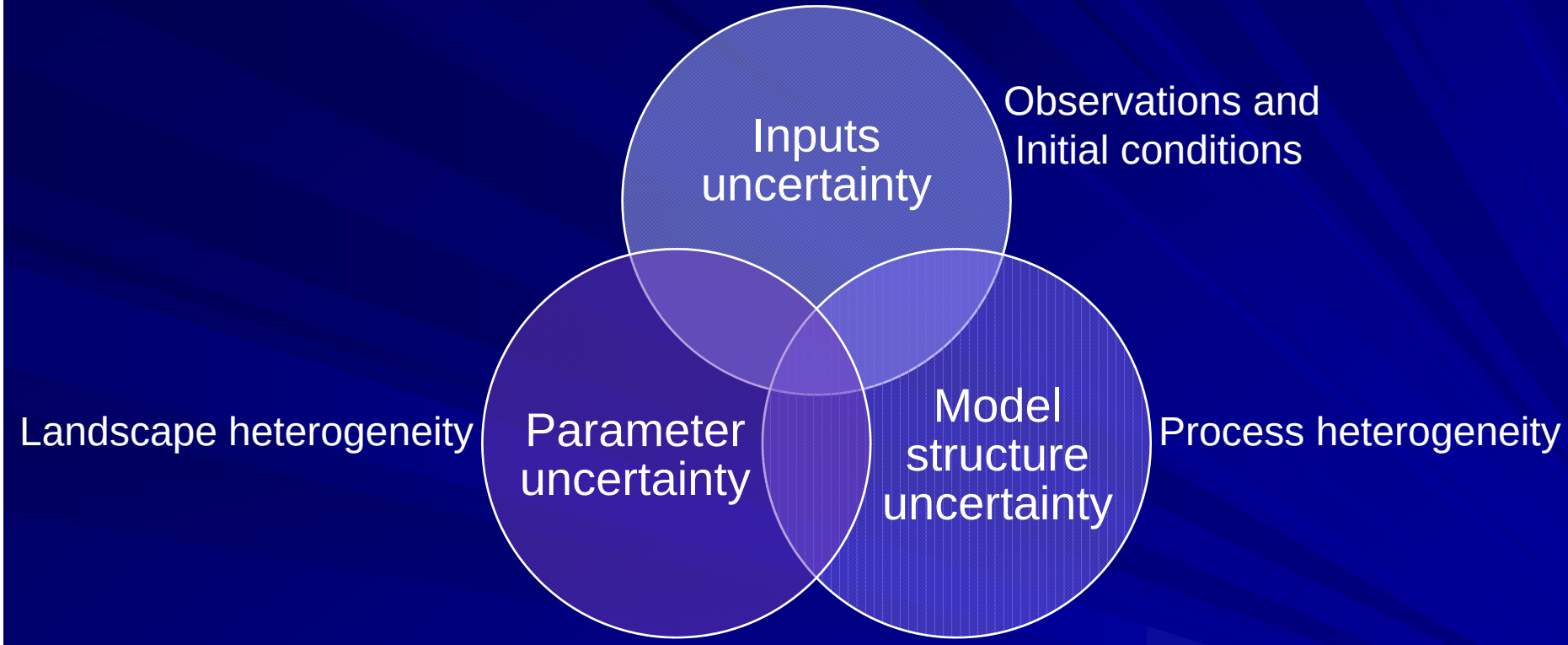
- Follow the plan!
- Renewal and Consolidation of Themes
  - Benchmark Report completion
  - New inputs
- Themes to Teams
  - Integration and Demonstration Project teams
  - Local solutions for hydrobiogeoclimate zones and data availability situations
- Contribute to International Hydrology
  - Elevate hydrological practice to science
  - Strengthen IAHS and link to Commissions
  - Put PUB in Practice

Follow the Plan

- **TARGET 1: Examine and improve existing models in terms of their ability to predict in ungauged basins.**
- **TARGET 2: Develop new, innovative models for making predictions in ungauged basins.**



Predictive Uncertainty



New strategies that combine detailed process understanding with an overall knowledge of the system are needed.

New Initiatives to Address the Science Plan

- Comprehensive efforts on
  - i) improved process, basin behaviour and predictive understanding,
  - ii) incorporation of understanding into new innovative model structures
    - development of new modelling schemes based on i) and ii)
  - iii) Input uncertainty

Example: Model Regionalisation

- Typically Regionalisation is based on:
  1) regression approach (parameters and basin characteristics).
  2) transference based on similarity/spatial proximity
  3) regional calibration

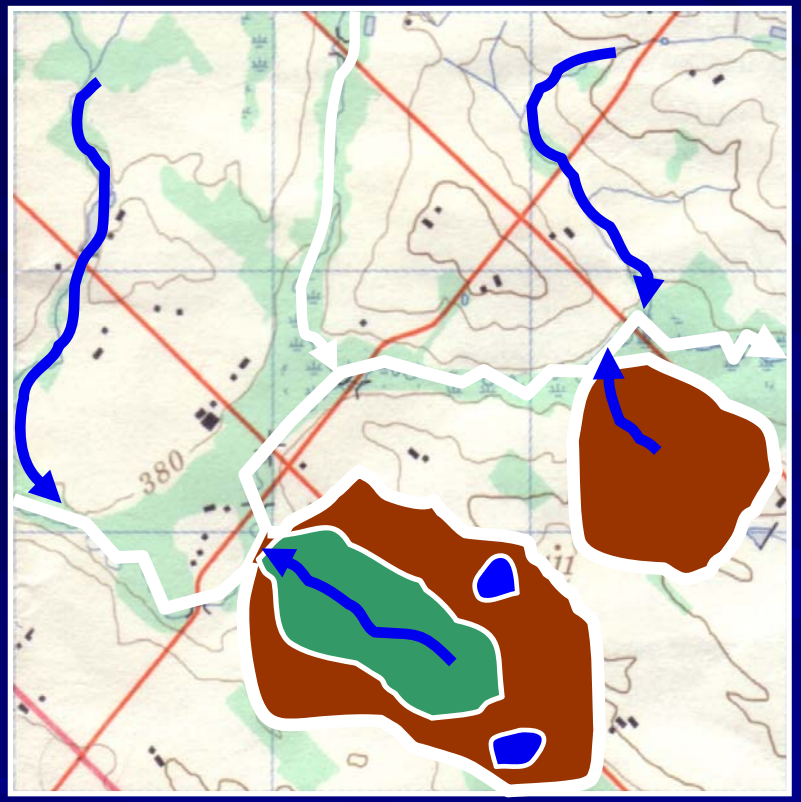
Good for conceptual models – Inappropriate for Physically Based Models

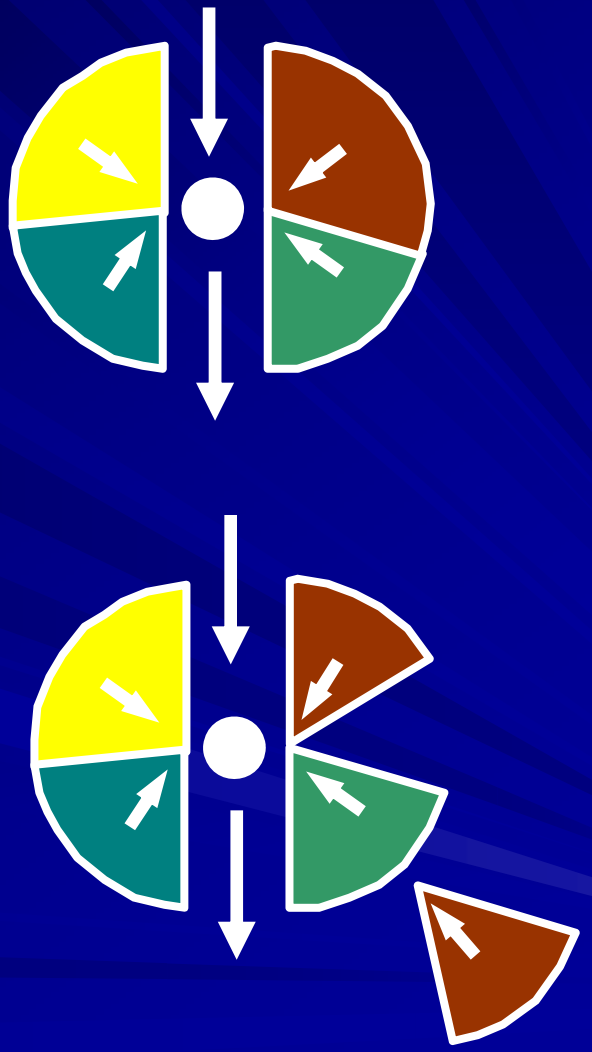
- **Physiographic approach**

Based on **Self similarity** concept of landscape units: topography, vegetation.

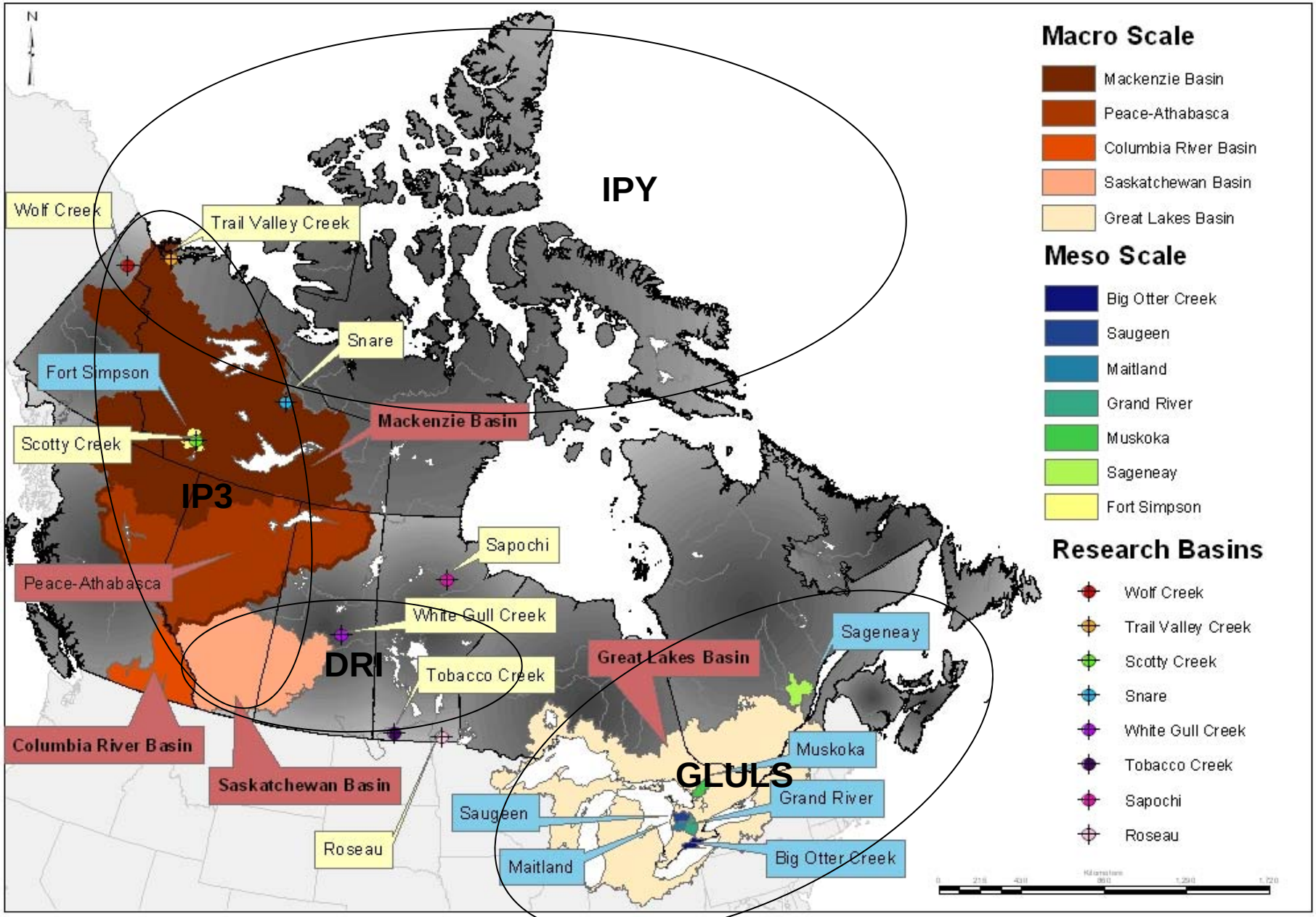
- **Transference of landcover based parameters**

Hydrological Land Surface Schemes for PUB in Ungauged Regions – Structural Adaptation

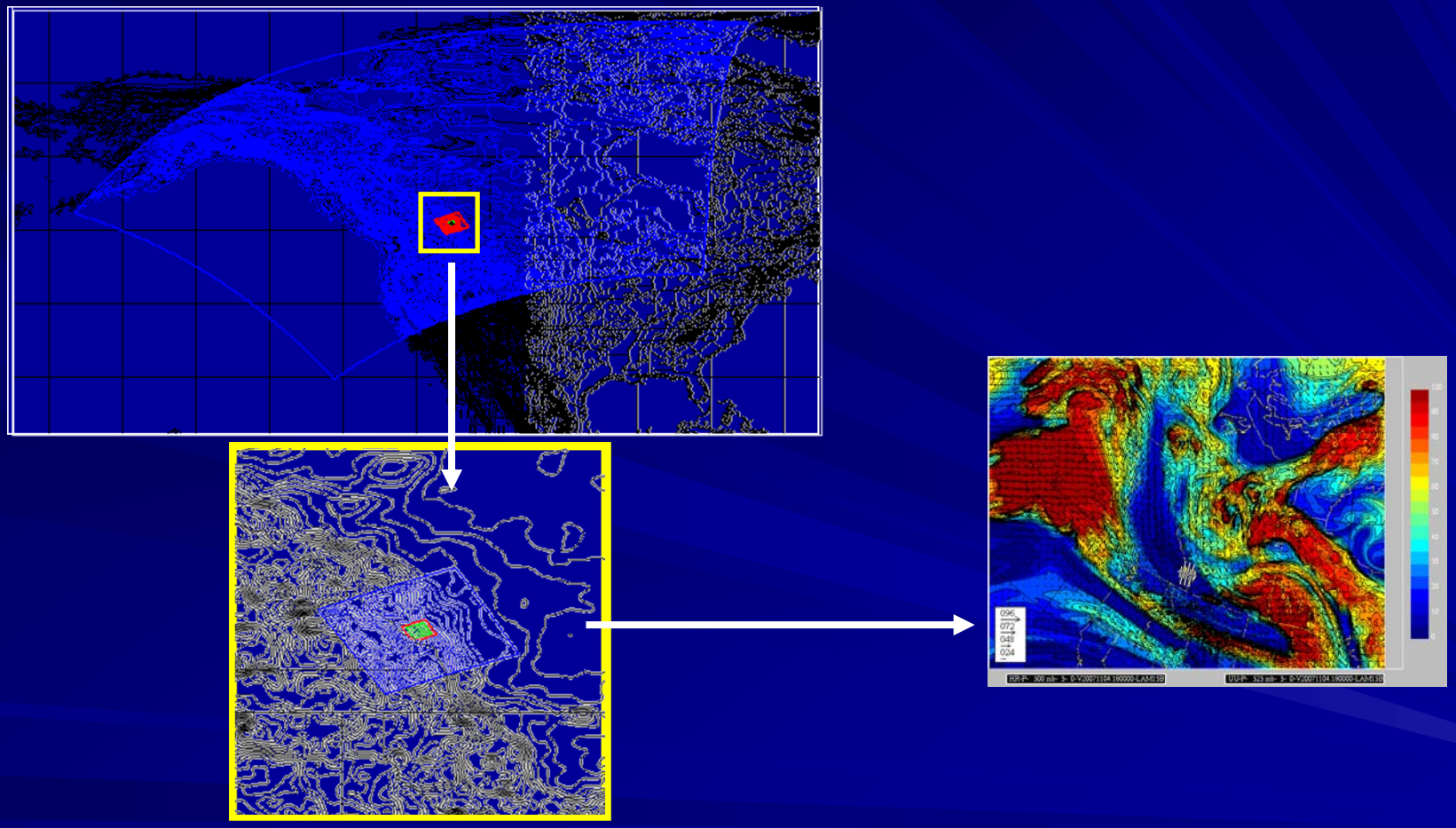




Example of Structure and Parameter Regionalisation Strategy for HLSS



Improved Input Data for PUB



Nested atmospheric & surface models, data assimilation, precipitation gauge network recommendations

Renewal and Consolidation of Themes

- Major Conclusions of Themes to be Consolidated and Articulated
  - Discharge Benchmark Report – completed 2010 (Bloschl & chapter leads)
  - PUB International Workshop 2011.

Themes to Teams

- Solution Oriented: ***Integration and Demonstration Project*** Teams (IDP)
- IDP to integrate knowledge and techniques from themes and demonstrate PUB around the world
  - Organized on different hydroclimatic, physiographic, biogeological and socioeconomic zones
  - Organized on different data availability and predictive interest levels
  - Working groups to map to IDP Teams.
- IDP Teams to provide a range of
  - Collaborative models (local, national, international)
  - Solutions for tropical, temperate, arid, cold, mountain, wetland environments
  - Ways to incorporate new types of basin information: remote sensing, tracers, ecohydrology, process classification, dynamic data assimilation
  - Appropriate solutions for developed and less developed nations
  - Philosophical approaches: e.g. statistical vs physically based, top down vs bottom up,

PUB Practice Report

- IDP teams to Report and Review experiences
  - Team Leaders will
    - Develop best practices
    - Encourage cross fertilization
    - Share data and models
    - **Contribute to a major report on "How to PUB"**
      - **Regional perspectives on how to predict ungauged basins**
      - **Successes and challenges**
      - **Philosophical perspectives**
      - **Practical methods**

Contribute to International Hydrology

- Elevate hydrological practice to science, even “Art”.
- Strengthen IAHS and link to Commissions
  - Joint events with commissions
  - Special Issues in HSJ
- Enhanced communication strategy
  - Website, list-serve emails to community
- PUB in Practice
  - Major Report on How to Predict in Ungauged Basins for various hydrological regimes.
    - Planning in 2010. Start report in 2011 for completion by 2013. Distribution by UN agencies

SSG Renewal

- Theme representatives
- Communications
- Regional/national teams
- Young Members

- Looking for new approaches and interest.

Melbourne 2011

- Townhall Meeting for Development of Plan to Complete PUB in 2013 and provide something rather nice to IAHS and international hydrology.

Ideas and Comments are WELCOME!

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