



International Institute for  
Applied Systems Analysis  
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science for global insight

# Water Futures and Solutions: Developing a New Generation of Integrated World Water Scenarios

*Worlds Within Reach, From Science to Policy*

*26 October, 2012, Laxenburg, Austria*

David A. Wiberg

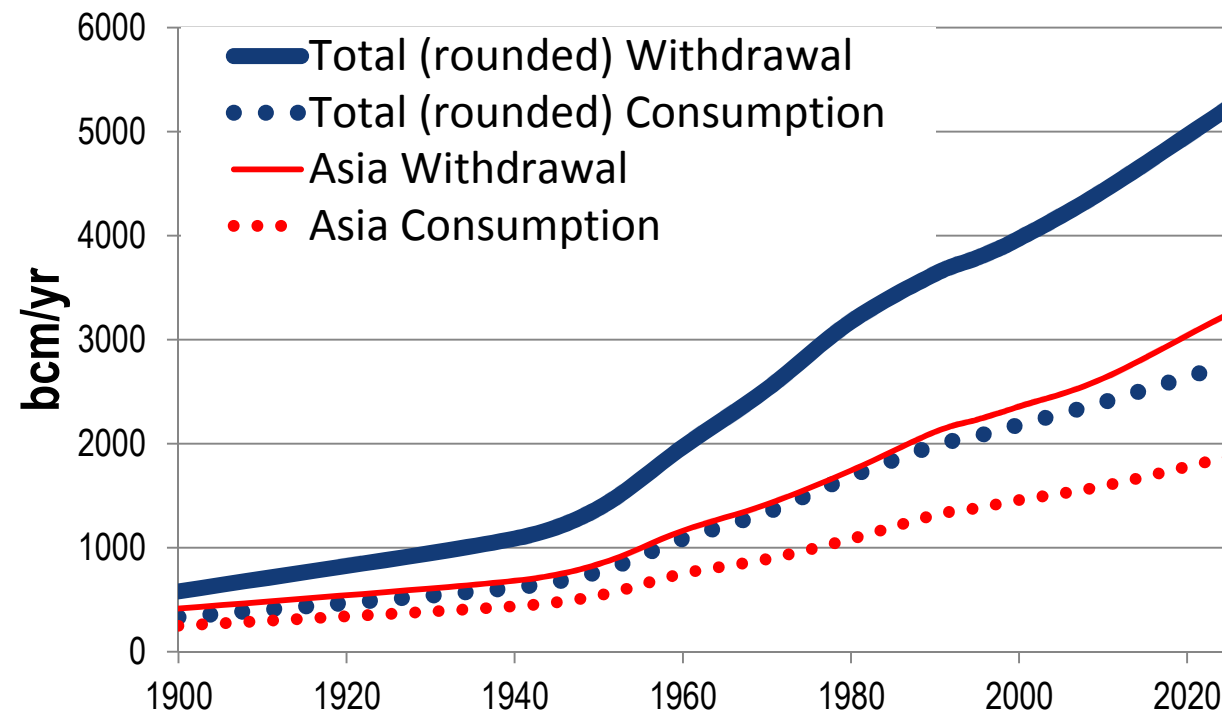


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# Water: Global Challenges

## *Access and Use*

- ~ 900 million people still have inadequate access to safe freshwater (WHO & UNICEF, 2010)
- Water use has been growing at more than twice the rate of population increase in the last century (FAO & UN-Water)

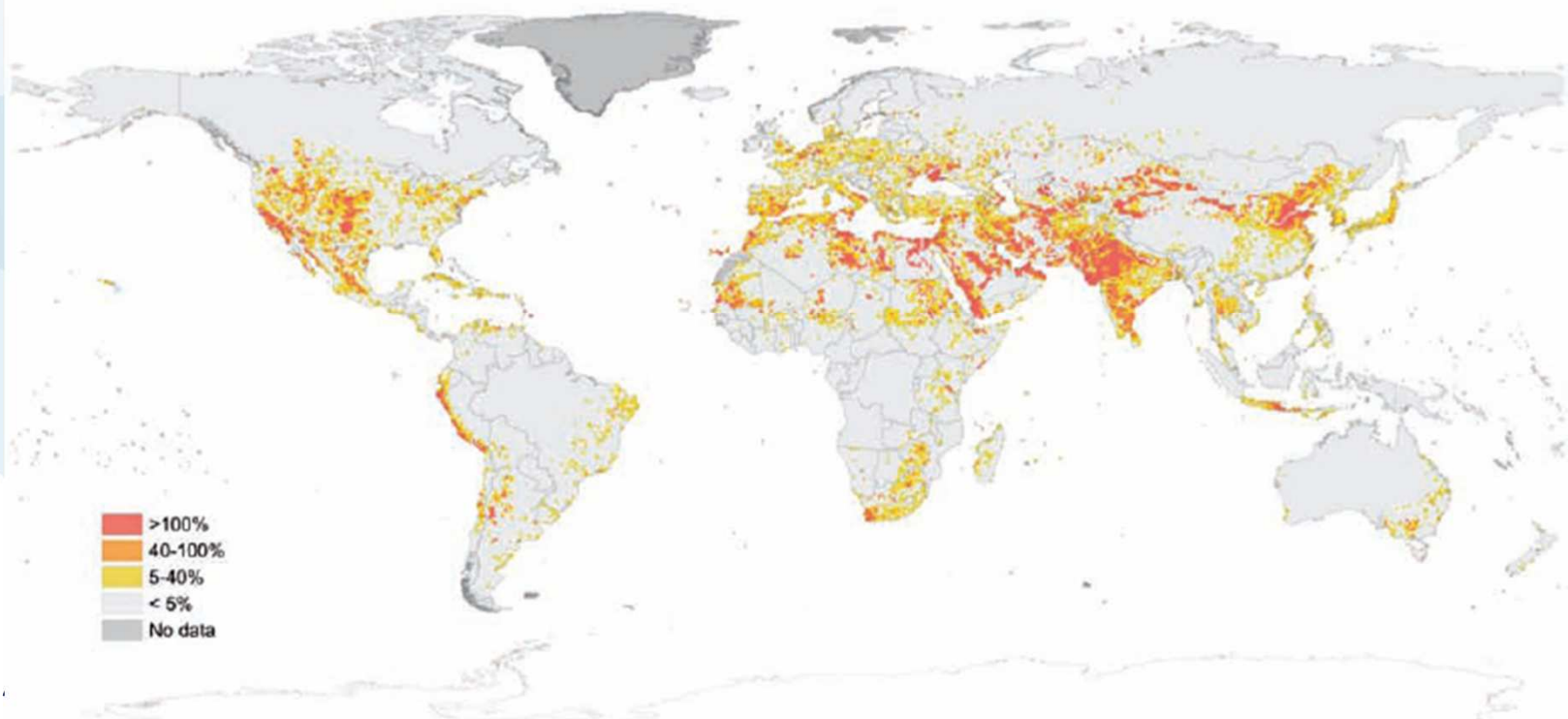


# Water: Global Challenges

## *Water Scarcity*

- 25% of population live in areas of physical water scarcity
- In many areas, withdrawals exceed local renewable water resources.

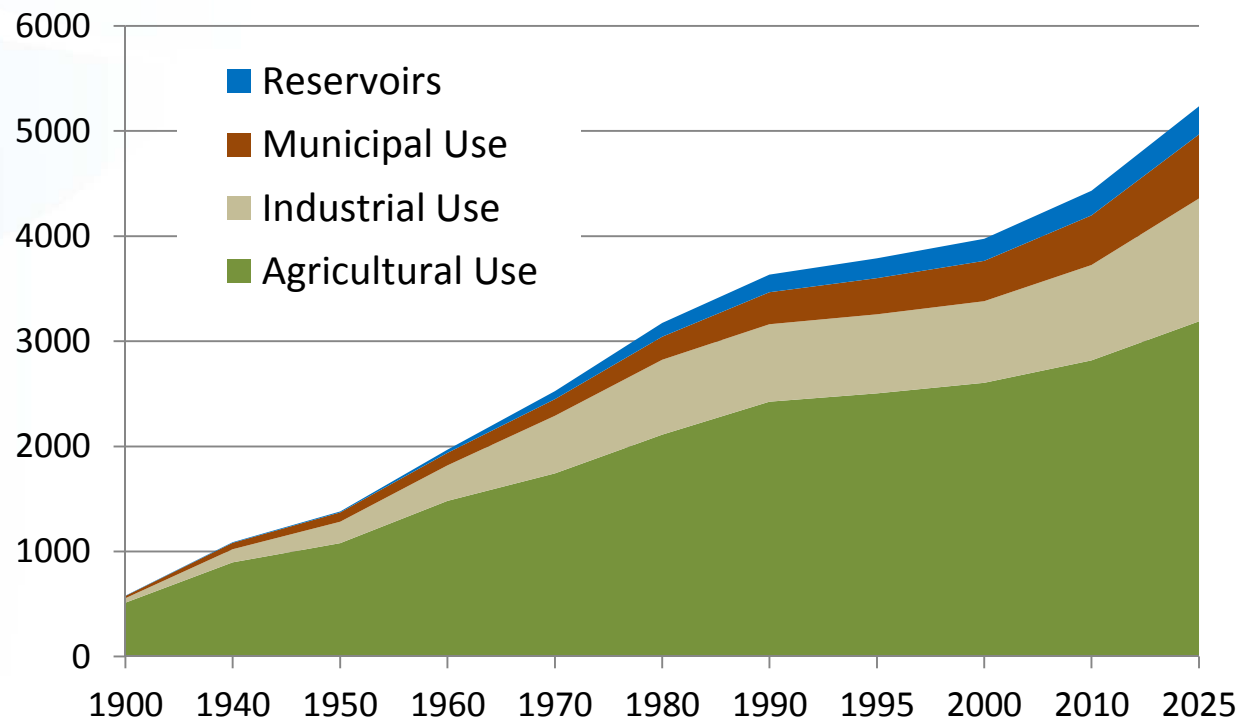
FIGURE 15: RATIO OF ANNUAL WATER WITHDRAWAL TO AVAILABLE RENEWABLE WATER RESOURCE



# Water: Global Challenges

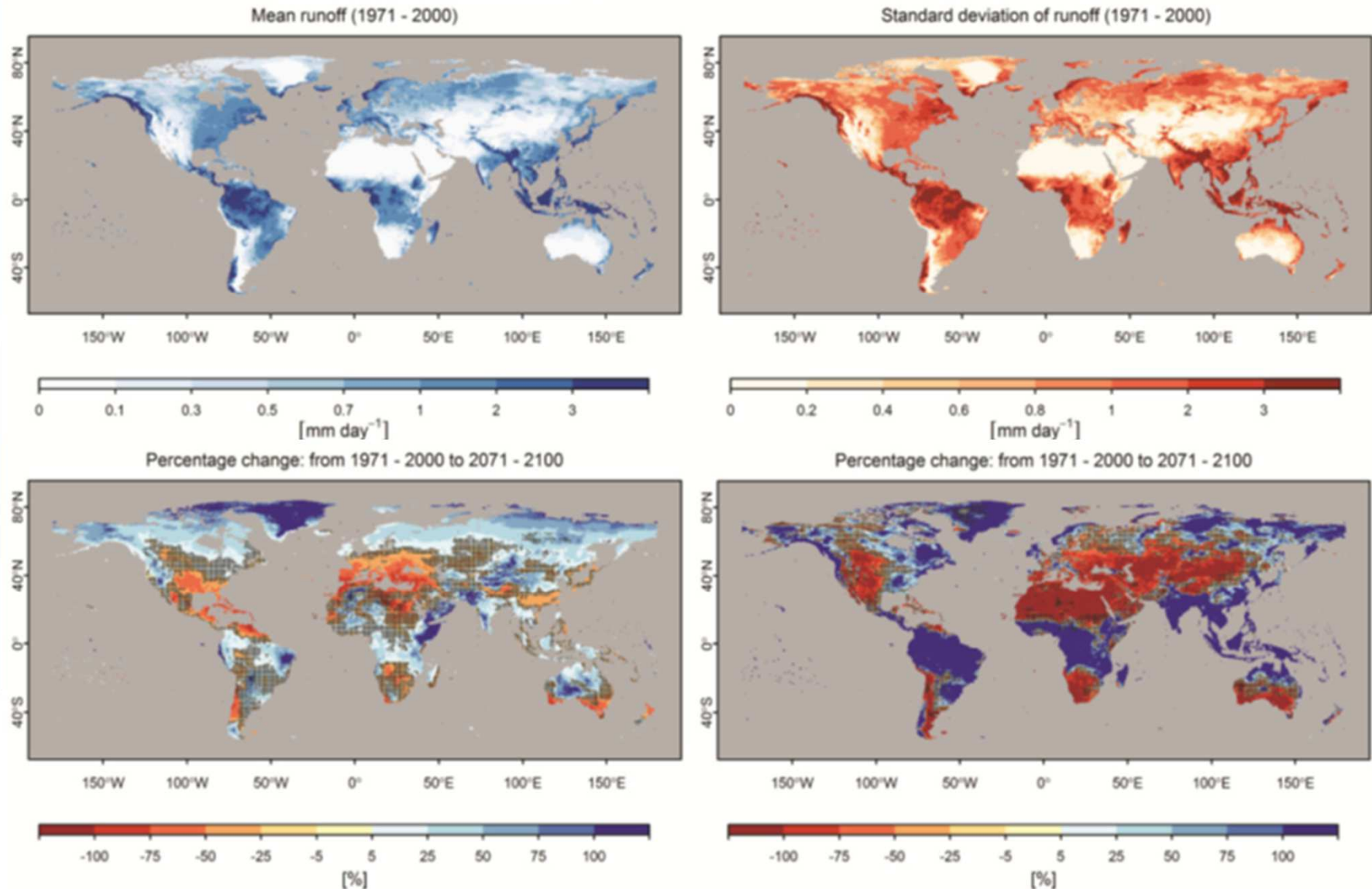
## *Increasing and Competing Demands*

- Population still growing, adding 2 billion more by 2050
- Food production requirements potentially 70% greater by 2050
- 20% of the world's population has no access to electricity
  - Industrial and energy water uses exceed agriculture in high-income countries.
- Ecosystems?



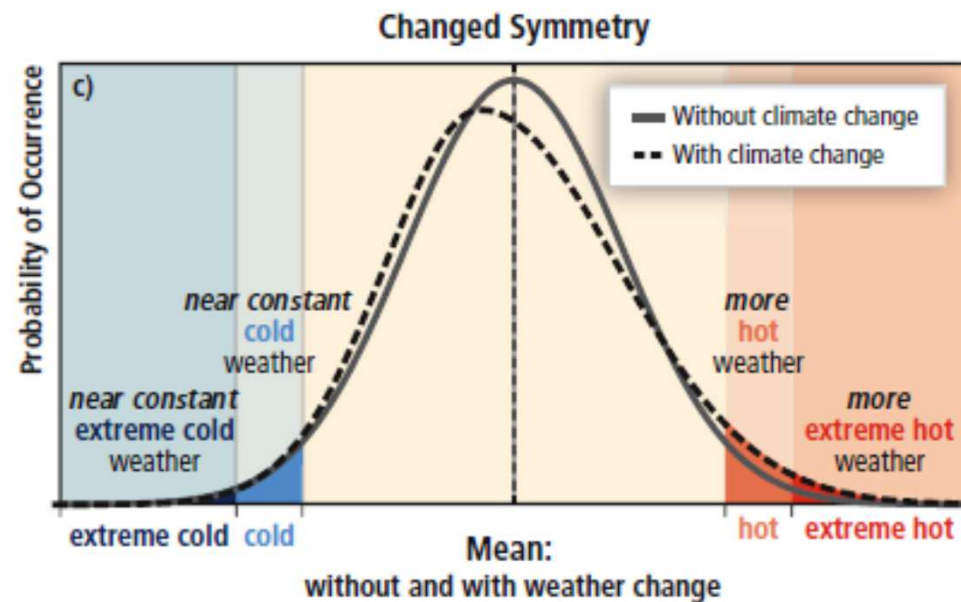
# Water: Global Challenges

## *Climate Change and Variability*



# Water: Management Challenges

- Water management must intensify.
- Managing the water sector alone is no longer enough
  - Water integrates across scales and sectors, which all use and influence increasingly scarce water resources.
- Water management is risk based, but how does risk change?
  - Large uncertainties
    - Data
    - Scenarios
    - Models
  - No stationarity
    - More robust, flexible solutions required





# Water: Management Challenges

## *Decisions under Uncertainty*

- How do we make decisions now that will be effective and robust into the future under increasing risks?

Crystal Ball?

Perfect foresight?

No

# Water Futures and Solutions

## *World Water Scenarios Approach*

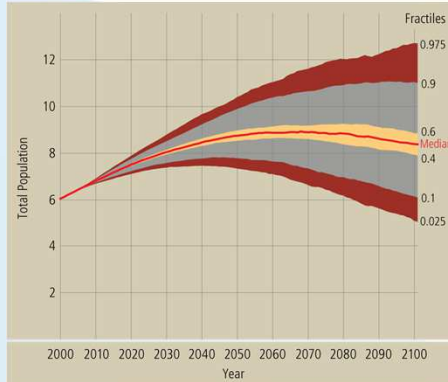
1. Conceptual model
2. Driver analysis
3. Narratives of future
4. Changes in drivers
5. Impacts
6. Management options
7. Identify sets of robust, flexible solutions
8. Communicate

*All items are done iteratively with stakeholders*

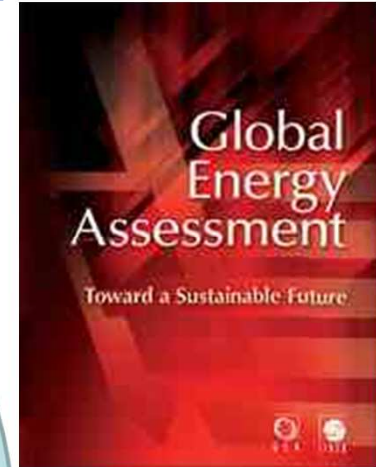
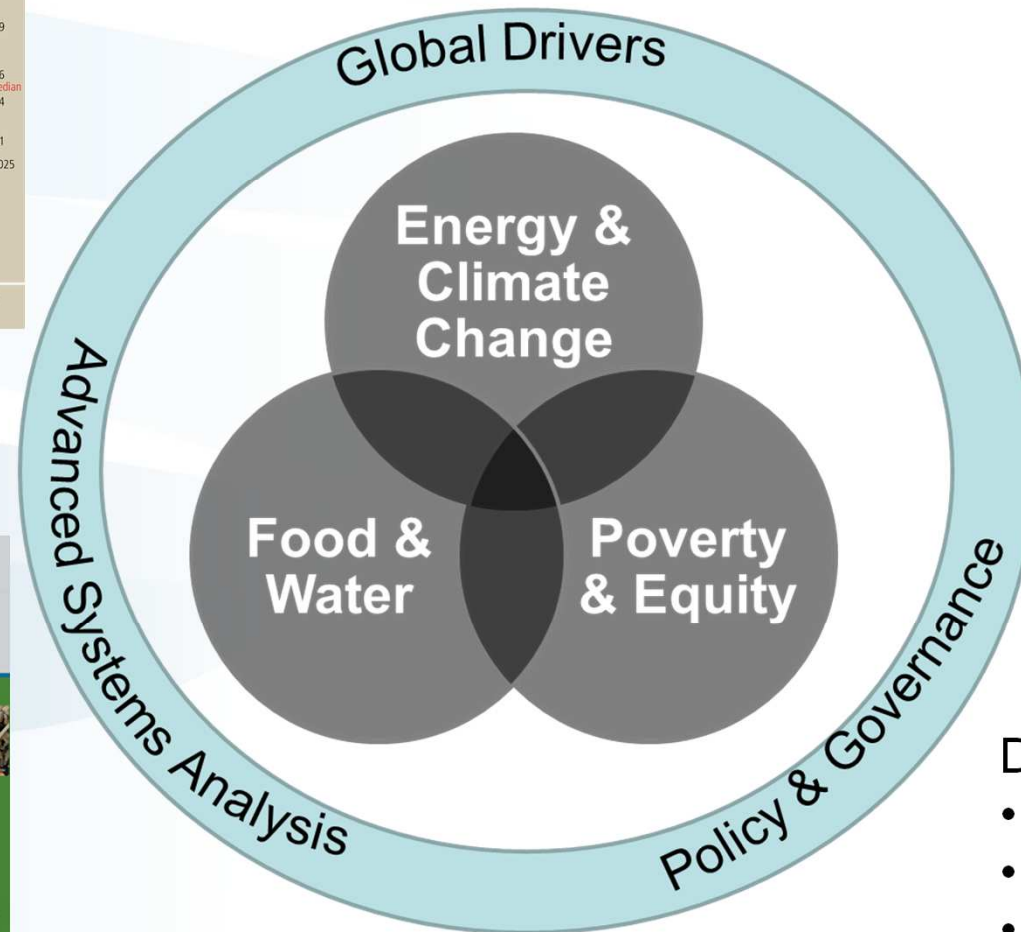


# Water Futures and Solutions

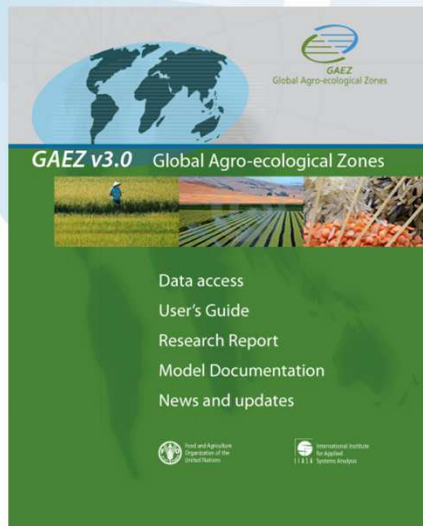
## World Water Scenarios Approach: Applying Experience



<http://www.iiasa.ac.at/Research/POP/proj07/>



<http://www.iiasa.ac.at/Research/ENE/GEA/>



<http://www.gaez.iiasa.ac.at>

Data repository for:

- IPCC
- WATCH
- GEA
- GAEZ
- POP
- GAINS



David A. Wiberg

# Water Futures and Solutions

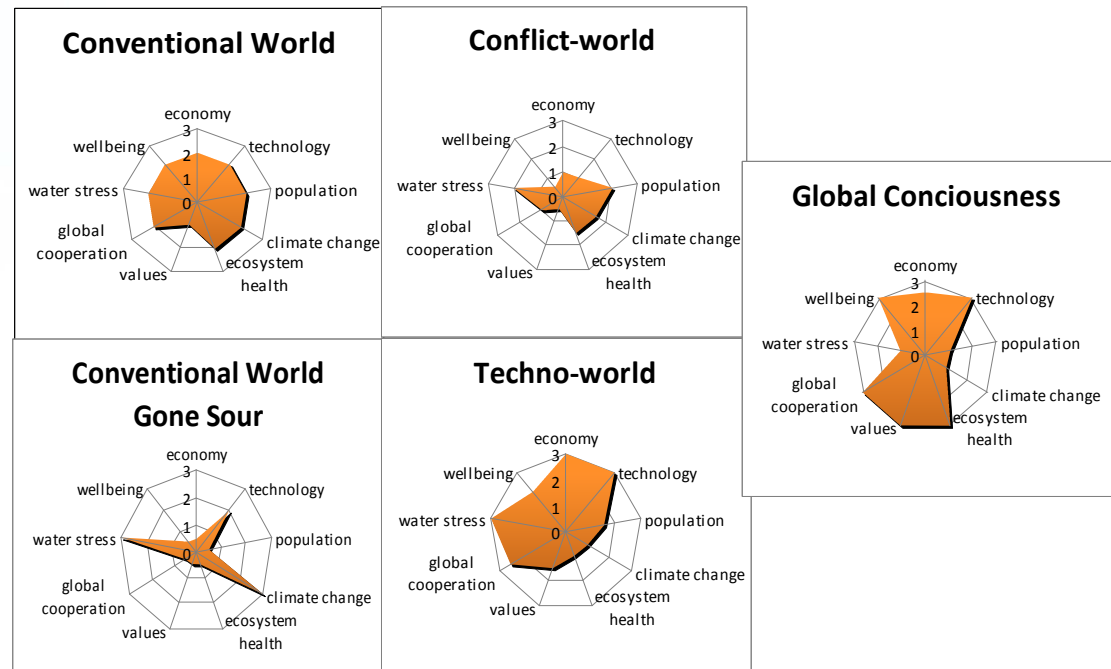
## *World Water Scenarios Approach: Initializing*

### Development Phase Reports – Drivers and Stylized Scenarios

#### Drivers

- Agriculture
- Climate change/variability
- Demography
- Economy/Security
- Ethics
- Governance
- Infrastructure
- Politics
- Technology
- Water Resources

#### Stylized Scenarios



# Water Futures and Solutions

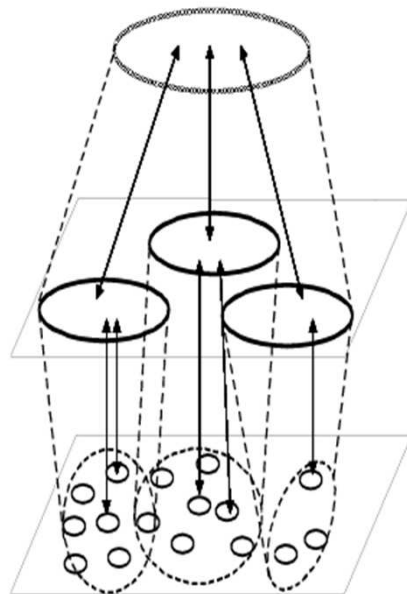
## World Water Scenarios Approach: Applying Experience

SCENES: Multi-level Scenarios for Europe

Pan-European

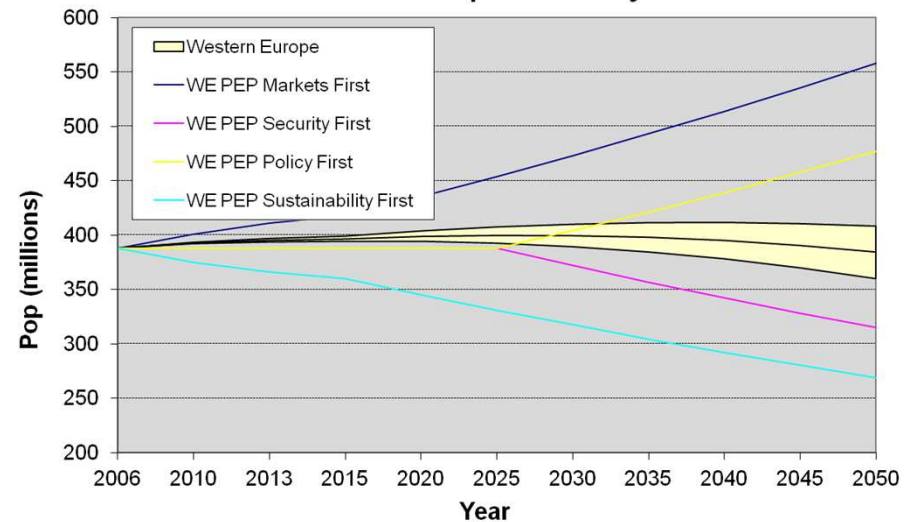
Regions

Pilot Areas



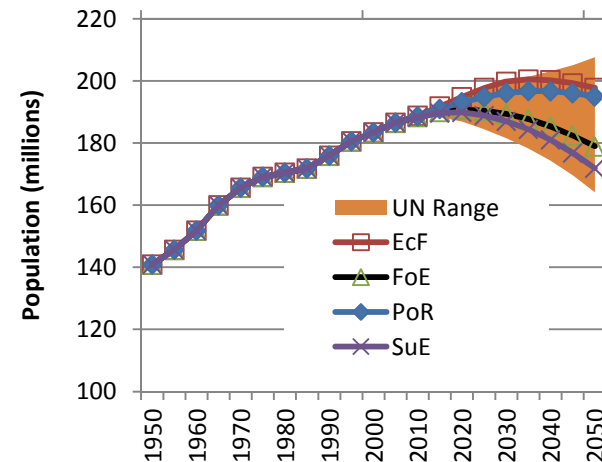
### Early stakeholder growth estimates

Probabilistic Population Projections vs. PEP



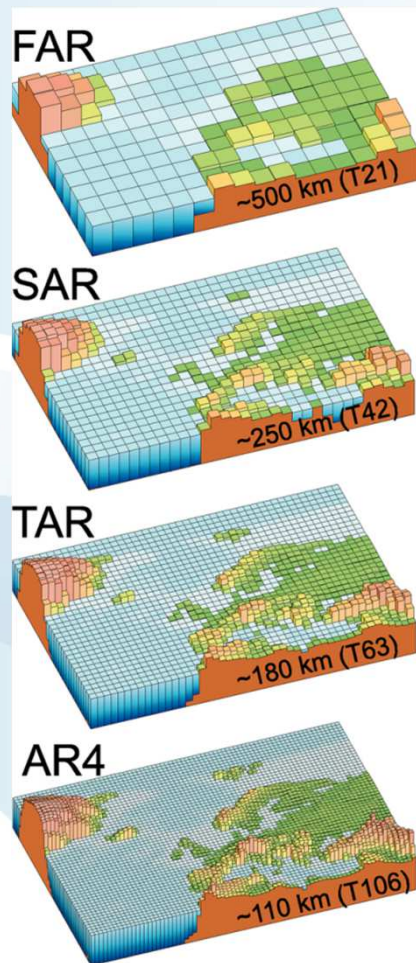
### After two rounds of enrichment

Western Europe

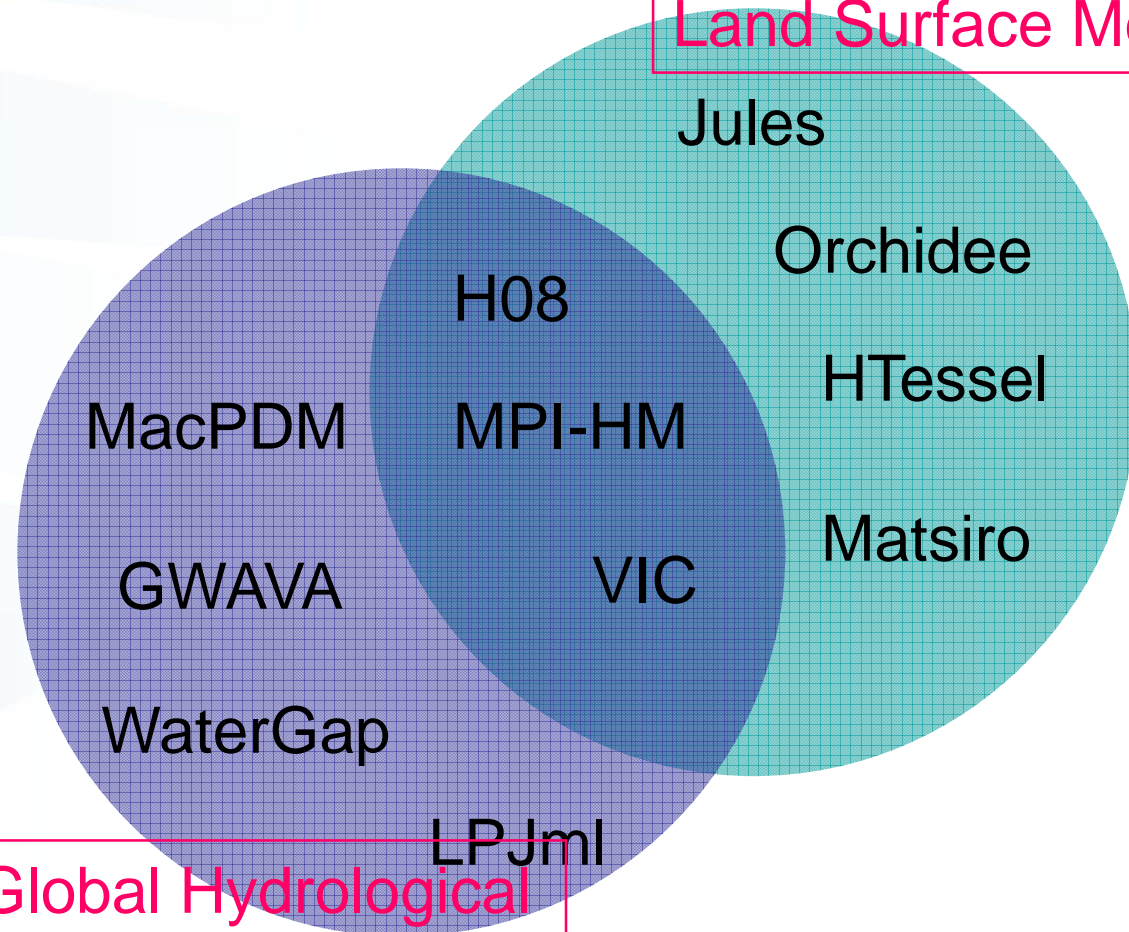


# Water Futures and Solutions

*World Water Scenarios Approach: Applying Experience*



Land Surface Models



Global Hydrological Models

Modeling Advances and Multi-model Assessments

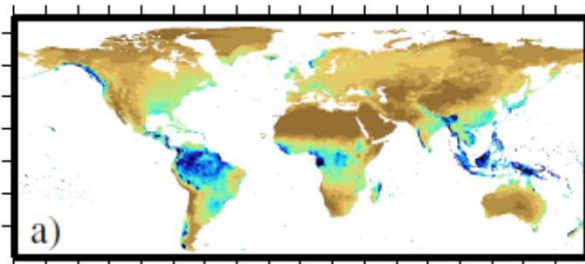




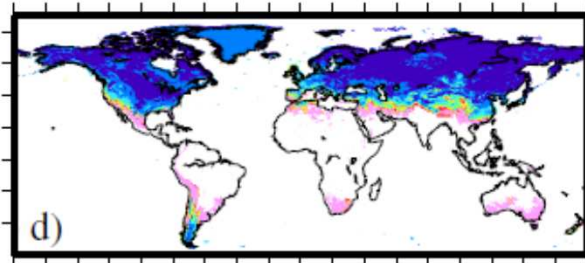
# Multi-model Assessments

Summary of Watch Results – average of models 1985-1999

## Precipitation

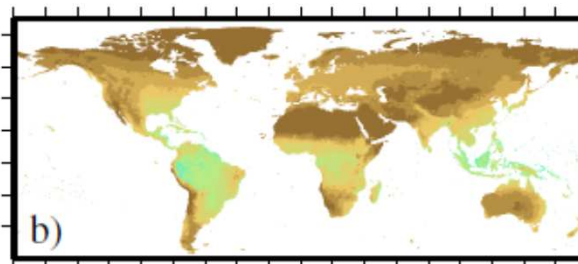


0 2 4 6 8 10 mm day<sup>-1</sup>

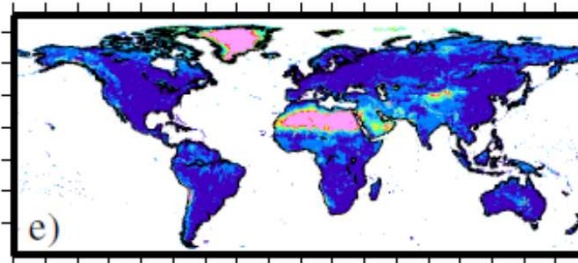


0.0 0.4 0.8 1.2 1.6 CV

## Evaporation

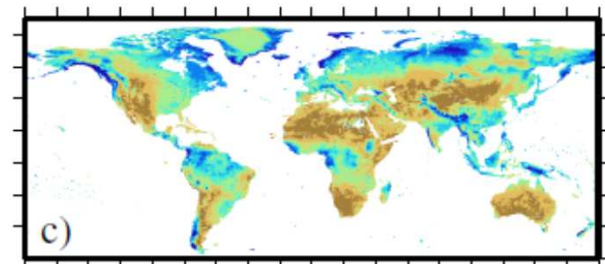


0 2 4 6 8 10 mm day<sup>-1</sup>

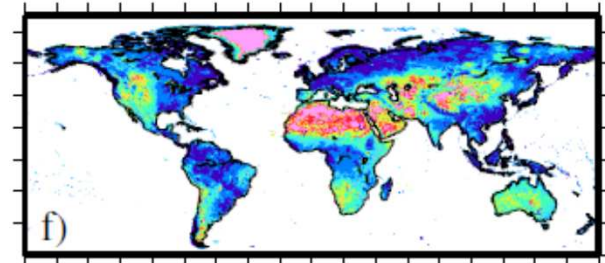


0.0 0.4 0.8 1.2 1.6 CV

## Run-off Fraction



0.0 0.4 0.8 fraction



0.0 0.4 0.8 1.2 1.6 CV

**Watermip: 872 mm**

**415-586 mm**

**0.33 - 0.52**

**GSWP2: 829 mm**

**272-442 mm**

**0.47 - 0.68**

Haddeland et al, *in review* J Hydromet.



# Water Futures and Solutions

## *World Water Scenarios Output*

- New generation of integrated global water scenarios and vision that are consistent with other global scenarios.
- Solution options toolbox for scenario-based decision making
  - Methods
  - Data bases and information
  - Exploratory models, impact calculators, automated checklists
  - Solution options
  - Decision trees for mapping solutions to local conditions
- Information exchange network
  - Mutual learning through exchange of experience and solutions
- Training workshops



If we focus our attention on problems, we will find problems.

If we focus our attention on solutions, we will find solutions.

**THANK YOU!**

