Model Intercomparison Initiative

WaterMIP

- Water Model Intercomparison Project

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(and many others)
Motivation

First International Workshop on Computing the World Water Balance

University of Kassel, Kassel, Germany
25-26 April, 2007

Sponsored by
Global Water System Project
EU WATCH Project
Center for Environmental Systems Research, Uni-Kassel
Motivation

Key Issues of the Model Intercomparison Exercise

- Model intercomparison is a joined **GWSP-WATCH** initiative
- Improved understanding of the **uncertainties** and the drivers of the current and future global water balance / water resources
- **Vulnerability** of global water resources
- Facilitate the design of a **modelling framework**
  - Intercomparison follows a strict and well defined **modelling protocol**
- Improving the **representation** of the global hydrological cycle in GCMs to improve the simulation of **feedbacks**
  - Bring together different communities: LSMs - GHMs
Motivation

Improvements

water community  climate community

GHM  LSM  GHM  LSM

Water Model Intercomparison Project

SSC-Meeting GWSP
Bonn, Germany

WaterMIP – Joint GWSP-WATCH Initiative

8th of December 2010
The modelling framework

Historic data sets

Global Circulation Models

Bias Correction

20th Century forcing data (WB1)

21st Century forcing data (WB3)

Global Hydrological Models & Land Surface Models (WB6)

Model Inter-comparison (WB1&WB6)

Module exchange

Non climatic drivers (WB2)
- Land Use
- Population
- Water use
- Soil type

New components:
- Groundwater
- Water Quality
- Irrigation
- Dams
The modelling framework

Sets of Model Intercomparisons

1st round of model intercomparison
- model improvements

2nd round of model intercomparison
- naturalized run
- model run with anthropogenic impacts (dams, extractions etc.)
- model improvements

3rd round of model intercomparison
- What are the impacts of climate change on the global hydrological cycle and global water resources?
- Datasets with future scenarios of non climatic drivers
- Datasets with non climatic drivers

Initial dataset with 20th century forcing data

Final WATCH dataset (WFD) with 20th century forcing data

Climate change scenarios resulting in datasets with 21st century forcing data
WaterMIP Results

What have we accomplished so far

- “Tested” WATCH Forcing Data using many models
- 5 models have submitted **human impacts runs**
- A clear **protocol** for data submission and model runs – a great benefit for the rest of the WATCH project.
- First **paper** submitted
- **Many** model runs submitted for the **21st century** over the last few week
- Potentially the first global **multi climate** and **multi impact** model assessment
Global mean annual runoff and evaporation

WaterMIP Results

Haddeland et al 2010, in review
WaterMIP Results

Precipitation
- WaterMIP: 872 mm
- GSWP2: 829 mm

Evaporation
- WaterMIP: 415-586 mm
- GSWP2: 272-442 mm

Run-off Fraction
- WaterMIP: 0.33 - 0.52
- GSWP2: 0.47 - 0.68

Haddeland et al 2010, in review
Key findings for naturalized modeling results

- Considerable **spread** in model results (range in runoff is 25,000 km³).
- Interannual **variation** in predicted global **runoff** is much larger than variation in **ET**.
- Global Hydrological Models show **higher average** and **median runoff** values than Land Surface Models. Partly due to a different snow melt scheme.
- **Energy balance** models in general predict **lower snow water equivalents** than models using a **degree day** approach.
- Calculating **ET** based on **temperature** solely can lead to significantly different results than using **radiation** and **humidity** in addition.
- **Reliable** conclusions for the impacts of climate change on water resources should **not** be based on the results of a **single** model.

Haddeland et al. 2010, *in review*
WaterMIP - Outlook

What’s coming next?

No.
2
x
3
x
???

Emission scenario A
Emission scenario B

ECHAM5
IPSL
CNRM

Impact model A
Impact model B
Impact model C
Impact model D
Impact model E
Multi Model Analysis on Water Scarcity

Water stress
(A2 ECHAM5, 2010s)

withdrawal-to-availability ratio

0 - 0.2 [low water stress]
0.2 - 0.4 [mid water stress]
more than 0.4 [severe water stress]
no data

(c) Center for Environmental Systems Research, University of Kassel, Okt 2010 - WaterGAP 2.2
Multi Model Analysis on Water Scarcity

Water stress
(A2 ECHAM5, 2100s)

- Withdrawal-to-availability ratio:
  - 0 - 0.2 (low water stress)
  - 0.2 - 0.4 (mid water stress)
  - more than 0.4 (severe water stress)
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Water Scarcity
WaterMIP - Outlook

Data sets from WaterMIP (WATCH)

- WATCH Forcing Data – WFD (1901-2002)
- 100 years daily and monthly runoff data from several hydrological models
- bias corrected climate forcings from 3 GCM x 2 scenarios.
- 140 years daily and monthly runoff data from several hydrological models