Faculty of Geosciences Department of Physical Geography

Water2Invest: Global facility for calculating investments needed to bridge the climate-induced water gap

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Introduction

Decision makers responsible for climate change adaptation investments are confronted with large uncertainties regarding future water availability and water demand, as well as the investment cost required to reduce the water gap. **Water2Invest aims to (i) assess the joint impact of climate change and socio-economic change on water scarcity, (ii) integrate impact and potential adaptation in one flow, (iii) prioritize adaptation options to counteract water scarcity on their financial, regional socio-economic and environmental implications, and (iv) deliver all this information as a web-based service.** Here we present the project outline and preliminary results

Water availability

PCR-GLOBWB (Van Beek et al. 2009) provides water availability on a global scale until 2100 based on CMIP5 model output (Fig. 1). Monthly time series are derived for each of the 1400 water provinces (Fig. 2)

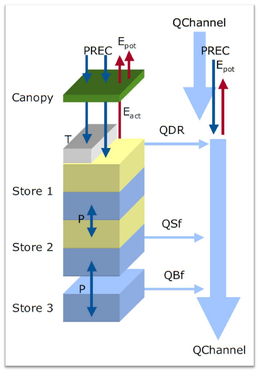

Figure 1 PCR-GLOBWB model conceptual scheme. Model runs at 6 minute resolution

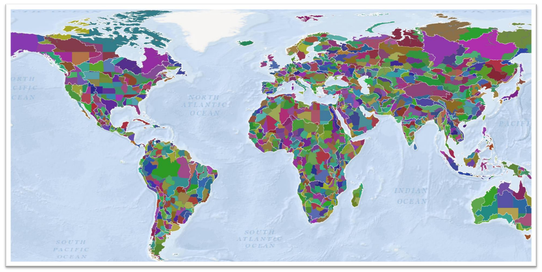

Figure 2 Water provinces: intersection of administrative areas and major basins used to aggregate model output

Water demand and allocation

Water demanded by agriculture, industry, domestic, and the environmental is computed based on socio-economic scenarios of increase in population and gross domestic product. Using a Lagrangian relaxation optimization, water is allocated on a monthly basis over the four sectors. The water allocation model allocates the water based on priority and water supply pricing and simulates in which sector shortages may occur at what time (Figs 3-5).

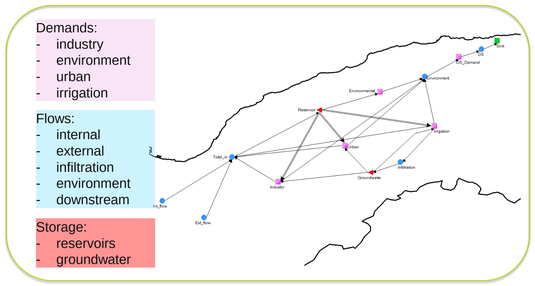

Figure 3 Water allocation model setup with required nodes for each province.

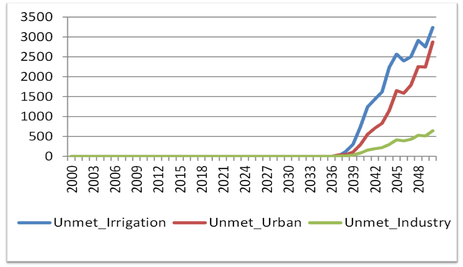

Figure 4 Example output: Expected shortages per demand for one water province.

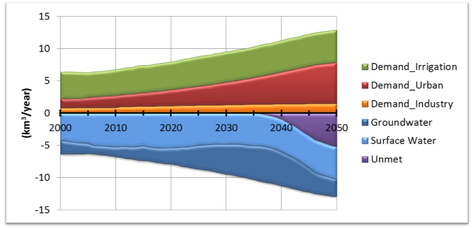

Figure 5 Development of water supply and demand over time based on CMIP5 climate data.

Investments and indicators

Based on the unmet water demands, different measures may be taken to bridge the water gap for each water province (Fig. 6).

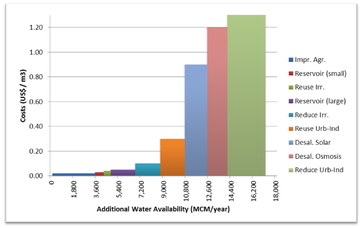

Figure 6 Cost-effectiveness of measures

To make investment decisions, insight in both the cost of measures and the impacts of these measures on water using sectors and ecosystems is required. To be able to prioritize adaptation options, the water scarcity is further processed into socio-economic impacts, such as economic loss of agriculture production. The change in river flow regime – the variations in both and high and low flows – is assessed to understand potential environmental impacts. A scheme is developed to evaluate the strategies on robustness and flexibility under climate change and scenario uncertainty, and each measure is linked to possibilities for investment and financing mechanisms, with particular attention to private sector involvement (Fig. 7, 8).

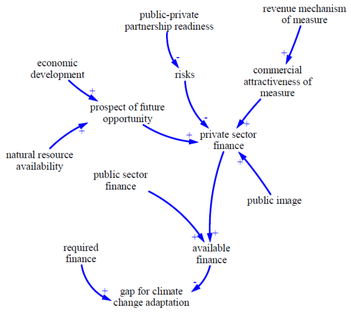

Figure 7 Preliminary analysis of factors determining private finance availability

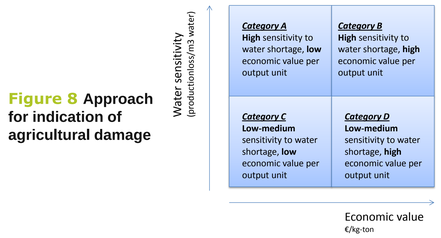

Figure 8 Approach for indication of agricultural damage

Web mapping and user interaction

We are implementing the global facility as a web-based tool to allow for convenient querying and user interaction. However, it also includes advanced web-services for further systems integration.

The technology is based upon standards set forth by the Open Geospatial Consortium:

- A web mapping service (WMS) enables web-based visualisation of map layers (Fig. 9)
- A web feature service (WFS) enables querying for specific details on water provinces
- A web processing service (WPS) enables scenario analysis and querying of "what if" questions, e.g. increase in reservoir capacity, desalinization plants, or drip irrigation (Fig 10, 11).

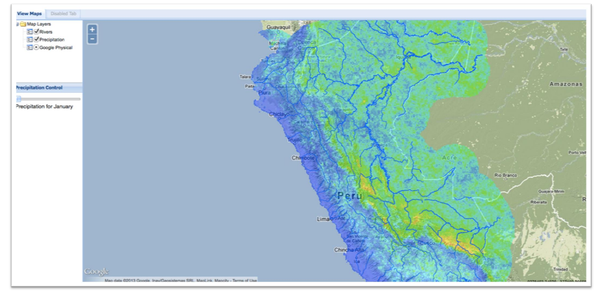

Figure 9 WMS of precipitation with google maps background

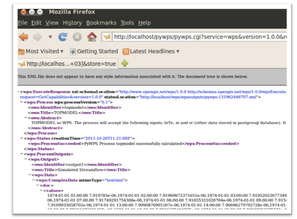

Figure 10 Prototype of a hydrological model as a web processing service (WPS)

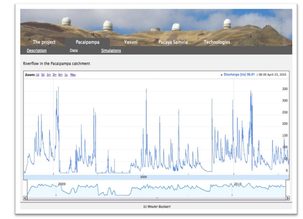

Figure 11 Prototype of interactive visualisation of hydrological time series

The tool can be used by consultants, water authorities, non-governmental and commercial investors alike to test investment strategies, but could also be used by companies as a vehicle for advertisement water saving or crop water productivity technologies that can be evaluated on their effectiveness on the spot.

checkout **www.water2invest.com** by July 2013

reference Van Beek, L.P.H. and M.F.P. Bierkens (2009), The Global Hydrological Model PCR-GLOBWB: Conceptualization, Parameterization and Verification, Report Department of Physical Geography, Utrecht University, Utrecht, The Netherlands.