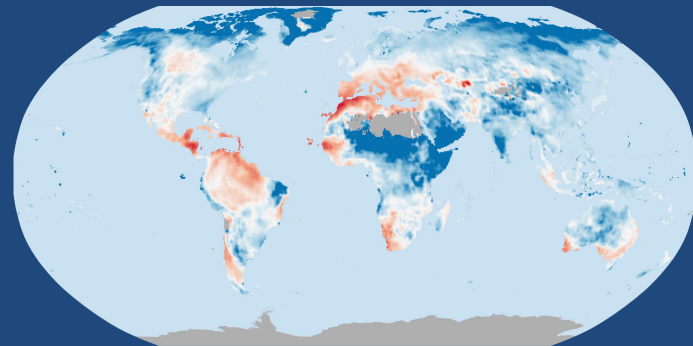


Exploring Climate Change Impacts on Global Water Resources

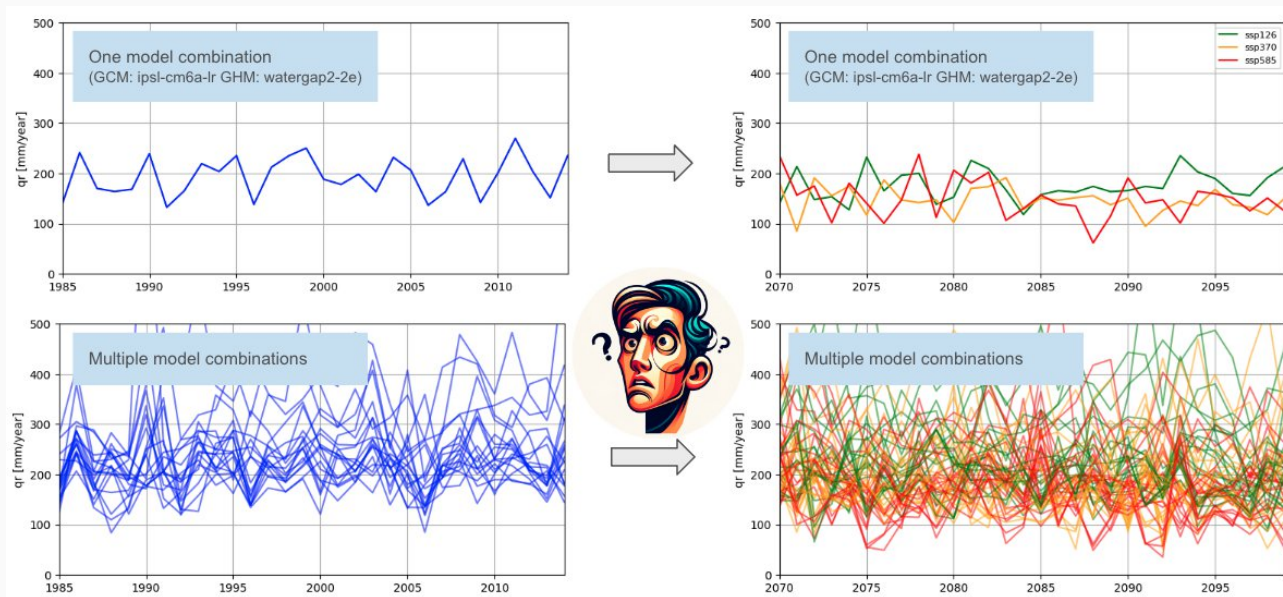
An Interactive Tool for Decision-Making and Adaptation

Guillaume Attard (AGEOCE)

With the participation of Laura Müller, Petra Döll, Fabian Kneier
and Julien Bardonnet



Quantifying Climate Change Hazards and Their Uncertainty is Challenging



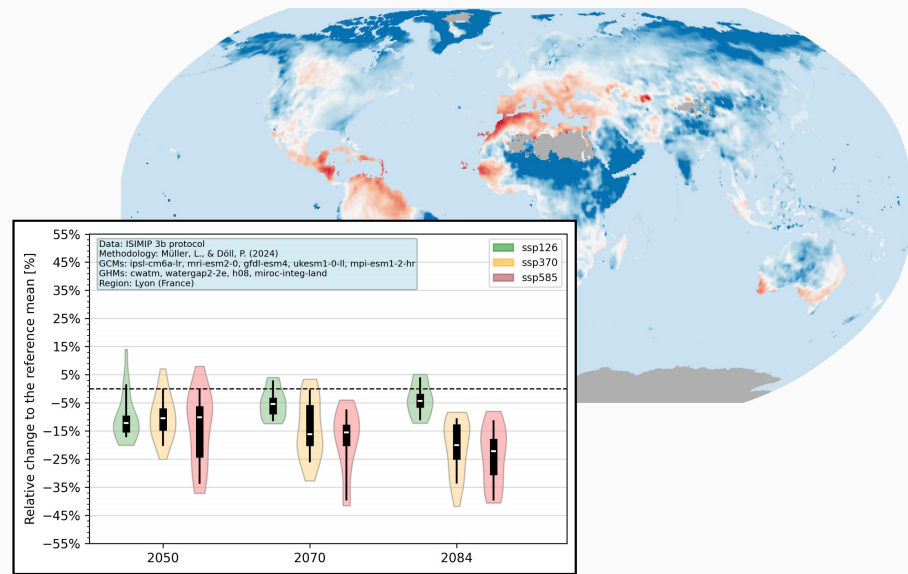
Example of yearly groundwater recharge time series considering one or multiple combinations of models illustrating the variability of model outputs

Availability of Water Resources Under the Effect of Climate Change

Our aim is to provide global data to measure your exposure to climate risks

- ✓ Determine the effects of different climate scenarios
- ✓ Assess the level of consensus between models
- ✓ Identify critical changes
- ✓ Several indicators are available

Using a robust scientific approach¹ and authoritative climate data²



¹Müller, L., and Döll, P. (2024): Quantifying and communicating uncertain climate change hazards in participatory climate change adaptation processes. Geosci. Commun., 7/2, 121–144. <https://doi.org/10.5194/gc-7-121-2024>

²Gosling S. N., Müller Schmied H., Bradley A., Burek P., Gedney N., Grillakis M., Guillaumot L., Hanasaki N., Ito A., Kou-Giesbrecht S., Koutroulis A., Nishina K., Otta K., Sahu R.-K., Satoh Y., Schewe J. (2024): ISIMIP3b Simulation Data from the Global Water Sector (v1.3). ISIMIP Repository. <https://doi.org/10.48364/ISIMIP.230418.3>

Data

Data Sources: ISIMIP3b / Water Global

Temporal Coverage:

- **Reference Period:** 1985–2014
- **Projection Period:** 2015–2100

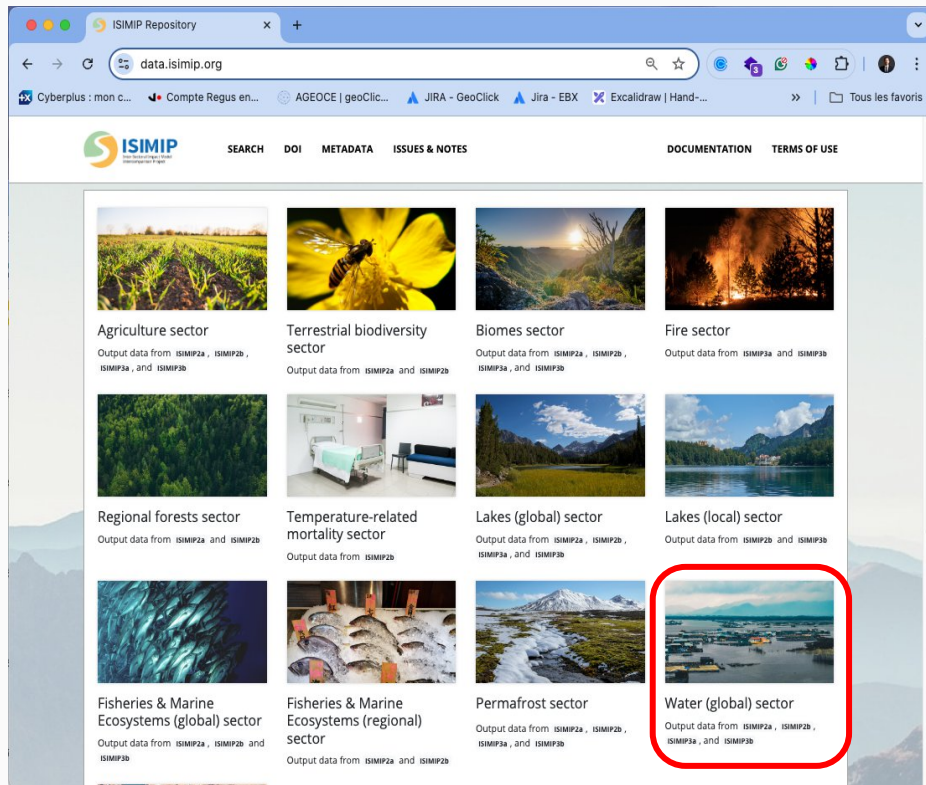
Emissions Scenarios (3): SSP1-RCP2.6, SSP3-RCP7.0, SSP5-RCP8.5

Hydrological models (4): JULES-ES-vn6p3, MIROC-INTEG-LAND, CWATM, WaterGAP v2.2e

Circulation models (5): MPI-ESM1-2-HR, UKESM1-0-LL, MRI-ESM2-0, GFDL-ESM4, IPSL-CM6A-LR

Variables :

- Total Runoff,
- Groundwater Recharge,
- Total Evapotranspiration



Processing

Creation of 30-years composites for each combination of models and scenario (GCM*, GHM*, SSP*)

- Calculate the yearly and seasonal averaged variables for historical and future periods
- For each combination, calculate the relative changes between the projection and the historical values (Müller & Döll 2014).

*GCM: Global Circulation model

*GHM: Global Hydrological Model

*SSP: Shared Socioeconomic Pathways

Geosci. Commun., 7, 121–144, 2024
<https://doi.org/10.5194/gc-7-121-2024>
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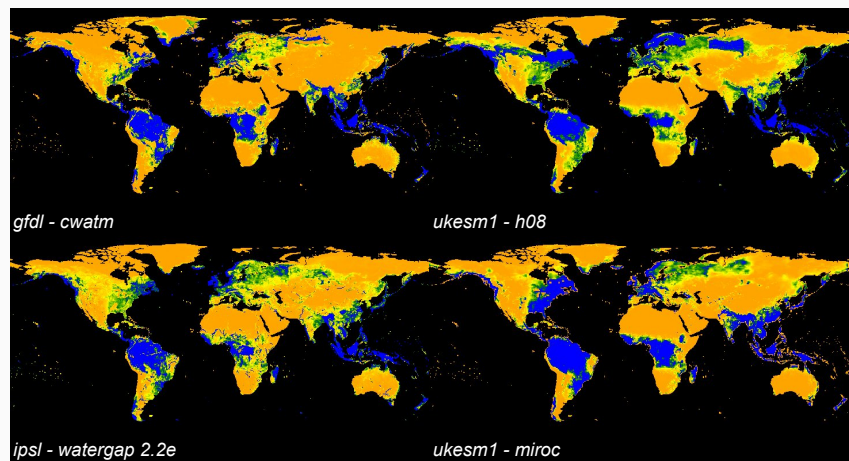


Quantifying and communicating uncertain climate change hazards in participatory climate change adaptation processes

Laura Müller¹ and Petra Döll^{1,2}

¹Institute of Physical Geography, Goethe University Frankfurt, Frankfurt, 60438, Germany

²Senckenberg Leibniz Biodiversity and Climate Research Centre (SBiK-F) Frankfurt, Frankfurt, 60325, Germany



30 years annual averaged historical recharge (1985-2015) according to 4 GCM / GHM combinations (0 to 500 mm/year - orange to blue)

Technologies

- Data download and processing of netCDF file on a local machine into Cloud-Optimized GeoTIFF
- Ingestion and On-the-fly calculation using Google Earth Engine*



Google Earth Engine combines a multi-petabyte catalog of satellite imagery and geospatial datasets with planetary-scale analysis capabilities.

Visit the explorer

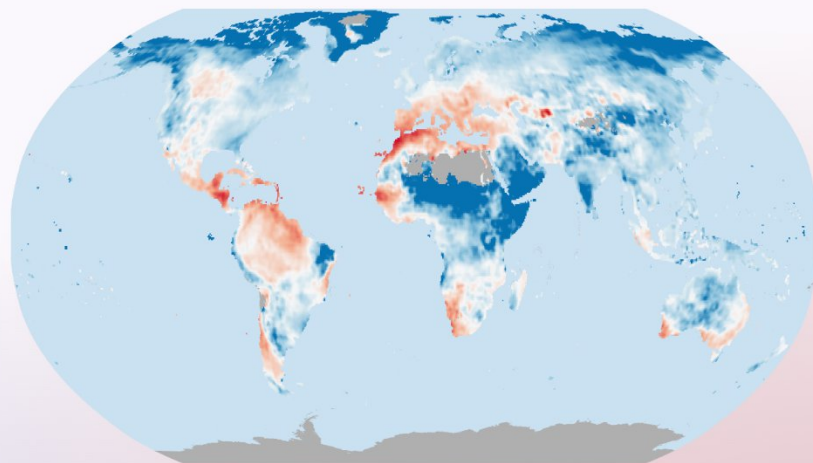
<https://ageoce.com/en/solutions/climate-change-water-explorer/>

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Explorer for climate change impacts on water resources

This web application is designed to visualize potential future changes in water resources worldwide. Developed through a collaboration with the Goethe University of Frankfurt, this tool leverages multi-model ensemble simulations from ISIMIP3b to support local climate change adaptation initiatives.

- ✓ Visualize how water resources might shift under different scenarios.
- ✓ Understand the agreement among models.
- ✓ Discover the percentage of models predicting changes that exceed user-defined thresholds.
- ✓ Dive into detailed data for actionable, location-specific adaptation planning.
- ✓ Account for uncertainties in greenhouse gas emissions and climate models.

[Documentation](#)[Live explorer](#)[Request dataset](#)

Explore potential future changes in water resources

<https://ageoce.com/en/solutions/climate-change-water-explorer/>

Climate Change Impact on Water Resources

This app explores potential future changes in global water resources using a multi-model ensemble from the IS92a protocol. It supports local climate adaptation by visualizing water resource changes while accounting for uncertainties in emissions, climate, and hydrological models. The top map presents the median relative change of a variable, the bottom map reflects model agreement on simulating a specific change in that variable, and the local insights box shows ensemble distribution shifts at a selected location across three future periods.

[App homepage](#) [Documentation](#) [Contact](#)

Relative change: set your parameters

Select your variable of interest to explore potential future changes (yearly or seasonal) in water resources from the period 1985-2014. The median relative change map will appear at the top of the page.

Variable: **Groundwater Recharge** Climate scenario: **SSP 5 (RCP 8.5)**

Projection: **2071-2100** Seasonality: **Yearly**

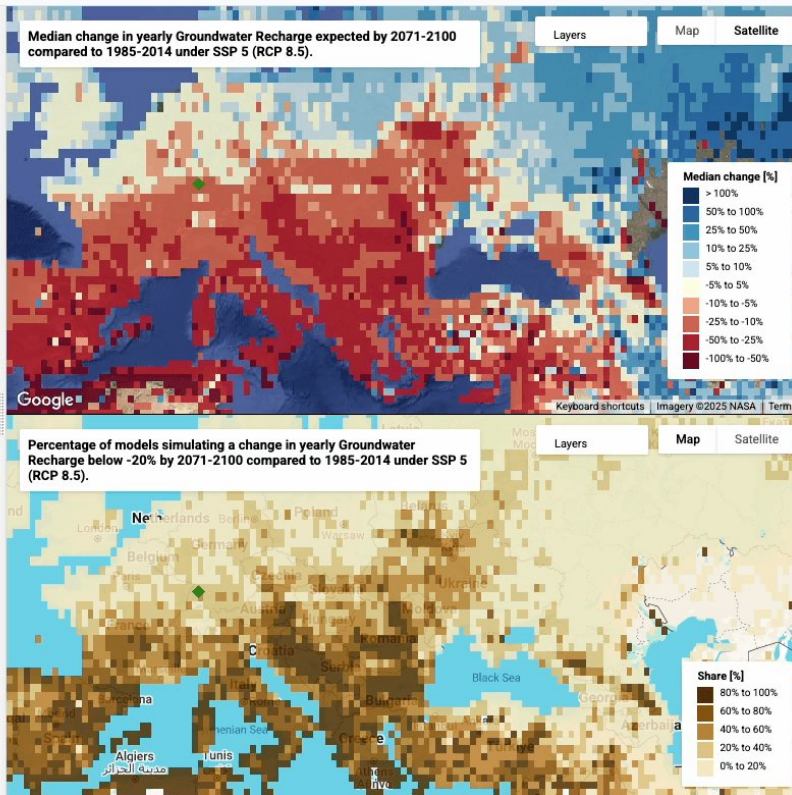
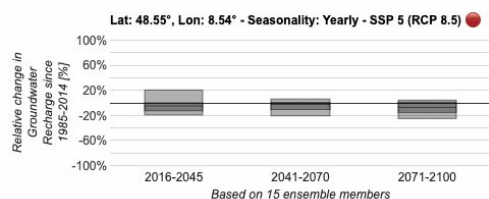
Share of models exceeding a specific change: set your value

Concerned about a certain change? Set a value for change of interest. The bottom map will show the percentage of models simulating that the variable's change is either above (select 'above') or below (select 'below') this value.

Display the share **BELOW** Change [%]:

Local insights: click on the map

Explore local distributions of models depicting the potential relative change of the variable to the reference period (1985-2014). The 10th and 90th percentiles is represented in light color. The interval between 30th and 70th percentiles is represented in a dark color with the median line inside.



Determine where a certain change might occur

<https://ageoce.com/en/solutions/climate-change-water-explorer/>

Search places

Climate Change Impact on Water Resources

This app explores potential future changes in global water resources using a multi-model ensemble from the IS92a protocol. It supports local climate adaptation by visualizing water resource changes while accounting for uncertainties in emissions, climate, and hydrological models. The top map presents the median relative change of a variable, the bottom map reflects model agreement on simulating a specific change in that variable, and the local insights box shows ensemble distribution shifts at a selected location across three future periods.

[App homepage](#) [Documentation](#) [Contact](#)

Relative change: set your parameters

Select your variable of interest to explore potential future changes (yearly or seasonal) in water resources from the period 1985-2014. The median relative change map will appear at the top of the page.

Variable: **Total Runoff** Climate scenario: **SSP 3 (RCP 7.0)**

Projection: **2071-2100** Seasonality: **JJA**

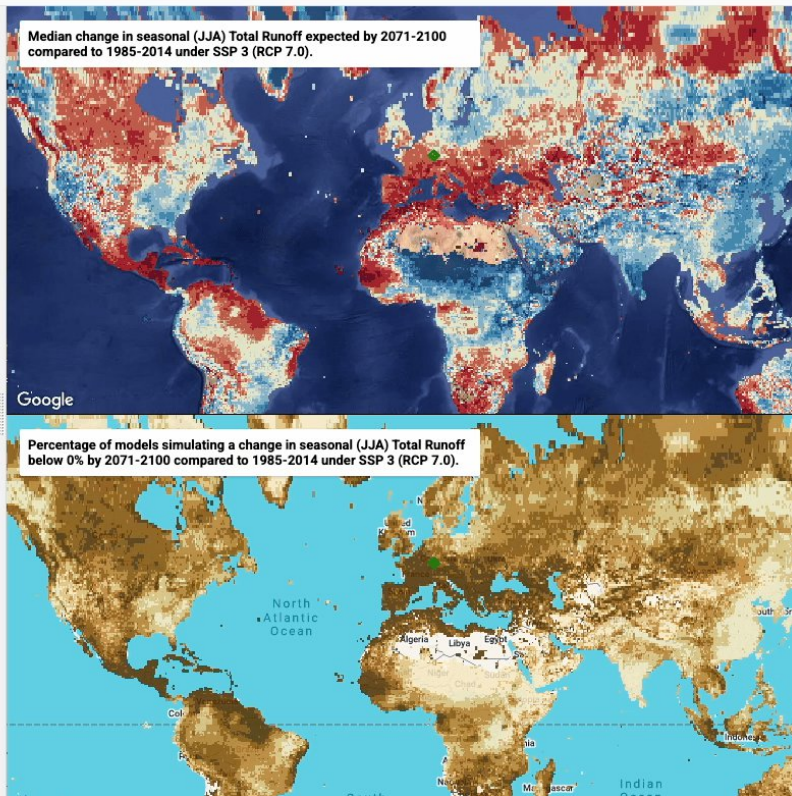
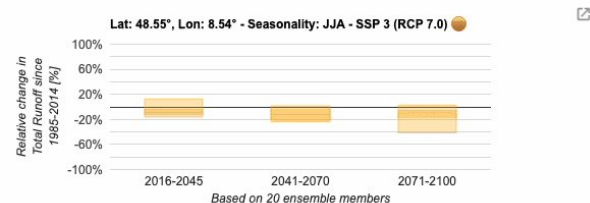
Share of models exceeding a specific change: set your value

Concerned about a certain change? Set a value for change of interest. The bottom map will show the percentage of models simulating that the variable's change is either above (select "above") or below (select "below") this value.

Display the share **BELOW** Change [%]:

Local insights: click on the map

Explore local distributions of models depicting the potential relative change of the variable to the reference period (1985-2014). The interval between 10th and 90th percentiles is represented in light color. The interval between 30th and 70th percentiles is represented in a dark color with the median line inside.



Get local insights with percentile boxes

<https://ageoce.com/en/solutions/climate-change-water-explorer/>

