PROCLIAS/ISIMIP workshop Potsdam May 2022

Global water sector meeting

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ISIMIP
Inter-Sectoral Impact Model Intercomparison Project

Agenda

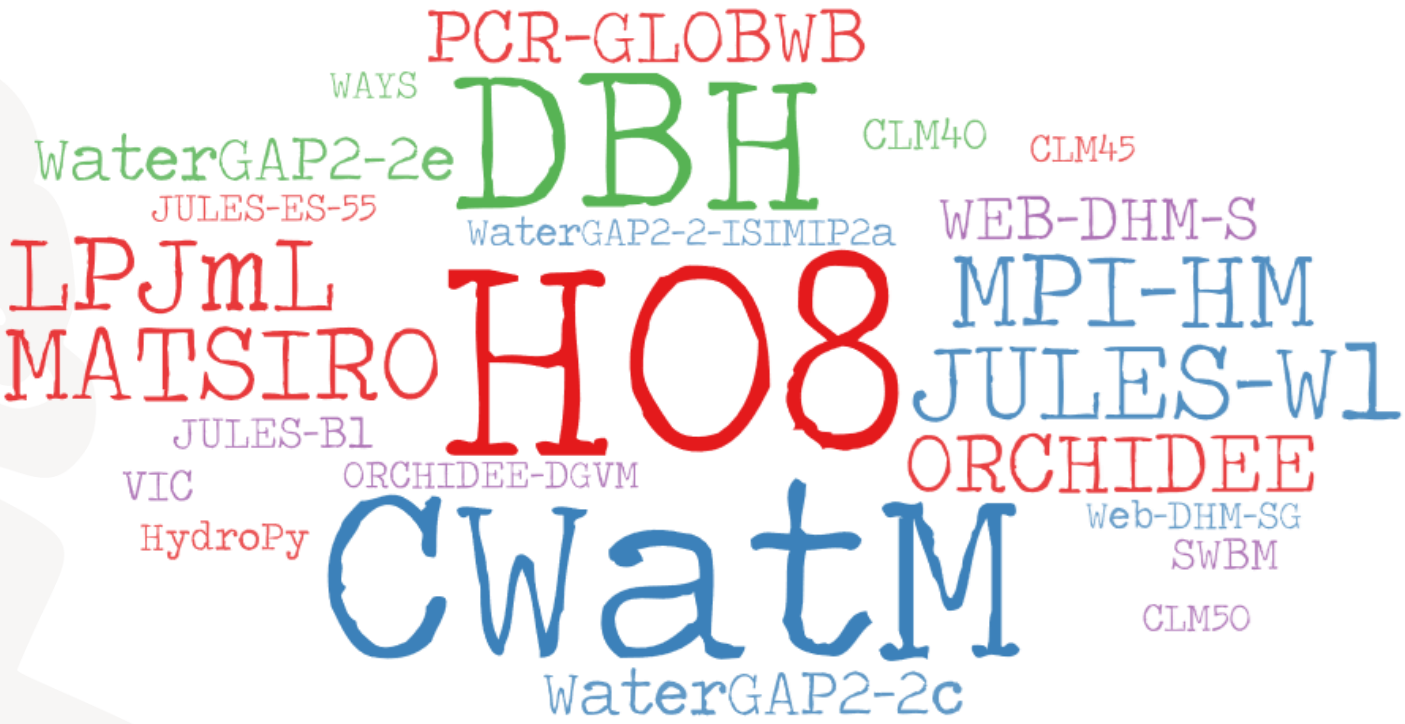
1. **Current state of the global water sector**
   - The sector in numbers
   - State of the model diagram review paper
   - Paper writing workshop
2. **Two presentations & discussions**
   - Junguo Liu: „Water scarcity assessment and multiple model intercomparison“
   - Sebastian Gnann: „A comparison of global hydrological models using hydrological signatures“

   break
3. **Topics for joint discussion**
   - Status of the ISIMIP3 simulation progres
   - ISIMIP3b group III simulations
   - Status of paper writing for ISIMIP3 outputs
   - Follow-on of the ISIMIP2b model review paper (Telteu et al., 2021)
   - About different drainage direction maps and ways out
   - Any other points

Current state of the global water sector – The sector in numbers

Number of models with available output data (status 5.5.2022 at DKRZ)

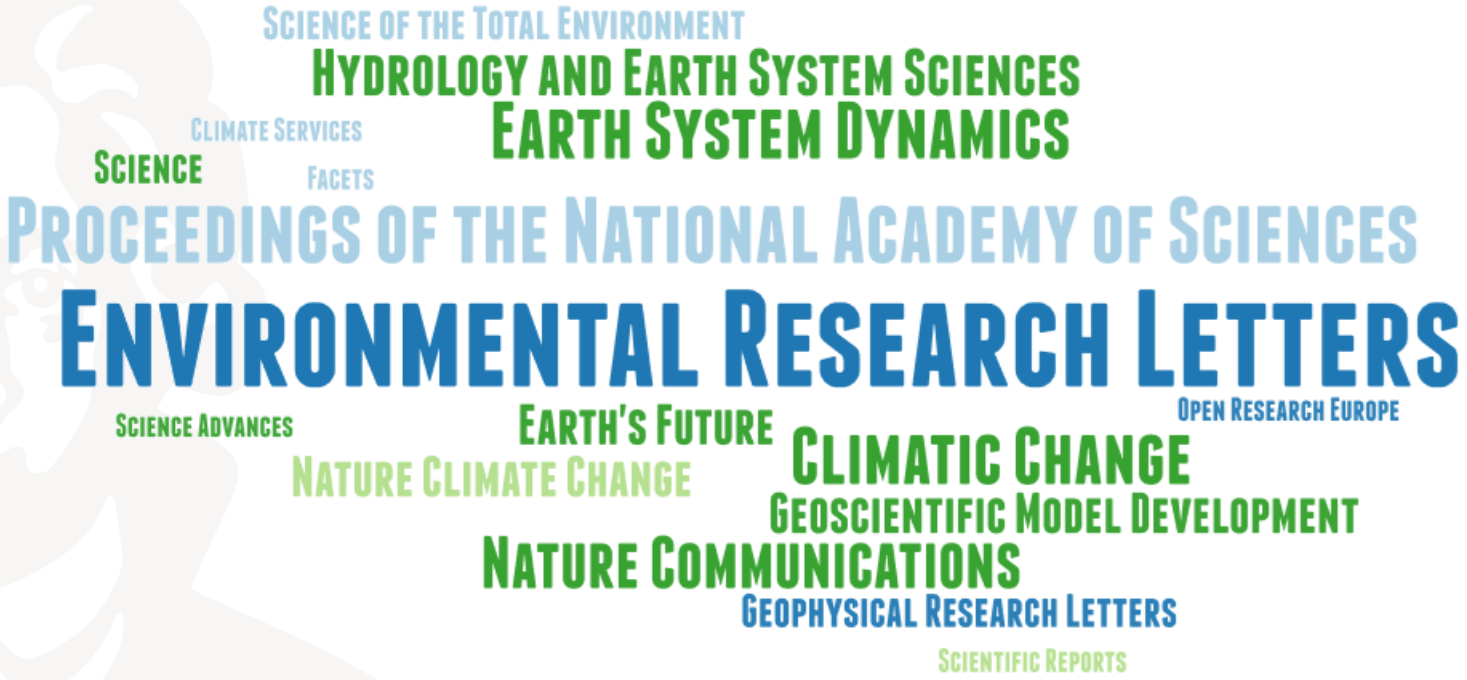
2a	2b	3a	3b
17	15	5	3



Current state of the global water sector – The sector in numbers

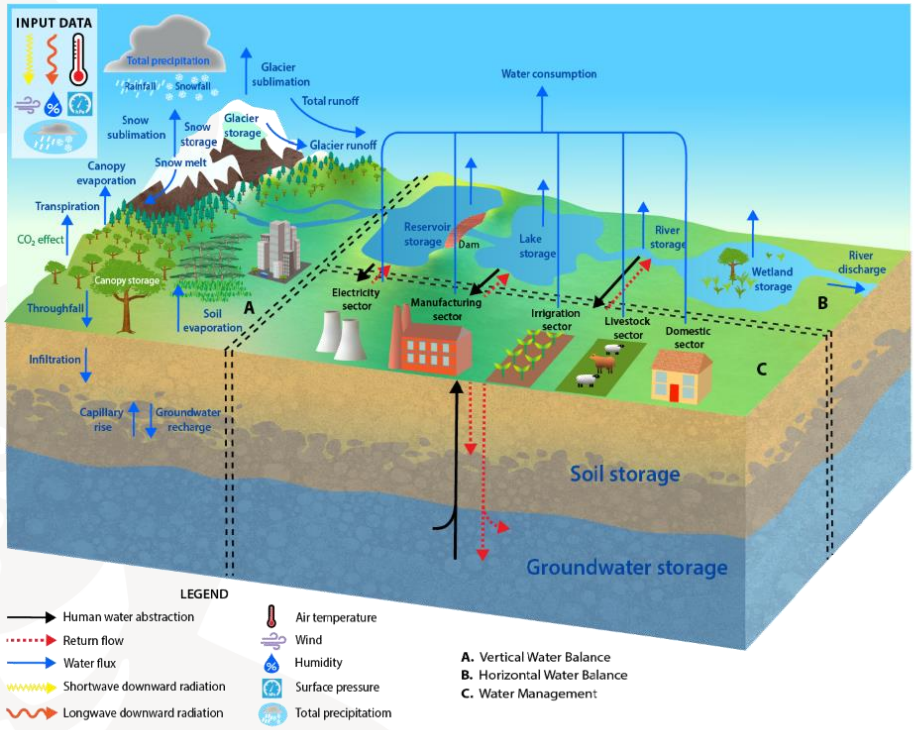
Number of papers published with global water sector relation (status 5.5.2022 via isimip.org)

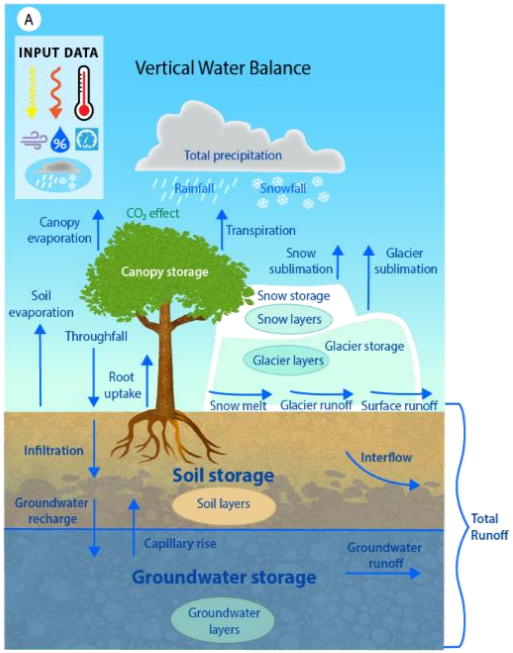
Fast Track	2a	2b	3a/b
21	22	23	0



Current state of the global water sector – The model diagram paper

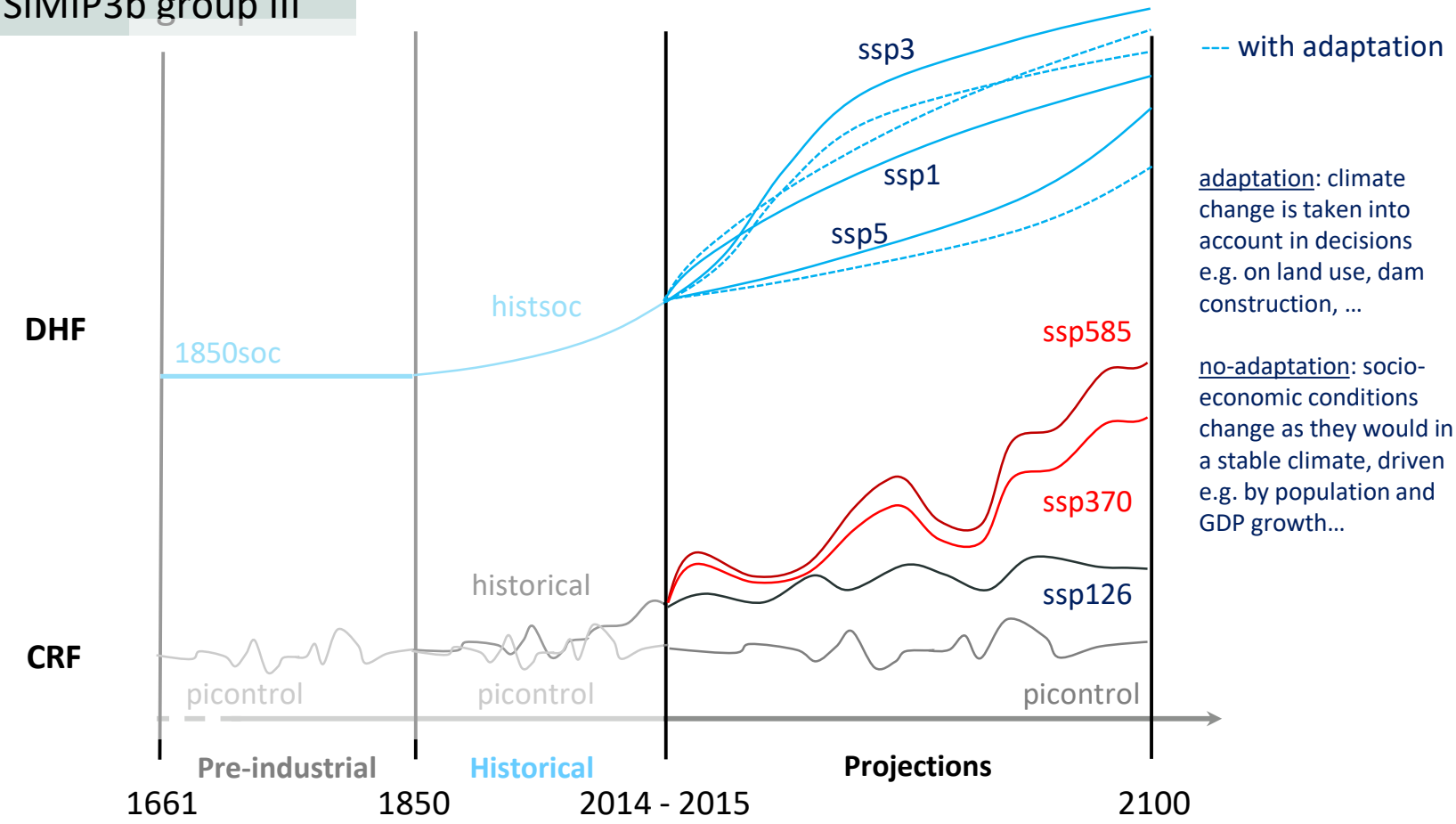
- Telteu et al. (2021): model review paper of ISIMIP2b global water models (https://doi.org/10.5194/gmd-14-3843-2021)
  - Description of the models, their fluxes and storages + equations in the supplement
- Currently: visualization of the models via a common diagram + individual model diagrams with greyed out components, supported by a graphics designer (Marlo Garnsworthy)





Current state of the global water sector – group III simulations

ISIMIP3b group III



adaptation: climate change is taken into account in decisions e.g. on land use, dam construction, …

no-adaptation: socio-economic conditions change as they would in a stable climate, driven e.g. by population and GDP growth…

Direct Human Forcings (DHF), ISIMIP3b, group III

Forcing	Status	Source, description
Land use and irrigation data	mandatory	From three different LUM (MagPIE, GLOBIOM, IMAGE), harmonisation started
Wood harvest	optional	From three different LUM (MagPIE, GLOBIOM, IMAGE), harmonisation started
Growing seasons	mandatory	Generated within AgMIP, accounting for changes in climate; **Can we create an SSP dependent version?**
N-fertilizer inputs	mandatory	From three different LUM (MagPIE, GLOBIOM, IMAGE), harmonisation started
N-deposition	optional	Tian et al. (2018)
Marine fishing efforts and fish catches	mandatory	From Oceanic System Pathways, under development (Olivier Maury et al.)
Dams and reservoirs	optional	Dam construction scenarios based on REMIND hydropower demand and Gernaat et al. dam location model, under development (with H. Biemans)
Water abstraction	optional	domestic/industrial: New projections under development by H08, WaterGAP, PCR-GLOBWB… groups, following WFaS approach irrigation: From LUMs
Lake surface area	optional	extend based on future hydropower dam scenarios?
Population data	mandatory	National SSP data; **How could the downscaling be done?**
GDP data	mandatory	National SSP data; **How could the downscaling be done?**

short discussion later…

Current state of the global water sector – paper writing workshop 2022

- The paper writing workshop 2018 in Frankfurt has been a great success
  - E.g. Gudmundsson et al. streamflow attribution (Science), Pokhrel et al. TWS (Nature Climate Change), Telteu et al. Model review (GMD)
- **Next paper writing workshop 21.-22.9. in Frankfurt**, followed by a symposium on „Global Hydrology: 25 years of WaterGAP and Beyond“ 23.-24.9.
- Potentially some travel support via PROCLIAS available
- Interested? Send us an email: hannes.mueller.schmied@em.uni-frankfurt.de
- Call will follow soon.

Junguo Liu: „Water scarcity assessment and multiple model intercomparison“

Sebastian Gnann et al: „A comparison of global hydrological models using hydrological signatures“

Image source: freepik.com

Status of the ISIMIP3 simulation progres

- Several modeling teams indicated data submission in these weeks – any update?
- Interest in hist-nat and counterfactual simulations (esp. by Lukas Gudmundsson and Wim Thiery)
- Any other issues (e.g. with the protocol)?

Non-irrigation (dom, man, elec) water requirements for ISIMIP3b group III simulations

Procedures agreed:

Generally, follow the approach taken by WFaS and described in [1], but with the following important changes and additions:

- Scenarios: SSPs 1, 3 and 5
  - For SSP 5, assume the same technological change rates as for SSP 1 (like in ref. [2]).
- Base year: 2015 (to be confirmed - what year does the data in [3] represent? -> Niko)
- Apply technological change rates up to 2050, and then assume no further change until 2100.
- Initially, do not consider any effects of climate change on water requirements (or water availability). This should be what most models usually do anyway. The resulting projections thus correspond to the "no-adaptation" case in ISIMIP3b group III. In a future step, we might consider whether and how alternative "adaptation" scenarios could be produced where climate change has an effect on water requirements and

Input data:

- **electricity production** scenarios downscaled to the country level, for SSPs 1, 3, and 5. (Provided by Fabio Sferra from IIASA)
- country-level **GDP** and **population** projections for the SSPs (compiled by PIK).
- **technological change** rates (shared by Martina Flörke; same as in WFaS).
- Starting level of water use **efficiency**, according to [3] (data file to be shared by Niko Wanders)

→ Ready to go?

References

[1] Wada et al., 2016, 10.5194/gmd-9-175-2016)

[2] Hanasaki et al., 2013, 10.5194/hess-17-2375-2013

[3] Wada et al., 2014, https://doi.org/10.5194/esd-5-15-2014

- Any concrete paper plans?

- We received feedback that time is limited to work on papers by the modelling teams → invite people outside of the sector to write papers?

Follow-on of the model review paper (Telteu et al., 2021)

- Huge effort to collect and present the ISIMIP2b models
- Interest to repeat this exercise for ISIMIP3?
- Towards the next steps:
  - Model diagram representation (in progres)
  - Evaluation of specific storages/fluxes with reference data and in terms of process representation (funding? ISIMIP2a suitable (ends 2005)?)

Geosci. Model Dev., 14, 3843–3878, 2021
https://doi.org/10.5194/gmd-14-3843-2021

Geoscientific Model Development
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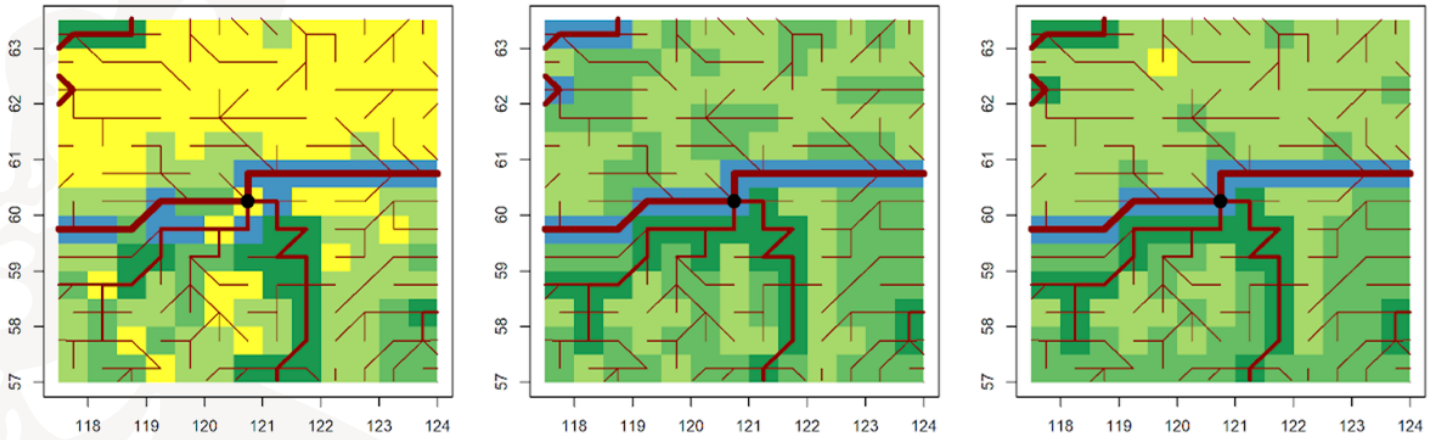
EGU

Understanding each other's models: an introduction and a standard representation of 16 global water models to support intercomparison, improvement, and communication

Camelia-Eliza Telteu[1], Hannes Müller Schmied[1,2], Wim Thiery[3], Guoyong Leng[4], Peter Burek[5], Xingcai Liu[4], Julien Eric Stanislas Boulange[6], Lauren Seaby Andersen[7], Manolis Grillakis[8], Simon Newland Gosling[9], Yusuke Satoh[10], Oldrich Rakovec[11,12], Tobias Stacke[13], Jinfeng Chang[14,15], Niko Wanders[16], Harsh Lovekumar Shah[17], Tim Trautmann[1], Ganquan Mao[18], Naota Hanasaki[6], Aristeidis Koutroulis[19], Yadu Pokhrel[20], Luis Samaniego[11], Yoshihide Wada[21], Vimal Mishra[17], Junguo Liu[18], Petra Döll[1,2], Fang Zhao[22,23], Anne Gädeke[24], Sam S. Rabin[25], and Florian Herz[1]

About different drainage direction networks and ways out

- Some models of the global water sector deviate in the drainage direction of their river routing procedure → hinders consistent evaluation with station observations
- Leonie Schiebener (GU Frankfurt) assessed a dataset of 1509 stations (merge of 3 data sets with certian quality criteria) to:
  - Select stations where original coordinates fit to the DDM30 (the „standard“) (711 stations)
  - Select those with > 50.000 km2 catchment size (313 stations)
  - Visual inspection for each model if the station is located in the drainage network
  - 135 stations can be used for consistent intercomparison for all 11 models
  - Report & station (meta)data publication in progress



Example where station is not in stream network for all (3 out of 11) models

Any other points?

- Communication?
- Model contact persons?
- …

Image source: michaelmilton.org

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Global water sector meeting

THANK YOU FOR PARTICIPATING

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