

SBTN's Freshwater Quantity Target v2

Change logs

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Summary

This document describes the changes in method and input data used to develop version 2 of the Dataset of Science Based Target Network's Freshwater Quantity Target data product with respect to version 1. For a description of the method and input data used to develop version 1 of the Freshwater Quantity Target, please refer to the Technical Documentation available with version 1 of this data product (DOI: 10.4121/089afa18-bbd5-493e-8a6c-39e1ca7b2a59.v1).

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Background

The SBTN is a collaboration of over 80 leading global organizations that collectively co-develop scientifically rigorous methodologies for setting science-based targets (<https://sciencebasedtargetsnetwork.org/>). The targets are defined as measurable, actionable, and time-bound objectives based on the best available science. The Freshwater Quantity Target (FQT) is part of a wider set of Targets for nature and specifically refers to what the latest hydrological science says is necessary to meet local thresholds and allow actors to align with Earth's limits and societal sustainability goals.

For a description of the broader framework and application of the science-based targets for freshwater by companies, please refer to the Technical Guidance of the SBTN (Science Based Targets Network, 2023).

For a description of the method and input data used to develop version 1 of the Freshwater Quantity Target, please refer to the Technical Documentation available with version 1 of this data product (DOI: 10.4121/089afa18-bbd5-493e-8a6c-39e1ca7b2a59.v1).

This document describes the changes in method and input data used to develop version 2 of the Dataset of Science Based Target Network's Freshwater Quantity Target data product with respect to version 1.

Changes in estimating Blue Water Runoff (BWR)

For version 1 (v1) of the FQT, outputs of three Global Hydrology Models (GHMs) taken from ISIMIP simulation round 2a, were used to estimate monthly fields of blue water runoff (BWR, unit: m³/month). GHMs included were PCR-GLOBWB (Sutanudjaja et al., 2018); H08 (Hanasaki et al., 2008); and WaterGAP2-2C (Müller Schmied et al., 2016). For version 2 (v2) of the FQT, outputs from ISIMIP simulation round 3a were taken instead (<https://protocol.isimip.org/#/ISIMIP3a>). This more recent simulation round unlocks runoff data until 2019 (versus until 2010 in round 2a / FQT v1). However, a different set of GHMs participated in round 3a. For v2, therefore, BWR is based on outputs from H08 (Hanasaki et al., 2008); MIROC-INTEG-LAND (Yokohata et al., 2020); and WaterGAP2-2^E (Müller Schmied et al., 2016).

From each GHM, we retrieved monthly local runoff generated by precipitation at 30 × 30 arcmin resolution over the period 1990—2019 from the ISIMIP repository. Next, using the same procedures and assumptions that underly v1, we aggregated grid-scale fields to HydroBASINS level 05 and took the median of the three runoff estimates—i.e., of the GHM model ensemble—as BWR.

Table 1: List of specific input datasets used to calculate BWR in v2 of the Freshwater Quantity Target.

Impact model	Variable	Temporal resolution	Socio-economic scenario	File name	Source
H08	qtot	Monthly	1901soc	h08_gswp3-w5e5_obsclim_1901soc_default_qtot_global_monthly_1901_2019	ISIMIP3a
miroc-integ-land	qtot	Monthly	1901soc	miroc-integ-land_gswp3-w5e5_obsclim_1901soc_default_qtot_global_monthly_1901_2019	ISIMIP3a
watergap2-2e	qtot	Monthly	1901soc	watergap2-2e_gswp3-w5e5_obsclim_1901soc_default_qtot_global_monthly_1901_2019	ISIMIP3a

Changes in estimating Environmental Flow Requirements (EFR)

FQT v2 employs the same approach as v1 to estimate environmental flow requirements (EFR, unit: m³/month), with a slight modification for the Smakhtin, Revenga, and Döll (2004) method. This method requires the runoff that is exceeded 90% of the time (Q_{90} , unit: m³) as input variable, which in v1 was calculated from *daily* grid-scale runoff data before aggregating to HydroBASINS level 05. Given that v2 used ISIMIP's monthly runoff fields directly, Q_{90} in v2 is calculated from *monthly* grid-scale runoff data before aggregating to the sub-catchment level. In line with the new time span of BWR, EFR in v2 is calculated over the period 1990—2019.

Changes in estimating Blue Water Footprint (BWF)

FQT v2 employs the same approach as v1 to estimate blue water footprints (BWF, unit: m³/month), but uses two alternative data sources as input. For v1, monthly fields of BWF were derived from gridded PCR-GLOBWB estimates on domestic water supply, industrial water consumption, potential irrigation consumption, and livestock water consumption over the period 1990–2010 (Sutanudjaja et al., 2018). These are replaced by two different water footprint account datasets to represent monthly total BWF over the period 1990–2019.

First, domestic water supply, electricity water consumption, manufacturing water consumption, and livestock water consumption estimates are derived from WaterGap2-2E (Müller Schmied et al., 2016). We retrieved *potential* water consumption of each sector, as well as the *actual* and *potential* total water consumption from ISIMIP’s repository (see Table 2). We then calculated the actual-potential ratio of total water consumption and applied this ratio to all sectoral potential consumption accounts to obtain actual sectoral water consumption accounts. These estimates replace PCR-GLOBWB’s domestic water supply, industrial water consumption, and livestock water consumption estimates used in v1 and add electricity water consumption as a new sector.

Second, irrigation water consumption is taken from the ACEA global gridded crop model (Oleksandr Mialyk et al., 2024; O. Mialyk & Su, 2024). Based on AquaCrop-OSPy, ACEA simulates crop yield and green and blue evapotranspiration at 5 x 5 arc minute spatial resolution. We ran ACEA to obtain these variables for 175 individual crops over the period 1990–2019. These estimates reflect potential water consumption (i.e., assuming unlimited irrigation water supply to irrigated crops) and replace PCR-GLOBWB’s potential irrigation consumption estimates used in v1.

Table 2: List of specific input datasets used to calculate BWF in v2 of the Freshwater Quantity Target.

Impact model	Variable	Temporal resolution	Socio-economic scenario	File name	Source
watergap2-2e	atotuse	Monthly	Histsoc	watergap2-2e_gswp3-w5e5_obsclim_histsoc_default_atotuse_global_monthly_1901_2019	ISIMIP3a
watergap2-2e	pdomuse	Monthly	Histsoc	watergap2-2e_gswp3-w5e5_obsclim_histsoc_default_pdomuse_global_monthly_1901_2019	ISIMIP3a
watergap2-2e	peleuse	Monthly	Histsoc	watergap2-2e_gswp3-w5e5_obsclim_histsoc_default_pelecuse_global_monthly_1901_2019	ISIMIP3a
watergap2-2e	prruse	Monthly	Histsoc	watergap2-2e_gswp3-w5e5_obsclim_histsoc_default_prruse_global_monthly_1901_2019	ISIMIP3a
watergap2-2e	pliveuse	Monthly	Histsoc	watergap2-2e_gswp3-w5e5_obsclim_histsoc_default_pliveuse_global_monthly_1901_2019	ISIMIP3a
watergap2-2e	pmanuse	Monthly	Histsoc	watergap2-2e_gswp3-w5e5_obsclim_histsoc_default_pmanuse_global_monthly_1901_2019	ISIMIP3a
watergap2-2e	ptotuse	Monthly	Histsoc	watergap2-2e_gswp3-w5e5_obsclim_histsoc_default_ptotuse_global_monthly_1901_2019	ISIMIP3a

Changes in calculating Blue Water Availability (BWA)

FQT v2 employs the same approach as v1 to calculate blue water availability (BWA, unit: m^3/month), but leverages the updated input variables BWR, EFR, and BWF to calculate BWA over the 1990—2019 period. Furthermore, v2 took the monthly average BWF over the 2009—2019 period (versus the 1990—2010 period in v1) to represent recent historical water consumption patterns.

Changes in calculating Blue Water Footprint Caps (BWFC)

FQT v2 employs the same approach as v1 to calculate blue water footprint caps (BWFC, unit: m^3/month), but in alignment with the updated time series' length is calculated for each month over the 1990—2019 period (versus the 1971—2010 period in v1).

Changes in calculating the Freshwater Quantity Target (FQT)

FQT v2 employs the same approach as v1 to calculate the Freshwater Quantity Target.

A comparison between v1 and v2 is given in Figure 1 below.

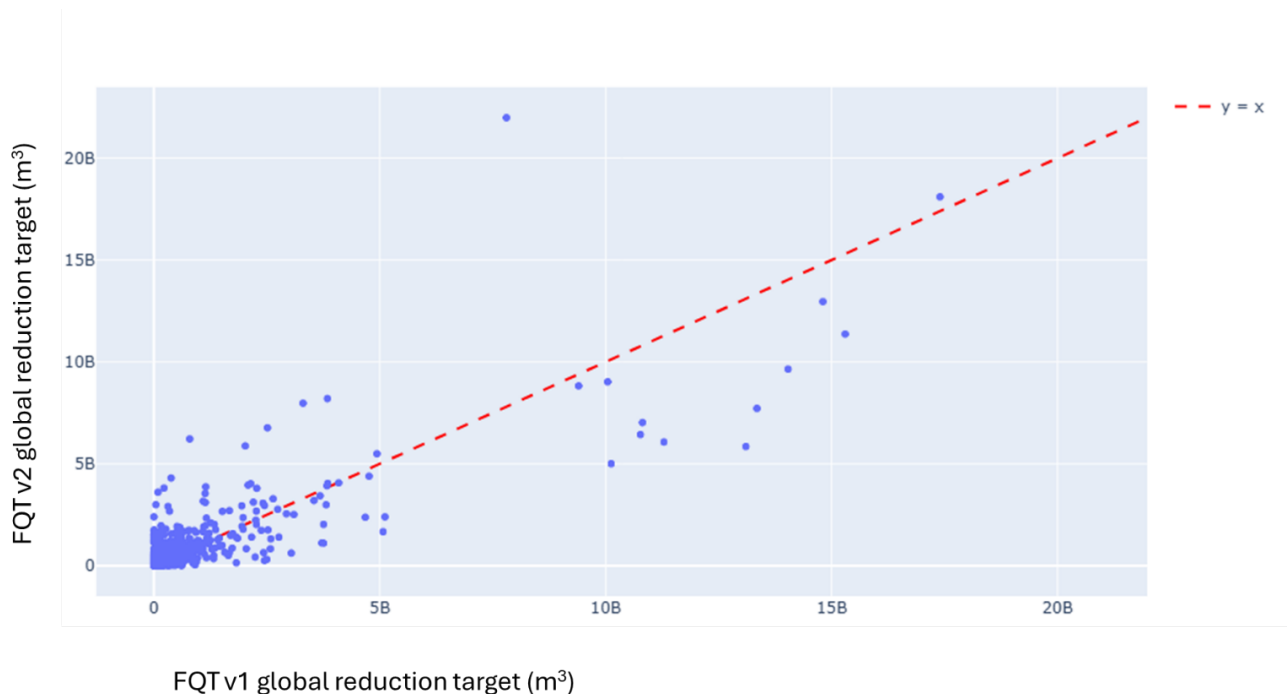


Figure 1: Comparison between v1 and v2 of the FQT. Blue dots represent HydroBASINS level 05 subbasins.

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