



# Supplement of

# HERA: a high-resolution pan-European hydrological reanalysis (1951–2020)

Aloïs Tilloy et al.

Correspondence to: Aloïs Tilloy (alois.tilloy@ec.europa.eu)

The copyright of individual parts of the supplement might differ from the article licence.

# Supplement of: HERA: a high-resolution pan-European hydrological reanalysis (1951-2020)

Tilloy et al. (2024)

Corresponding to Aloïs Tilloy (alois.tilloy@ec.europa.eu)

# Contents

Model calibration	2
Model inputs	4
Model validation	
Gauging stations used in calibration	
Comparison with EUmHM run	15
References:	19

#### **Model calibration**



Figure S1: HERA domain with spatial distribution of catchments with calibrated (blue, 69.6% or domain area), regionalized (orange, 23.9% of domain area) and default (red, 6.5% of domain area) parameters. Dots represent the 2448 stations used for the validation of HERA. Dots are coloured according to their calibration status: red (default), orange (regionalized), light blue (calibrated domain), dark blue (stations used for the calibration).

Parameter name	Description	Default value	Parameter range
SnowMeltCoef	Snow melt rate in degree day model equation [mm/(C day)]	4	[2.5 – 6.5]
b_Xinanjiang	Exponent in Xinanjiang equation for infiltration capacity of the soil [-]	0.5	[0.01 – 5]
PowerPrefFlow	Exponent in the empirical function describing the preferential flow (i.e. flow that bypasses the soil matrix and drains directly to the groundwater) [-]	4	[0.5 – 8]
UpperZoneTime Constant	Time constant for upper groundwater zone [days]	10	[0.01 - 40]
GwPercValue	Maximum percolation rate from upper to lower groundwater zone [mm/day]	0.8	[0.01 - 2]
LowerZoneTime Constant	Time constant for lower groundwater zone [days]	100	[40 - 500]
LZThreshold	Threshold to stop outflow from lower groundwater zone to the channel [mm]	10	[0-30]
GwLoss	Maximum loss rate out of lower groundwater zone expressed as a fraction of lower zone outflow [-]	0	[0-1]
QSplitMult	Multiplier to adjust discharge triggering floodplains flow [-]	2	[0 - 20]
CalChanMan1	Multiplier for channel Manning's coefficient n for riverbed [-]	1	[0.5 – 2]
CalChanMan2	Multiplier for channel Manning's coefficient n for floodplains [-]	1	[0.5 - 5]
adjust_Normal_ Flood	Multiplier to adjust reservoir normal filling (balance between lower and upper limit of reservoir filling). [-]	0.8	[0.01 – 0.99]
ReservoirRnorm qMult	Multiplier to adjust normal reservoir outflow [-]	1	[0.25 - 2]
LakeMultiplier	Multiplier to adjust lake outflow [-]	1	[0.5 - 2]

 Table S1: LISFLOOD calibration parameter for EFAS-5 (for more details, refer to CEMS-Flood online documentation, 2023)

# **Model inputs**

Table S2: Surface field maps used as input to OS LISFLOOD to general the hydrological reanalysis. HERA refers to the HERA dataset while LF-EU maps refers to the LISFLOOD static and parameter maps for Europe (2024) dataset. More information on main data sources is provided in Table S3.

Surface field name	Main data	Data location								
		source								
Morphology and river network										
Mask area	Boolean map defining model boundaries		HERA							
Local drainage	CaMa-	LF-EU maps								
direction (LDD)	from springs to mouth	Flood								
Grid-cell area	Area of every grid cell	CaMa-	LF-EU maps							
(pixArea)		Flood								
Grid-cell length	Length of every grid cell	Grid-cell area	LF-EU maps							
Upstream area	Accumulated area of all connected grid-cells of the	LDD,	LF-EU maps							
(upArea)	LDD from springs to mouth	pixArea								
<i>Standard deviation of elevation</i>	Amount of elevation variation within a grid-cell	MERID DEM	LF-EU maps							
Gradient	Elevation gradient between two connected grid-	MERIT	LF-EU maps							
	cells	DEM,								
		LDD								
Channel bottom width	Width of the bottom of the channel	CaMa- Flood	LF-EU maps							
Channel length	Length of river channel in each grid-cell	CaMa-	LF-EU maps							
0		Flood	Ĩ							
Channel gradient	Gradient (slope) of river channel inside a grid-cell	MERIT	LF-EU maps							
C		DEM,								
		CaMa-								
		Flood,								
		LDD								
Manning's	Manning's roughness coefficient of river channel	MERIT	LF-EU maps							
roughness	for each grid-cell	DEM,upAr								
coefficient for		ea								
channels										
Channel mask	Channel presence in the grid-cell indicator	Mask	HERA							
Side slope	Slope of river banks		LF-EU maps							
Bankful channel	Channel depth	upArea	LF-EU maps							
depth										
	Vegetation types and properties									
Crop coefficient for	Ratio between the potential (reference)	CGLS-	LF-EU maps							
forest	evapotranspiration rate, in mm/day, and the	LC100,								
	potential evaporation rate of forest (averaged by	SPAM,								
	time and ecosystem type)	FAO								
Crop coefficient for	Ratio between the potential (reference)	CGLS-	LF-EU maps							
irrigated crops	evapotranspiration rate, in mm/day, and the	LC100,								
	potential evaporation rate of irrigated crops	SPAM,								
	(averaged by time and ecosystem type)	FAO								
Crop coefficient for	Ratio between the potential (reference)	CGLS-	LF-EU maps							
other cover type	evapotranspiration rate, in mm/day, and the	LC100,								
	potential evaporation rate of other cover type	SPAM,								
	(averaged by time and ecosystem type)	FAO								
Crop group number	Represents a vegetation type and is an indicator of	CGLS-	LF-EU maps							
for forest	its adaptation to dry climate (forest)	LC100,								

		SPAM,	
		FAO	
Crop group number	Represents a vegetation type and is an indicator of	CGLS-	LF-EU maps
for irrigated crops	its adaptation to dry climate (irrigated crops)	LC100,	-
		SPAM,	
		FAO	
Crop group number	Represents a vegetation type and is an indicator of	CGLS-	LF-EU maps
for other cover type	its adaptation to dry climate (other)	LC100,	*
		SPAM,	
		FAO	
Manning's surface	Roughness or friction applied to the flow by the	CGLS-	LF-EU maps
roughness	surface on which water is flowing (forest)	LC100,	
coefficient for forest		SPAM,	
		FAO	
Manning's surface	Roughness or friction applied to the flow by the	CGLS-	LF-EU maps
roughness	surface on which water is flowing (irrigated crops)	LC100,	*
coefficient for		SPAM,	
irrigated crop		FAO	
Manning's surface	Roughness or friction applied to the flow by the	CGLS-	LF-EU maps
roughness	surface on which water is flowing (other)	LC100,	
coefficient for other		SPAM,	
cover types		FAO	
Leaf area index for	Defined as half the total area of green elements of	CGLS-LAI	LF-EU maps
forest	the canopy per unit horizontal ground area m2/m2		
	(10-day average; 36 fields in total)		
Leaf area index for	Defined as half the total area of green elements of	CGLS-LAI	LF-EU maps
irrigated crop	the canopy per unit horizontal ground area m2/m2		
	(10-day average; 36 fields in total)		
Leaf area index for	Defined as half the total area of green elements of	CGLS-LAI	LF-EU maps
other cover types	the canopy per unit horizontal ground area m2/m2		
	(10-day average; 36 fields in total)		
Rice planting day 1	Most probable day of the year when rice is planted	RiceAtlas	LF-EU maps
	for the first time		
Rice planting day 2	Most probable day of the year when rice is planted	RiceAtlas	LF-EU maps
	for the second time	<u></u>	
Rice planting day 3	Most probable day of the year when rice is planted	RiceAtlas	LF-EU maps
D: 1 (: 1	for the third time	D' A (1	IE EU
Rice narvesting day	Most probable day of the year when fice is	RiceAtlas	LF-EU maps
Pice harvesting day	Most probable day of the year when rice is	<b>DiceAtlas</b>	I F FU mans
2	harvested after planting for the second time	RiceAuas	LI-LO maps
Rice harvesting day	Most probable day of the year when rice is	RiceAtlas	I F-FU mans
3	harvested after planting for the third time	Ricer Hius	Li Lo inaps
-	Soil properties		
Soil depth layer 1 for	Forest soil depth for surface soil [laver 1]	SoilGrids	LF-EU maps
forest			
Soil depth layer 1 for	Other soil depth for surface soil [layer 1]	SoilGrids	LF-EU maps
other			L.
Soil depth layer 2 for	Forest soil depths for middle soil [layer 2]	SoilGrids	LF-EU maps
forest			
Soil depth layer 2 for	Other soil depths for middle soil [layer 2]	SoilGrids	LF-EU maps
other			
Soil depth layer 3 for	Forest soil depths for subsoil [layer 3]	SoilGrids	LF-EU maps
forest			

Soil depth layer 3 for other	Other soil depths for subsoil [layer 3]	SoilGrids	LF-EU maps
Saturated volumetric soil moisture content layers 1 for forest	Maximum water content in surface soil for forest	SoilGrids	LF-EU maps
Saturated volumetric soil moisture content layers 1 for other	Maximum water content in surface soil for other	SoilGrids	LF-EU maps
Saturated volumetric soil moisture content layers 2 for forest	Maximum water content in middle soil for forest	SoilGrids	LF-EU maps
Saturated volumetric soil moisture content layers 2 for other	Maximum water content in middle soil for other	SoilGrids	LF-EU maps
Saturated volumetric soil moisture content layers 3	Maximum water content in subsoil	SoilGrids	LF-EU maps
Residual volumetric soil moisture content layer 1	Minimum water content in the surface soil	SoilGrids	LF-EU maps
Residual volumetric soil moisture content layer 2	Minimum water content in the middle soil	SoilGrids	LF-EU maps
Residual volumetric soil moisture content layer 3	Minimum water content in the subsoil	SoilGrids	LF-EU maps
<i>Pore size index layer</i> 1 for forest	pore size index of the surface soil for forest	SoilGrids	LF-EU maps
Pore size index layer 1 for other	Van Genuchten parameter $\lambda$ representing the pore size index of the surface soil for other	SoilGrids	LF-EU maps
Pore size index layer 2 for forest	Van Genuchten parameter $\lambda$ representing the pore size index of the middle soil for forest	SoilGrids	LF-EU maps
Pore size index layer 2 for other	Van Genuchten parameter $\lambda$ representing the pore size index of the middle soil for other	SoilGrids	LF-EU maps
Pore size index layer 3	Van Genuchten parameter $\lambda$ representing the pore size index of the subsoil	SoilGrids	LF-EU maps
Van Genuchten equation parameter layer 1 for forest	Van Genuchten parameter $\alpha$ of the surface soil for forest	SoilGrids	LF-EU maps
Van Genuchten equation parameter layer 1 for other	Van Genuchten parameter $\alpha$ of the surface soil for other	SoilGrids	LF-EU maps
Van Genuchten equation parameter layer 2 for forest	Van Genuchten parameter $\alpha$ of the middle soil for forest	SoilGrids	LF-EU maps
Van Genuchten equation parameter layer 2 for other	Van Genuchten parameter $\alpha$ of the middle soil for othert	SoilGrids	LF-EU maps
Van Genuchten equation parameter layer 3	Van Genuchten parameter $\alpha$ of the subsoil	SoilGrids	LF-EU maps
Saturated soil conductivity for layer 1 forest	Ease with which water moves through pore spaces of the surface soil for forest	SoilGrids	LF-EU maps

conductivity for layer 1 other       of the surface soil for other       SoilGrids       LF-EU maps         conductivity for layer 2 forest       Ease with which water moves through pore spaces       SoilGrids       LF-EU maps         Saturated soil conductivity for layer 2 other       Ease with which water moves through pore spaces       SoilGrids       LF-EU maps         Saturated soil conductivity for layer 3       Ease with which water moves through pore spaces       SoilGrids       LF-EU maps         Saturated soil conductivity for layer 3       Ease with which water moves through pore spaces       SoilGrids       LF-EU maps         Sealed surface fraction       Evergreen and deciduous needle leaf and broad leaf tree areas       CGLS- LC100, LANZE, s       HERA/socioe conomic_map         Irrigated surface fraction       Irrigated areas of all possible crops excluding rice       CLC2018, HERA/socioe HANZE, s       HERA/socioe conomic_map         Inland water fraction       Rivers, freshwater and saline lakes, ponds and other permanent water bodies over the continent       CIC1S- HERA/socioe conomic_map       HERA/socioe conomic_map         Other land cover fraction       Agricultural areas, non-forested natural area, pervious surface of urban areas       HERA/socioe conomic_map       S         Other land cover fraction       Agricultural areas, schools, and public buildings/ Max       GLS-POP, HERA/water_ AQUAST       AguAST         Water demand for domesti	Saturated soil	Ease with which water moves through pore spaces	SoilGrids	LF-EU maps
layer 1 otherSaturated soilEase with which water moves through pore spaces conductivity for of the middle soil for forestSoilGridsLF-EU mapsSaturated soilEase with which water moves through pore spaces of the middle soil for other layer 2 otherSoilGridsLF-EU mapsSaturated soilEase with which water moves through pore spaces of the subsoilSoilGridsLF-EU mapsSaturated soilEase with which water moves through pore spaces of the subsoilSoilGridsLF-EU mapsIayer 3Land useSoilGridsLF-EU mapsForest surface fractionEvergreen and deciduous needle leaf and broad leaf tree areasCGLS- LC100, HANZE, sHERA/socioe conomic_map HANZE, sSealed surface fractionUrban areas, characterizing the human impact on the environmentCGLS- HERA/socioe CL2018, HERA/socioe CL2018, HERA/socioe fractionHERA/socioe conomic_map sInland water fractionRivers, freshwater and saline lakes, ponds and other permanent water bodies over the continents fractionCGLS- HERA/socioe CL2018, HERA/socioe CL2018, HERA/socioe CL2018, HERA/socioe conomic_map sMater demand for domestic useDaily supply of water volume for fabricating, product incorporating water into a rangorting a product, incorporating a recessing, washing and sanita	conductivity for	of the surface soil for other		Ĩ
Saturated soil conductivity for layer 2 forest         Ease with which water moves through pore spaces         SoilGrids         LF-EU maps           Saturated soil conductivity for layer 2 other         Ease with which water moves through pore spaces         SoilGrids         LF-EU maps           Saturated soil conductivity for layer 3         Ease with which water moves through pore spaces         SoilGrids         LF-EU maps           Saturated soil conductivity for layer 3         Ease with which water moves through pore spaces         SoilGrids         LF-EU maps           Forest surface fraction         Evergreen and deciduous needle leaf and broad leaf         CGLS- LC100, the environment         HERA/socioe conomic_map           Sealed surface fraction         Urban areas, characterizing the human impact on the environment         CGLS- HERA/socioe tactor         HERA/socioe conomic_map           Irrigated areas of all possible crops excluding rice fraction         Rivers, freshwater and saline lakes, ponds and outer permanent water bodies over the continent         CLC2018, HERA/socioe conomic_map         HERA/socioe conomic_map           Irrigated rice fraction         Irrigated areas of rice         CLC2018, CLC2018, HERA/socioe         HERA/socioe conomic_map           Soildorid         Lysey by of water volume for indoor and outdoor household purposes and for all the uses that are conceted to the municipal system (e.g., that are conceted to the municipal system (e.g., that are conceted to the municipal system (e.g., that are conceted to the municipal	laver 1 other			
conductivity for layer 2 jorest       of the middle soil for forest       SoilGrids       LF-EU maps         conductivity for layer 2 other       Ease with which water moves through pore spaces       SoilGrids       LF-EU maps         conductivity for layer 2 other       Ease with which water moves through pore spaces       SoilGrids       LF-EU maps         conductivity for layer 3       Ease with which water moves through pore spaces       SoilGrids       LF-EU maps         Forest surface       Evergreen and deciduous needle leaf and broad leaf       CGLS-       LFAA/socioe         fraction       tree areas       LC100, HANZE, s       HERA/socioe         fraction       the environment       CL208, HANZE, s       HERA/socioe         fraction       rirgated areas of all possible crops excluding rice fraction       HERA/socioe       CL2018, HANZE s       HERA/socioe         Inland water       Rivers, freshwater and saline lakes, ponds and other permanent water bodies over the continents       CL2018, HANZE s       HERA/socioe         Irrigated rice       Irrigated areas of rice       CL2018, HANZE s       HERA/socioe         fraction       Agricultural areas, non-forested natural area, pervious surface of urban areas       Arc, AQUAST       HERA/water_ AQUAST         demand for       Daily supply of water volume for fabricating, product       MSWW       MSWX	Saturated soil	Ease with which water moves through pore spaces	SoilGrids	LF-EU maps
layer 2 forest       Ease with which water moves through pore spaces       SoilGrids       LF-EU maps         Saturated soil       conductivity for       Ease with which water moves through pore spaces       SoilGrids       LF-EU maps         Saturated soil       conductivity for       ease with which water moves through pore spaces       SoilGrids       LF-EU maps         conductivity for       of the subsoil       Evergreen and deciduous needle leaf and broad leaf       CGLS-       HERA/socioe         fraction       tree areas       LOU0,       conomic_map       HANZE,       s         Sealed surface       Urban areas, characterizing the human impact on       CGLS-       HERA/socioe         fraction       the environment       LC100,       conomic_map         Inland water       Rivers, freshwater and saline lakes, ponds and       CGLS-       LERA/socioe         fraction       ther permanent water bodies over the continents       CLC108,       HERA/socioe         fraction       rrigated areas of rice       CLC2018,       HERA/socioe       conomic_map         fraction       Agricultural areas, non-forested natural area,       ref       s       conomic_map         fraction       Daily supply of water volume for indoor and       outdoor household purposes and for all the uses       conomic_map       s <td>conductivity for</td> <td>of the middle soil for forest</td> <td>201101100</td> <td>Li Le impo</td>	conductivity for	of the middle soil for forest	201101100	Li Le impo
Display         Ease with which water moves through pore spaces of the middle soil for other         SoilGrids         LF-EU maps           Saturated soil conductivity for layer 3         Ease with which water moves through pore spaces of the subsoil         SoilGrids         LF-EU maps           Saturated soil conductivity for layer 3         Ease with which water moves through pore spaces of the subsoil         SoilGrids         LF-EU maps           Saturated soil conductivity for layer 3         Ease with which water moves through pore spaces of the subsoil         SoilGrids         LF-EU maps           Free starting of the subsoil         Evergreen and deciduous needle leaf and broad leaf         CGLS- LC100, CL00, CL00, Cl00, Cl00, Cl00, Cl00, Cl00, Cl00, Cl00, Cl00, Cl00, Cl00, Cl00, HANZE,         HERA/socioe conomic_map HANZE,           Irrigated surface fraction         Irrigated areas of all possible crops excluding rice fraction         CGLS- HERA/socioe conomic_map HANZE         HERA/socioe conomic_map HANZE           Irrigated rice fraction         Rivers, freshwater and saline lakes, ponds and other permanent water bodies over the continents         CGLS- HERA/socioe conomic_map HANZE         HERA/socioe conomic_map HANZE           Other land cover fraction         Agricultural areas, non-forested natural area, pervious surface of urban areas         GHS-POP, HERA/socioe conomic_map AT, water used by shops, schools, and public buildings)         MSWX           Water demand for monstric use         Daily supply of water volume for fabricating, product	laver 2 forest			
District of the middle solit for other       District on the middle solit for other         layer 2 other       SoliGrids       LF-EU maps         staturated solit       Ease with which water moves through pore spaces       SoilGrids       LF-EU maps         conductivity for       Ice e middle solit for other       SoilGrids       LF-EU maps         conductivity for       Ice e middle solit for other       SoilGrids       LF-EU maps         conductivity for       Ice e middle solit for other       SoilGrids       LF-EU maps         conductivity for       Ice e middle solit for other       SoilGrids       LF-EU maps         conductivity for       Ice e meas       SoilGrids       LF-EU maps         conductivity for       Ice e meas       SoilGrids       LF-EU maps         s       Evergreen and deciduous needle leaf and broad leaf       CGLS       HERA/socioe         fraction       Urban areas, characterizing the human impact on       Ice ICI0,       conomic_map         fraction       Rivers, freshwater and salite lakes, ponds and       Ice ICL018,       HERA/socioe         fraction       Irrigated areas of rice       CL2018,       HERA/socioe         fraction       Pervious surface of urban areas       CC2018,       HERA/socioe         fraction       Daily supply of water	Saturated soil	Fase with which water moves through nore spaces	SoilGrids	LE-FU mans
Contact (Mity) for layer 2 of the induct son for order         Saturated soil conductivity for layer 3       Ease with which water moves through pore spaces of the subsoil       SoilGrids       LF-EU maps         Saturated soil conductivity for layer 3       Ease with which water moves through pore spaces       SoilGrids       LF-EU maps         Forest surface fraction       Evergreen and deciduous needle leaf and broad leaf       CGLS- LC100, HANZE, seled surface       HERA/socioe conomic_map         Frigated surface fraction       Urban areas, characterizing the human impact on the environment       CGLS- HERA/socioe CC2018, HERA/socioe       HERA/socioe conomic_map         Inland water fraction       Rivers, freshwater and saline lakes, ponds and other permanent water bodies over the continents       CGLS- HERA/socioe conomic_map       HERA/socioe s         Irrigated rice fraction       Irrigated areas of rice       CLC2018, HERA/socioe s       HERA/socioe conomic_map         Other land cover fraction       Agricultural areas, non-forested natural area, pervious surface of urban areas       GHS-POP, AT       HERA/water_ duct         Water demand for domestic use       Daily supply of water volume for indoor and outdor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)       MSWX         Water demand for ductsrial use       Daily supply of water volume for fabricating a product       GCAM       AT, GCAM	conductivity for	of the middle soil for other	Sononas	LI -LO maps
Date 1 June         Ease with which water moves through pore spaces of the subsoil         SoilGrids         LF-EU maps           Saturated soil (ayer 3)         Land use         Forest surface         Evergreen and deciduous needle leaf and broad leaf         CGLS         HERA/socioe           Forest surface         Evergreen and deciduous needle leaf and broad leaf         CGLS         HERA/socioe           fraction         Urban areas, characterizing the human impact on the environment         CGLS         HERA/socioe           fraction         Inrigated areas of all possible crops excluding rice fraction         Rivers, freshwater and saline lakes, ponds and other permanent water bodies over the continents         CGLS- LC100, conomic_map         HERA/socioe           Inrigated rice fraction         Irrigated areas of rice         CLC2018, HERA/socioe         HERA/socioe           fraction         Agricultural areas, non-forested natural area, pervious surface of urban areas         HERA/socioe         S           Other land cover         Agricultural areas, schools, and public buildings)         GHS-POP, AUAST         HERA/water_ AQUAST         AguasT           domestic use         Daily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)         GHS-POP, AQUAST         HERA/water_ AQUAST           demand for         Daily supply of water	laver 2 other	of the middle son for other		
Satisfield solit       Lase with which water infores through pole spaces       SolitChilds       Land use         forest surface       Evergreen and deciduous needle leaf and broad leaf       CGLS-       HERA/socioe         fraction       tree areas       Land use       CGLS-       HERA/socioe         Sealed surface       Urban areas, characterizing the human impact on       CGLS-       HERA/socioe         fraction       the environment       HANZE, s       s         Irrigated surface       Irrigated areas of all possible crops excluding rice       CLC2018, HERA/socioe       CACS-         fraction       Rivers, freshwater and saline lakes, ponds and other permanent water bodies over the continents       CLC010, conomic_map         HANZE       Irrigated areas of rice       CLC2018, HERA/socioe       CCC000mic_map         fraction       Irrigated areas of rice       CLC2018, HERA/socioe       conomic_map         fraction       Irrigated areas of rice       CLC2018, HERA/socioe       s         Other land cover       Agricultural areas, non-forested natural area, pervious surface of urban areas       GHS-POP, HANZE       AQUAST         domestic use       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a AT, GCAM, MSWX       GCAM         Water demand for       Daily sup	Saturated soil	Easo with which water moves through pero spaces	SoilGride	I E ELI mono
Land use           Land use           Forest surface         Forest surface         Forest surface         Forest surface         Forest surface         Forest surface         HERA/socioe           CGLS         HERA/socioe           Forest surface         HERA/socioe           Fraction         CGLS         HERA/socioe           Forest surface drive permanent water bodies over the continents         LC100, conomic_map           Fraction         Other permanent water bodies over the continents         LC100, conomic_map           Fraction         CGLS-         HERA/socioe           Fraction         CGLS-         HERA/socioe           Fraction         CL2018, HERA/socioe           Fraction         CL2010, conomic_map           Fracti	saturatea soli	ease with which water moves through pole spaces	Solicitus	LF-EU maps
Land use           Forest surface fraction         Evergreen and deciduous needle leaf and broad leaf tree areas         CGLS- LC100, LC100, Exercision         HERA/socioe conomic_map           Sealed surface fraction         Urban areas, characterizing the human impact on the environment         CGLS- HERA/socioe         HERA/socioe           Irrigated surface fraction         Irrigated areas of all possible crops excluding rice fraction         CL2018, HERA/socioe         HERA/socioe           Inland water fraction         Rivers, freshwater and saline lakes, ponds and other permanent water bodies over the continents         CGLS- LC100, LC100, conomic_map         HERA/socioe           Irrigated rice fraction         Irrigated areas of rice         CL2018, HERA/socioe         HERA/socioe spAM, conomic_map           Other land cover fraction         Agricultural areas, non-forested natural area, pervious surface of urban areas         HERA/socioe conomic_map           Water demand for domestic use         Daily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)         GHS-POP, MERA/water_ AQUAST         HERA/water_ AQUAST           Water demand for thermoelectric use         Daily supply of water volume for the cooling of thermoelectric use         GCAM, MSWX           Water demand for thermoelectric use         Daily supply of water volume for domestic animal need         AQUAST         HE	Layon 2	of the subsoli		
Visual action         Evergreen and deciduous needle leaf and broad leaf         CGLS- LC100, HANZE         HERA/socioe conomic_map HANZE           Sealed surface fraction         Urban areas, characterizing the human impact on the environment         CGLS- LC100, HANZE         HERA/socioe conomic_map HANZE           Irrigated surface fraction         Irrigated areas of all possible crops excluding rice fraction         CCL2018, HERA/socioe conomic_map s           Inland water         Rivers, freshwater and saline lakes, ponds and other permanent water bodies over the continents         CGLS- LC100, conomic_map s           Irrigated rice         Irrigated areas of rice         CL2018, LC100, conomic_map s           Other land cover         Agricultural areas, non-forested natural area, pervious surface of urban areas         HERA/socioe conomic_map s           Water demand for domestic use         Daily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)         MSWX           Water demand for industrial use         Daily supply of water volume for fabricating, processing, washing and sanitation, cooling of transporting a product, incorporating water into a product         AGHS-POP, AQUAST         HERA/water_ AQUAST           Water demand for thermoelectric use         Daily supply of water volume for domestic animal need         AQUAST         HERA/water_ AQUAST           Mawater demand for thermoelectric use         Dail	iuyer 5	Landuce		
Protest surface       Evergreen and deciduous heedle leaf and broad teal       CULO       FIRKA/socioe         fraction       tree areas       LC100, conomic_map       HANZE, s       HERA/socioe         Sealed surface       Urban areas, characterizing the human impact on the environment       CGLS-       HERA/socioe         Irrigated surface       Irrigated areas of all possible crops excluding rice       CL2018, HERA/socioe       CCO10, conomic_map         Inland water       Rivers, freshwater and saline lakes, ponds and other permanent water bodies over the continents       CGLS-       HERA/socioe         Irrigated rice       Irrigated areas of rice       CL2018, HERA/socioe       HANZE       s         Irrigated rice       Irrigated areas of rice       CL2018, HERA/socioe       conomic_map         fraction       Agricultural areas, non-forested natural area, pervious surface of urban areas       PAM       conomic_map         Water demand for       Daily supply of water volume for indoor and outdoor household purposes and public buildings       MSXX       MUANZE         Water demand for       Daily supply of water volume for the cooling of thermoelectric use       AT, water used by shops, schools, and public buildings       MSXX         Water demand for       Daily supply of water volume for the cooling of thermoelectric and nuclear power plant       ACAM       GCAM         Water demand for	<b>E</b>	Lana use	CCLC	
graction       tree areas       LC100, conomic_map         Sealed surface       Urban areas, characterizing the human impact on       CGLS-         fraction       the environment       CC2018, HERA/socioe         Irrigated surface       Irrigated areas of all possible crops excluding rice       CC2018, HERA/socioe         fraction       Rivers, freshwater and saline lakes, ponds and       CCL2018, HERA/socioe         fraction       other permanent water bodies over the continents       CCL2018, HERA/socioe         fraction       SPAM, conomic_map       s         fraction       Agricultural areas, non-forested natural area, pervious surface of urban areas       CBS-MM, conomic_map         fraction       Daily supply of water volume for indoor and domestic use       GHS-POP, HERA/water_         domestric use       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a reas       GHS-POP, HERA/water_         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use       GHS-POP, HERA/water_         MQUAST       demand tara       AT, GCAM       AT, GCAM         Water demand for       Daily supply of water volume for domestic animal need       AT, GCAM         Water demand for       Daily supply of water volume for domestic animal need       AQUAST	Forest surface	Evergreen and deciduous needle leaf and broad leaf	CGLS-	HERA/SOCIOE
Sealed surface fraction       Urban areas, characterizing the human impact on the environment       CGLS- LC100, LC100, HRNZE, s       HERA/socioe LC100, HRNZE, s         Irrigated surface fraction       Irrigated areas of all possible crops excluding rice       CLC2018, CLC2018, HERA/socioe fraction       HERA/socioe conomic_map s         Inland water fraction       Rivers, freshwater and saline lakes, ponds and other permanent water bodies over the continents       CGLS- LC100, LC100, HANZE       HERA/socioe conomic_map s         Irrigated rice fraction       Irrigated areas of rice       CLC2018, SPAM, HANZE       HERA/socioe conomic_map HANZE         Other land cover fraction       Agricultural areas, non-forested natural area, pervious surface of urban areas       HERA/socioe conomic_map s         Water demand for domestic use       Daily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)       MSWX         Water demand for uldustrial use       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a product       GCAM, MSWX         Water demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST AT, GCAM, MSWX       HERA/water_ AQUAST AT, GCAM, MSWX         Water demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST AT, GCAM, GLWST       HERA/water	fraction	tree areas	LC100,	conomic_map
Sealed surface       Urban areas, characterizing the human impact on       CGLS-       HERA/socioe         fraction       Irrigated areas of all possible crops excluding rice       CLC2018,       HERA/socioe         fraction       Rivers, freshwater and saline lakes, ponds and       CGLS-       HERA/socioe         fraction       Rivers, freshwater and saline lakes, ponds and       CGLS-       HERA/socioe         fraction       Cher permanent water bodies over the continents       LC100,       conomic_map         fraction       Irrigated areas of rice       CLC2018,       HERA/socioe         fraction       Irrigated areas of rice       CLC2018,       HERA/socioe         fraction       Agricultural areas, non-forested natural area,       HANZE       s         Other land cover       Agricultural areas, non-forested natural area,       HERA/socioe       conomic_map         fraction       Daily supply of water volume for indoor and       GHS-POP,       HERA/water_         domestic use       Daily supply of water volume for fabricating,       GHS-POP,       HERA/water_         industrial use       Daily supply of water volume for the cooling of       AT,       AT,         water demand for       Daily supply of water volume for domestic animal       AQUAST       AT,         water demand for       Daily		***	HANZE,	S
fraction       the environment       LC100, conomic_map HANZE, s         Irrigated surface fraction       Irrigated areas of all possible crops excluding rice fraction       CLC2018, HERA/socioe conomic_map s         Inland water       Rivers, freshwater and saline lakes, ponds and other permanent water bodies over the continents       CGLS - HERA/socioe conomic_map HANZE s         Irrigated rice fraction       Irrigated areas of rice       CLC2018, HERA/socioe conomic_map HANZE s         Irrigated rice fraction       Irrigated areas, non-forested natural area, pervious surface of urban areas       HERA/socioe conomic_map s         Other land cover       Agricultural areas, non-forested natural area, pervious surface of urban areas       HERA/socioe conomic_map s         Water demand for domestic use       Daily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)       MSWX         Water demand for lindustrial use       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a product       AT, GCAM         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use index on nuclear power plant       AQUAST         Water demand for thermoelectric and nuclear power plant       AQUAST       demand AT, GCAM, MSWX         Water demand for thermoelectric use       Daily supply of	Sealed surface	Urban areas, characterizing the human impact on	CGLS-	HERA/socioe
HANZE, sIrrigated surface fractionIrrigated areas of all possible crops excluding rice fractionCLC2018, HERA/socioe conomic_map sInland water fractionRivers, freshwater and saline lakes, ponds and other permanent water bodies over the continentsCGLS- LC100, LC100, Conomic_map HANZE sIrrigated rice fractionIrrigated areas of riceCLC2018, HERA/socioe fractionHERA/socioe conomic_map HANZE sIrrigated rice fractionIrrigated areas of riceCLC2018, CLC2018, HERA/socioe SPAM, conomic_map HANZE sOther land cover fractionAgricultural areas, non-forested natural area, pervious surface of urban areasHERA/socioe conomic_map sWater demand for domestic useDaily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., AT, water used by shops, schools, and public buildings)GHS-POP, MSWXWater demand for industrial use thermoelectric useDaily supply of water volume for fabricating, product, incorporating water into a product, incorporating water into a product, incorporating water into a product, incorporating water into a productGHS-POP, AUAST demand AT, GCAMWater demand for thermoelectric useDaily supply of water volume for domestic animal needAQUAST AUAST AUAST AUAST AUAST AUAST AUAST AUAST AUAST demand AT, GCAM, MSWXWater demand for thermoelectric and nuclear power plantAQUAST AQUAST AQUAST AUAST AUAST AUAST AUAST AUAST AUAST AUA	fraction	the environment	LC100,	conomic_map
Irrigated surface fractionIrrigated areas of all possible crops excluding rice (CLC2018, HERA/socioe conomic_map sInland water fractionRivers, freshwater and saline lakes, ponds and other permanent water bodies over the continentsCGLS- LC100, LC2018, HERA/socioe conomic_map HANZEIrrigated rice fractionIrrigated areas of riceCLC2018, HERA/socioe sHERA/socioe conomic_map HANZEIrrigated rice fractionIrrigated areas of riceCLC2018, CLC2018, HERA/socioe sHERA/socioe conomic_map HANZEOther land cover fractionAgricultural areas, non-forested natural area, pervious surface of urban areasHERA/socioe conomic_map HANZEWater demand for domestic useDaily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)MSWXWater demand for industrial use processing, washing and sanitation, cooling or transporting a product, incorporating water into a productAguAST AT, GCAMAguAST AT, GCAMWater demand for thermoelectric useDaily supply of water volume for the cooling of thermoelectric and nuclear power plantAguAST AUS-SPOP, HERA/water_ AQUASTWater demand for thermoelectric useDaily supply of water volume for domestic animal needAguAST AQUASTWater demand for thermoelectric useDaily supply of water volume for domestic animal needAguAST AQUASTWater demand for thermoelectric useDaily supply of water volume for domestic animal need </td <td></td> <td></td> <td>HANZE,</td> <td>S</td>			HANZE,	S
fraction       HANZE       conomic_map         Inland water       Rivers, freshwater and saline lakes, ponds and other permanent water bodies over the continents       CGLS-       HERA/socioe         fraction       Irrigated areas of rice       CL2018,       HERA/socioe         fraction       Irrigated areas of rice       CL2018,       HERA/socioe         fraction       Agricultural areas, non-forested natural area, pervious surface of urban areas       S       conomic_map         Other land cover       Agricultural areas, non-forested natural area, pervious surface of urban areas       HERA/socioe       conomic_map         Water demand for       Daily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)       MSWX         Water demand for       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a product       AT, GCAM         Water demand for       Daily supply of water volume for the cooling of thermoelectric use       AT, GCAM, MSWX         Water demand for       Daily supply of water volume for domestic animal need       AQUAST       AguAST         uter demand for       Daily supply of water volume for domestic animal need       AQUAST       AguAST         uter demand for       Daily supply of water volume fo	Irrigated surface	Irrigated areas of all possible crops excluding rice	CLC2018,	HERA/socioe
sInland water fractionRivers, freshwater and saline lakes, ponds and other permanent water bodies over the continentsCGLS- LC100, LC100, HANZEHERA/socioe conomic_map HANZEIrrigated rice fractionIrrigated areas of riceCLC2018, SPAM, conomic_map HANZEHERA/socioe socioefractionAgricultural areas, non-forested natural area, pervious surface of urban areasHERA/socioe conomic_map sWater demand for domestic useDaily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., processing, washing and sanitation, cooling or transporting a product, incorporating water into a productGHS-POP, AUXSTHERA/water_ demand AT, demandWater demand for industrial useDaily supply of water volume for the cooling of thermoelectric useGHS-POP, AUXSTHERA/water_ AQUASTWater demand for industrial useDaily supply of water volume for the cooling of thermoelectric useGHS-POP, AUXSTHERA/water_ AQUASTWater demand for thermoelectric useDaily supply of water volume for domestic animal needAQUAST AUXSTAERA/water_ AQUASTWater demand for thermoelectric useDaily supply of water volume for domestic animal needAQUAST AUXSTHERA/water_ AQUASTWater demand for thermoelectric useDaily supply of water volume for domestic animal needAQUAST AUXSTHERA/water_ AQUASTLake mask Reservoir mapArea covered by lakes only (binary representation)GLWD EFAS, H	fraction		HANZE	conomic_map
Inland water       Rivers, freshwater and saline lakes, ponds and other permanent water bodies over the continents HCI00, conomic_map HANZE s       CGLS-       HERA/socioe conomic_map HANZE s         Irrigated rice       Irrigated areas of rice       CLC2018, HERA/socioe SPAM, conomic_map HANZE s       CLC2018, HERA/socioe conomic_map HANZE s         Other land cover       Agricultural areas, non-forested natural area, pervious surface of urban areas       HERA/socioe conomic_map HANZE s         Water demand for domestic use       Daily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)       MSWX         Water demand for industrial use       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a product       GCAM         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use       GHS-POP, HERA/water_AQUAST         Water demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST       ARUAST         Water demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_AQUAST         Mater demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_AQUAST         Mater demand for thermoelectric use       Da				S
fraction       other permanent water bodies over the continents       LC100, HANZE       conomic_map s         Irrigated rice fraction       Irrigated areas of rice       CLC2018, SPAM, HANZE       HERA/socioe         Other land cover fraction       Agricultural areas, non-forested natural area, pervious surface of urban areas       HERA/socioe         Water demand for domestic use       Daily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)       MSWX         Water demand for industrial use       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a product       GHS-POP, HERA/water_ AQUAST         Water demand for industrial use       Daily supply of water volume for the cooling of thermoelectric use       GHS-POP, HERA/water_ AQUAST         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use       GHS-POP, HERA/water_ AQUAST         Water demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST         Mater demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST         Mater demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST         Lakes and reservoirs       ACAM, GCAM, GCAM, GCAM, GCAM, GCAM,	Inland water	Rivers, freshwater and saline lakes, ponds and	CGLS-	HERA/socioe
HANZEsIrrigated rice fractionIrrigated areas of riceCLC2018, SPAM, conomic_map HANZEHERA/socioe SPAM, conomic_map HANZEOther land cover fractionAgricultural areas, non-forested natural area, pervious surface of urban areasHERA/socioe conomic_map sWater demand for domestic useDaily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)GHS-POP, AQUAST AT, water used by shops, schools, and public buildings)Water demand for industrial use than areasDaily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a productGHS-POP, AT, AQUAST GCAMWater demand for thermoelectric useDaily supply of water volume for the cooling of thermoelectric and nuclear power plantGHS-POP, AQUAST AQUAST AQUAST demand AT, GCAM, MSWXWater demand for thermoelectric useDaily supply of water volume for domestic animal needAQUAST AT, GCAM, MSWXWater demand for livestock useDaily supply of water volume for domestic animal needAQUAST AT, GCAM, MSWXWater demand for livestock useDaily supply of water volume for domestic animal needAQUAST AT, GCAM, GLW3Lake mask Reservoir mapArea covered by lakes only (binary representation)GLWD LF-EU maps EFAS, GranDLake mask Reservoir mapArea covered by lakes only (binary representation)GLWD LF-E	fraction	other permanent water bodies over the continents	LC100,	conomic_map
Irrigated rice fraction       Irrigated areas of rice       CLC2018, SPAM, HANZE       HERA/socioe conomic_map HANZE         Other land cover fraction       Agricultural areas, non-forested natural area, pervious surface of urban areas       HERA/socioe conomic_map s         Water demand for domestic use       Daily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)       GHS-POP, AQUAST       HERA/water_ demand         Water demand for industrial use       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a product       GHS-POP, AQUAST       HERA/water_ demand         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric and nuclear power plant       GHS-POP, AQUAST       HERA/water_ demand         Water demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST       AQUAST         Water demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST       AQUAST         Mater demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST       AQUAST         Mater demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_ AT, GCAM, GLW3         Lakes and reservo		-	HANZE	s
fraction       SPAM, HANZE       conomic_map s         Other land cover fraction       Agricultural areas, non-forested natural area, pervious surface of urban areas       HERA/socioe conomic_map s         Water demand for domestic use       Daily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)       GHS-POP, AT, AT, mater used by shops, schools, and public buildings)         Water demand for industrial use       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a product       GHS-POP, AUAST AT, GCAM, MSWX         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use       GHS-POP, HERA/water_ demand         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use       GHS-POP, HERA/water_ AQUAST AT, GCAM, MSWX         Water demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST AT, GCAM, MSWX         Water demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST AT, GCAM, MSWX         Water demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST AT, GCAM, MSWX         Lakes and reservoirs       EAKS, HERA/reserv HANZE, Oirs       HERA/reserv HANZE, Oirs	Irrigated rice	Irrigated areas of rice	CLC2018,	HERA/socioe
HANZE s         HANZE s         Other land cover fraction       Agricultural areas, non-forested natural area, pervious surface of urban areas       HERA/socioe conomic_map s         Water demand for domestic use       Daily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)       MSWX         Water demand for industrial use       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a product       GHS-POP, HERA/water_ demand for thermoelectric use       GCAM         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use       GCAM         Water demand for thermoelectric use       Daily supply of water volume for domestic animal need       GCAM         Water demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST         Magex       Acquast       Acquast       Acquast         Mater demand for thermoelectric use       Daily supply of water volume for domestic animal need       Acquast         Mater demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST       Acquast         Mater demand for livestock use       Daily supply of water volume for domesti	fraction	ç	SPAM,	conomic map
Other land cover fraction       Agricultural areas, non-forested natural area, pervious surface of urban areas       HERA/socioe conomic_map s         Water demand for domestic use       Daily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)       HERA/water_ AQUAST         Water demand for industrial use       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a product       GHS-POP, HERA/water_ AQUAST       HERA/water_ demand         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use       GHS-POP, HERA/water_ AQUAST       AQUAST         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use       GHS-POP, HERA/water_ AQUAST       AQUAST         Water demand for livestock use       Daily supply of water volume for domestic animal need       GCAM, MSWX         Water demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST         Lakes and reservoirs       Art, GCAM, GLW3       CAUAST         Lake mask       Area covered by lakes only (binary representation)       GLWD       LF-EU maps         Reservoir map       Location and identifier of each reservoir       EFAS, GranD       EFAS, HERA/reserv	·		HANZE	s
fraction       pervious surface of urban areas       conomic_map s         Water demand for domestic use       Daily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)       GHS-POP, HERA/water_AQUAST         Water demand for industrial use       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a product       GHS-POP, HERA/water_AQUAST         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use       GHS-POP, HERA/water_AQUAST         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use       GHS-POP, HERA/water_AQUAST         Water demand for thermoelectric and nuclear power plant       GCAM       GCAM, MSWX         Water demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_AQUAST         Ivestock use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_AT, demand GCAM, GLW3         Ivestock use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_AT, demand GCAM, GLW3         Ivestock use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_AT, demand GCAM, GLW3       HERA/reserv HARA/reserv HARA/reserv HARA/reserv HARA/r	Other land cover	Agricultural areas, non-forested natural area,		HERA/socioe
Water demand         Water demand for domestic use       Daily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)       GHS-POP, AT, MSWX       HERA/water_ AQUAST         Water demand for industrial use       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a product       GHS-POP, AQUAST       HERA/water_ demand         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use       GHS-POP, thermoelectric and nuclear power plant       AT, GCAM, MSWX         Water demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_ demand         Water demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_ demand         Mater demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_ demand         Mater demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_ demand         Lives and reservoirs       Lakes and reservoirs       AQUAST       HERA/water_ demand       AT, demand         GCAM, GLW3       GLW3       LF-EU maps       LF-EU maps       EFAS, dors       H	fraction	pervious surface of urban areas		conomic map
Water demand           Water demand for domestic use         Daily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)         GHS-POP, MSWX         HERA/water_ demand           Water demand for industrial use         Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a product         GHS-POP, GCAM         HERA/water_ demand           Water demand for thermoelectric use         Daily supply of water volume for the cooling of thermoelectric use         GHS-POP, Daily supply of water volume for the cooling of thermoelectric use         GHS-POP, HERA/water_ AQUAST         HERA/water_ demand           Water demand for thermoelectric use         Daily supply of water volume for the cooling of thermoelectric use         GHS-POP, HERA/water_ AQUAST         HERA/water_ demand           Water demand for thermoelectric use         Daily supply of water volume for domestic animal need         AQUAST         HERA/water_ AT, GCAM, MSWX           Water demand for livestock use         Daily supply of water volume for domestic animal need         AQUAST         HERA/water_ AT, demand GCAM, GLW3           Lakee mask         Area covered by lakes only (binary representation)         GLWD         LF-EU maps EFAS, HERA/reserv           Reservoir map         Location and identifier of each reservoir         GFAS, HAXZE, oirs         HERA/reserv <td><i>j</i></td> <td>I · · · · · · · · · · · · · · · · · · ·</td> <td></td> <td>s s</td>	<i>j</i>	I · · · · · · · · · · · · · · · · · · ·		s s
Water demand for domestic use       Daily supply of water volume for indoor and outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)       GHS-POP, AT, AQUAST       HERA/water_ demand         Water demand for industrial use       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a product       GHS-POP, AQUAST       HERA/water_ demand         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use       GHS-POP, thermoelectric and nuclear power plant       GHS-POP, AQUAST       HERA/water_ demand         Water demand for thermoelectric use       Daily supply of water volume for domestic animal need       GCAM, MSWX       HERA/water_ demand         Water demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_ demand         Lake mask       Area covered by lakes only (binary representation)       GLWD       LF-EU maps         Reservoir map       Location and identifier of each reservoir       EFAS, GranD       HERA/reserv		Water demand		
domestic use       outdoor household purposes and for all the uses that are connected to the municipal system (e.g., water used by shops, schools, and public buildings)       AQUAST AQUAST MSWX         Water demand for industrial use       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a product       GHS-POP, AQUAST AQUAST demand         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use       GHS-POP, thermoelectric and nuclear power plant         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric and nuclear power plant       GHS-POP, AQUAST AQUAST         Water demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST ACAM, MSWX         Water demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST AT, GCAM, MSWX         Lake mask       Area covered by lakes only (binary representation)       GLWD       LF-EU maps EFAS, HERA/reserv HANZE, oirs         Reservoir map       Location and identifier of each reservoir       EFAS, HERA/reserv HANZE, oirs       HERA/reserv HANZE, oirs	Water demand for	Daily supply of water volume for indoor and	GHS-POP	HERA/water
admestic last       Sultation holisection purposes and for that the design of the municipal system (e.g., water used by shops, schools, and public buildings)       AT, water used by shops, schools, and public buildings)         Water demand for industrial use       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a transporting a product, incorporating water into a thermoelectric use       AT, demand         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use       GCAM         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use       GCAM, MSWX         Water demand for the demand for thermoelectric and nuclear power plant       AQUAST       AERA/water_ AQUAST         Water demand for the cooling of thermoelectric use       Daily supply of water volume for domestic animal ACUAST       HERA/water_ AQUAST         Water demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_ AT, demand GCAM, GLW3         Water demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_ HERA/water_ AT, demand GCAM, GLW3         Water demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_ HERA/water_ AT, demand GCAM, GLW3         Mater demask       Area covered by lakes only (binary representation) <td>domestic use</td> <td>outdoor household purposes and for all the uses</td> <td></td> <td>demand</td>	domestic use	outdoor household purposes and for all the uses		demand
water used by shops, schools, and public buildings)       MSWX         Water demand for industrial use       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a product       GHS-POP, AQUAST       HERA/water_ demand         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use       GCAM         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric use       GCAM, MSWX         Water demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST         Water demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST         HERA/water_ livestock use       Daily supply of water volume for domestic animal need       AQUAST         Lakes and reservoirs       Lakes and reservoirs       Lakes and reservoirs         Lake mask       Area covered by lakes only (binary representation)       GLWD       LF-EU maps         Reservoir map       Location and identifier of each reservoir       EFAS, HERA/reserv       HANZE, oirs	uomesne use	that are connected to the municipal system (e.g.		demand
Water demand for industrial useDaily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a productGHS-POP, AQUASTHERA/water_ demandWater demand for thermoelectric useDaily supply of water volume for the cooling of thermoelectric and nuclear power plantGHS-POP, AQUASTHERA/water_ demandWater demand for thermoelectric useDaily supply of water volume for the cooling of thermoelectric and nuclear power plantGHS-POP, AQUASTHERA/water_ demandWater demand for livestock useDaily supply of water volume for domestic animal needAQUAST AQUASTHERA/water_ demandLake maskArea covered by lakes only (binary representation)GLWDLF-EU mapsReservoir mapLocation and identifier of each reservoirEFAS, HERA/reserv HANZE, oirs GranDEFAS, HERA/reserv		water used by shops schools and public buildings)	MSWY	
water demand for industrial use       Daily supply of water volume for fabricating, processing, washing and sanitation, cooling or transporting a product, incorporating water into a product       AQUAST       demand         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric and nuclear power plant       GHS-POP, AQUAST       HERA/water_ AQUAST         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric and nuclear power plant       GCAM, MSWX         Water demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_ AQUAST         Lake mask       Area covered by lakes only (binary representation)       GLWD       LF-EU maps         Reservoir map       Location and identifier of each reservoir       EFAS, HERA/water, AT, demand       HERA/water_ AT, demand	Water domand for	Deily supply of water volume for febricating		LIED A /motor
Industrial use       processing, washing and samilation, cooling of transporting a product, incorporating water into a product       AQUAST       demand         Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric and nuclear power plant       GHS-POP, HERA/water_         Water demand for thermoelectric use       Daily supply of water volume for domestic animal need       AQUAST       demand         Water demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_         AT, demand       AT, demand       GCAM, MSWX         Water demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST       HERA/water_         Lake mask       Area covered by lakes only (binary representation)       GLWD       LF-EU maps         Reservoir map       Location and identifier of each reservoir       EFAS, HERA/reserv         HANZE, oirs       GranD       GranD	in dustrial use	Daily supply of water volume for fabricating,	UNS-FUF,	HERA/Walei_
Transporting a product, incorporating water into a productAT, GCAMWater demand for thermoelectric useDaily supply of water volume for the cooling of thermoelectric and nuclear power plantGHS-POP, AQUAST demand AT, GCAM, MSWXWater demand for livestock useDaily supply of water volume for domestic animal needAQUAST AQUAST AQUAST AQUAST AT, demand GCAM, GLW3Lake maskArea covered by lakes only (binary representation)GLWD EFAS, GRAN, HERA/reserv HANZE, oirs GranD	inaustriai use	processing, wasning and sanitation, cooling or	AQUASI	demand
Water demand for thermoelectric useDaily supply of water volume for the cooling of thermoelectric and nuclear power plantGHS-POP, AQUAST demand AT, GCAM, MSWXWater demand for livestock useDaily supply of water volume for domestic animal needAQUAST MSWXHERA/water_ HERA/water_ AT, demand GCAM, MSWXWater demand for livestock useDaily supply of water volume for domestic animal needAQUAST MSWXHERA/water_ demand GCAM, GLW3Lake maskArea covered by lakes only (binary representation)GLWD EFAS, GLWDLF-EU maps EFAS, HERA/reserv HANZE, oirs GranD		transporting a product, incorporating water into a	AI,	
Water demand for thermoelectric use       Daily supply of water volume for the cooling of thermoelectric and nuclear power plant       GHS-POP, HERA/water_ AQUAST demand AT, GCAM, MSWX         Water demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST HERA/water_ AT, demand GCAM, GLW3         Lake mask       Area covered by lakes only (binary representation)       GLWD       LF-EU maps         Reservoir map       Location and identifier of each reservoir       EFAS, HERA/reserv       HERA/reserv		product	GLAM	
thermoelectric use       thermoelectric and nuclear power plant       AQUAST       demand         AT,       GCAM,       MSWX         Water demand for       Daily supply of water volume for domestic animal       AQUAST       HERA/water_         livestock use       need       AT,       demand         GCAM,       GCAM,       GCAM,       GCAM,         GLW3       Image: Comparison of the servoirs       Image: Comparison of the servoir of	Water demand for	Daily supply of water volume for the cooling of	GHS-POP,	HERA/water_
AT,       GCAM,         Water demand for       Daily supply of water volume for domestic animal       AQUAST       HERA/water_         livestock use       need       AT,       demand         GCAM,       GLW3       GLW3         Lake mask       Area covered by lakes only (binary representation)       GLWD       LF-EU maps         Reservoir map       Location and identifier of each reservoir       EFAS,       HERA/reserv         HANZE,       oirs       GranD       GranD	thermoelectric use	thermoelectric and nuclear power plant	AQUAST	demand
GCAM, MSWX         Water demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST AT, demand GCAM, GLW3         Image: Comparison of the two states and reservoirs       AT, GLW3         Image: Comparison of two states and reservoirs       Image: Comparison of two states and reservoirs         Image: Comparison of two states and reservoirs       Image: Comparison of two states and reservoirs         Image: Comparison of two states and reservoir map       Image: Comparison of two states and reservoir         Image: Comparison of two states and reservoir map       Image: Comparison of two states and reservoir map         Image: Comparison of two states and reservoir map       Image: Comparison of two states and reservoir map         Image: Comparison of two states and reservoir map       Image: Comparison of two states and reservoir map         Image: Comparison of two states and reservoir map       Image: Comparison of two states and reservoir map         Image: Comparison of two states and reservoir map       Image: Comparison of two states and reservoir map         Image: Comparison of two states and reservoir map       Image: Comparison of two states and reservoir map         Image: Comparison of two states and reservoir map       Image: Comparison of two states and reservoir map         Image: Comparison of two states and reservoir map       Image: Comparison of two states and reservoir map         Image: Comparison of two states and reservoir map			AT,	
MSWX         Water demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST AT, GCAM, GLW3       HERA/water_ demand         Lake mask       Area covered by lakes only (binary representation)       GLWD       LF-EU maps         Reservoir map       Location and identifier of each reservoir       EFAS, GranD       HERA/reserv			GCAM,	
Water demand for livestock use       Daily supply of water volume for domestic animal need       AQUAST AT, GCAM, GLW3       HERA/water_ demand         Image: Construction of the second state of the sec			MSWX	
livestock use       need       AT, demand         GCAM, GLW3       GCAM,         Lake mask       Area covered by lakes only (binary representation)       GLWD       LF-EU maps         Reservoir map       Location and identifier of each reservoir       EFAS, HERA/reserv         HANZE, oirs       GranD	Water demand for	Daily supply of water volume for domestic animal	AQUAST	HERA/water_
GCAM, GLW3         Lakes and reservoirs         Lake mask       Area covered by lakes only (binary representation)       GLWD       LF-EU maps         Reservoir map       Location and identifier of each reservoir       EFAS,       HERA/reserv         HANZE,       oirs       GranD       GranD	livestock use	need	AT,	demand
GLW3         Lakes and reservoirs         Lake mask       Area covered by lakes only (binary representation)       GLWD       LF-EU maps         Reservoir map       Location and identifier of each reservoir       EFAS,       HERA/reserv         HANZE,       oirs       GranD       GranD			GCAM,	
Lake mask       Area covered by lakes only (binary representation)       GLWD       LF-EU maps         Reservoir map       Location and identifier of each reservoir       EFAS,       HERA/reserv         HANZE,       oirs       GranD       GranD			GLW3	
Lake maskArea covered by lakes only (binary representation)GLWDLF-EU mapsReservoir mapLocation and identifier of each reservoirEFAS,HERA/reservHANZE,oirsGranDHERA/reserv		Lakes and reservoirs		
Reservoir map       Location and identifier of each reservoir       EFAS,       HERA/reserv         HANZE,       oirs       GranD       GranD	Lake mask	Area covered by lakes only (binary representation)	GLWD	LF-EU maps
HANZE, oirs GranD	Reservoir map	Location and identifier of each reservoir	EFAS,	HERA/reserv
GranD			HANZE,	oirs
			GranD	

Dataset name	Description	Data source
AQUASTA	FAO's global information system on water resources and	https://www.fao.org/l
Т	agricultural water management.	and-water/databases-
		and-
		software/aquastat/en/
CaMa-Flood	The Catchment-based Macro-scale Floodplain (CaMa-	http://hydro.iis.u-
	Flood) Global River Hydrodynamics Model v4.0 265 maps	tokyo.ac.jp/~yamadai
	(CaMa-Flood) is a global hydrography dataset.	/cama-flood/
CGLS-LAI	The Copernicus Global Land Service (CGLS) Leaf Area	https://land.copernic
	Index (LAI) 1km Version 2 collection (CGLS-LAI) is a set of	us.eu/global/products
	global maps data describing vegetation dynamics – the	/lai
	annual evolution of LAI at 10-day intervals over the period	
	of 1999-2020.	
CGLS-	The Copernicus Global Land ServiceLand Cover (LC)	https://land.copernic
LC100	100m map (CGLS-LC100) 283 is a global land cover map	us.eu/global/products
	of the year 2015.	/lc
CLC2018	The Coordination of Information on the Environment	https://land.copernic
0202010	(CORINE) Land Cover (CLC) inventory for 2018	us.eu/en/products/cor
	(CLC2018) is a set of maps describing the land cover/land	ine-land-
	use status of 2018 covering 39 countries in Europe.	cover/clc2018
FAO	The FAO Irrigation and Drainage Paper No. 56 (FAO) is a	https://www.fao.org/l
	publication covering geographically referenced statistics	and-water/databases-
	for crop development stages, crop coefficients, crop height.	and-software/crop-
	rooting depth, and soil water depletion fraction for common	information/en/
	crons found across the world.	
GCAM	Global Change Analysis Model (GCAM) is an integrated.	https://github.com/J
0 01111	multi-sector model developed by the Joint Global Change	GCRI/gcam-core
	Research Institute (JGCRI) to explore the overall behaviour	
	of human and physical systems dynamics and interactions.	
GHS-POP	The Global Human Settlement Population Grid	https://ghsl.irc.ec.eur
0110 1 01	multitemporal version R2019A (GHS POP) is a spatial	opa.eu/ghs_pop2019.
	raster dataset that depicts the distribution of population.	php
	expressed as the number of people per grid-cell.	<u>+-+</u>
GLWD	The Global Lakes and Wetlands Database (GLWD) is a	https://www.worldwi
	global database of water bodies.	ldlife.org/pages/glob
	<u>.</u>	al-lakes-and-
		wetlands-database
GRanD	The Global Reservoir and Dam Database (GRanD) is a	https://www.globalda
	product of the Global Water System Project. It collates	mwatch.org/directory
	existing dam and reservoir datasets with the aim of	
	providing a single, geographically explicit and reliable	
	database for the scientific community.	
HANZE	The Historical Analysis of Natural Hazards in Europe	https://data.4tu.nl/col
	(HANZE) is a pan-European database of exposure to	lections/ /5065346/1
	natural hazards and damaging historical floods since 1870.	
MERIT	Multi-Error-Removed Improved-Terrain Digital Elevation	http://hydro.iis.u-
DEM	Model v.1.0.3 (MERIT DEM) is a high accuracy global	tokyo.ac.jp/~yamadai
	DEM at 3 arc second resolution (~90 m at the Equator).	/MERIT_DEM/
MSWX	Multi-Source Weather (MSWX) is a high-resolution	https://www.gloh2o.
	(3-hourly, 0.1°), bias-corrected meteorological product	org/mswx/
	with global coverage from 1979 to present.	

Table S3: Main datasets used in the creation of surface field inputs for LISFLOOD model. More information on the generation of these surface fields can be found in Choulga et al. (2023).

RiceAtlas	<i>The RiceAtlas v3 (RiceAtlas) is a spatial database of global rice calendars and production.</i>	https://dataverse.harv ard.edu/dataset.xhtml ?persistentId=doi:10. 7910/DVN/IE6R2R
SPAM	The Spatial Production Allocation Model (SPAM) – Global	https://mapspam.info
	Spatially-Disaggregated Crop Production Statistics Data	/data/
	for 2010 v2.0 (SPAM2010) is a global dataset which	
	redistributes crop production information from country and	
	sub-national provinces level to a finer grid-cell level.	
SoilGrids	The International Soil Reference and Information Centre	https://www.isric.org
	(ISRIC) SoilGrids250m global gridded soil information	/explore/soilgrids/faq
	release 2017 (fSoilGrids) is as a set of global soil property	-soilgrids-2017
	and class maps at 250 m resolution.	

Table S4: Water demand in km<sup>3</sup>.y<sup>-1</sup> by sector used for the HERA simulation (1951-2020) over the EFAS domain. Values correspond to Figure 4.c.

year	Domestic	Energy	Industrial	Livestock	Total
1951	34.04	46.21	38.98	6.28	125.51
1952	35.02	48.27	40.70	6.28	130.26
1953	36.00	50.12	42.49	6.28	134.88
1954	36.99	52.07	44.21	6.28	139.55
1955	37.95	54.04	46.03	6.28	144.29
1956	39.04	56.24	47.93	6.28	149.49
1957	40.16	58.19	49.88	6.28	154.50
1958	41.27	60.26	51.79	6.28	159.60
1959	42.40	62.32	53.68	6.28	164.69
1960	40.18	55.42	49.73	6.28	151.62
1961	41.32	56.99	51.00	6.28	155.58
1962	42.54	59.07	52.45	6.28	160.34
1963	43.94	60.87	53.61	6.28	164.69
1964	45.46	63.84	55.79	6.28	171.36
1965	46.88	65.34	57.42	6.28	175.92
1966	48.37	67.04	59.04	6.28	180.74
1967	49.83	69.15	60.83	6.28	186.09
1968	51.51	71.59	62.80	6.28	192.18
1969	53.36	74.52	65.20	6.28	199.36
1970	55.17	78.01	67.72	6.28	207.19
1971	56.96	80.57	69.76	6.28	213.56
1972	59.20	84.29	72.66	6.28	222.42
1973	62.22	88.49	76.70	6.28	233.69
1974	64.59	90.82	79.59	6.28	241.27
1975	66.15	91.74	80.68	6.28	244.84
1976	68.41	95.47	84.04	6.28	254.20
1977	70.58	96.43	85.53	6.28	258.82
1978	72.94	99.59	88.32	6.28	267.13
1979	76.85	103.98	92.79	6.28	279.90
1980	77.37	104.31	93.41	6.28	281.36
1981	78.25	104.52	93.77	6.28	282.82
1982	78.95	104.83	94.20	6.28	284.26
1983	79.51	105.67	94.69	6.28	286.14
1984	79.88	106.26	95.24	6.28	287.66
1985	80.64	107.08	95.74	6.28	289.74
1986	81.19	107.59	96.18	6.28	291.24
1987	81.82	108.12	96.75	6.28	292.96
1988	82.61	108.52	97.52	6.28	294.93
1989	83.88	109.09	98.39	6.28	297.64
1990	84.95	109.56	99.38	6.28	300.17
1991	85.69	109.19	97.89	6.17	298.93
1992	86.29	107.96	96.55	6.07	296.88
1993	86.61	104.48	94.70	5.99	291.78
1994	86.76	103.76	94.12	5.91	290.54
1995	86.95	102.17	93.16	5.85	288.13
1996	86.83	100.36	92.13	5.79	285.11
1997	87.21	100.46	91.82	5.75	285.25
1998	88.42	100.09	90.90	5.73	285.14
1999	89.59	99.32	89.87	5.72	284.50
2000	90.58	99.01	89.04	5.73	284.36
2001	91.94	98.60	87.98	5.74	284.26
2002	93.13	98.19	86.90	5.77	283.98
2003	92.65	96.80	83.46	5.79	278.70
2004	92.03	95.50	80.06	5.82	2/3.41
2005	91.84	94.20	76.67	5.86	268.56

2006	91.45	92.96	73.11	6.09	263.62
2007	91.05	91.83	69.58	6.35	258.81
2008	90.49	90.36	67.06	6.62	254.53
2009	90.39	88.44	64.42	6.90	250.16
2010	90.07	86.91	61.94	7.21	246.13
2011	89.72	84.60	60.29	7.61	242.22
2012	89.15	82.25	58.61	8.00	238.00
2013	90.44	81.74	58.39	8.37	238.94
2014	91.49	81.21	58.16	8.74	239.61
2015	92.52	80.71	57.92	9.10	240.25
2016	93.36	79.86	57.99	9.30	240.51
2017	94.63	79.08	58.09	9.49	241.29
2018	95.24	80.43	60.19	9.68	245.54
2019	95.89	80.53	61.30	9.88	247.60
2020	96.26	75.57	58.59	10.07	240.49

# Model validation

Gauging stations used in validation

## Table S 5 Stations manually checked for the validatation of HERA

Longitude	Latitude	upa	StationID	csource	obs_qa	sim_qa	station	river_name	KGE'	removal	comment	trueUpA	Tlong	Tlat	dist
-6.942	37.975	144	2004160	SpatialQMatch	0.3	1.1	AROCHE	NA	-1.36	NO	Arid catchment				0.7
-0.775	40.175	666	6227620	GRDCUpA	0.8	1.0	EL TERDE	RIO MIJARES	-0.47	NO	Arid catchment				1.6
-1.625	38.408	1541	2007043	EFAS	0.4	2.3	MINATEDA	ARROYO DE	-3.65	NO	Arid catchment				1.2
								TOBARRA							
-2.525	40.258	249	2003173	SpatialQMatch	0.2	1.1	PERALEJA, LA	NA	-2.58	NO	Arid catchment				1.9
14.792	37.658	700	6353500	EFAS	3.3	9.5	PONTE MACCARRONE	FIUME SIMETO	-1.17	NO	Arid catchment				0.9
-3.208	37.875	7019	6217500	EFAS	17.2	7.5	POSITO	RIO GUADIANA MENOR	-0.52	NO	Arid catchment				0.8
-2.275	38.242	368	2007102	SpatialQMatch	1.6	0.3	TAIBILLA	NA	-12.68	NO	Arid catchment + reservoirs not in HERA				1.1
-0.692	40.958	650	2009127	SpatialQMatch	0.9	0.3	ALCAINE	NA	-0.53	NO	Downstream a reservoir				0.8
-6.142	37.675	1025	2005077	EFAS	3.5	8.0	CENTRAL DE CALA	NA	-0.55	NO	Downstream a reservoir				1.0
13.942	37.175	1958	6353400	EFAS	4.2	16.6	DRASI	SALSO	-2.08	NO	Downstream a reservoir				0.6
-2.975	37.542	4073	2005019	SpatialQMatch	6.7	2.6	NEGRATIN	NA	-1.74	NO	Downstream a reservoir				2.9
-4.842	42.842	322	2002035	SpatialQMatch	1.4	4.8	OTERO DE GUARDO	NA	-1.66	NO	Downstream a reservoir				1.4
18.575	66.992	2200	3001969	SpatialQMatch	61.9	26.8	SEITEVARE KRV	NA	-0.48	NO	Downstream a reservoir				1.7
-5.475	38.925	7672	6216630	EFAS	9.7	25.8	ZUJAR	RIO ZUJAR	-0.93	NO	Downstream a reservoir				2.3
-3.592	39.192	11966	6216520	EFAS	0.8	2.7	VILLARRUBIA	RIO GUADIANA	-1.54	NO	Downstream a reservoir				0.7
11.842	47.875	220	6343110	GRDCUpA	1.8	7.8	ERB	LEITZACH	-2.55	YES	Dubious observations				1.7
3.375	44.192	165	6125300	EFAS	1.3	4.7	HERMET	CHAPOUROUX	-1.60	YES	Dubious observations				1.2
4.625	48.742	2143	6122120	EFAS	3.6	21.7	VITRY-EN-PERTHOIS	SAULX	-3.96	YES	Dubious observations				0.4
-0.175	51.408	131	4039003	SpatialQMatch	1.9	1.9	SOUTH WIMBLEDON	NA	-0.57	NO	Heavily influenced river (Wandle in London)				1.3
13.342	58.358	714	3002371	SpatialQMatch	5.6	4.6	ATTORP	NA	-0.52	NO	Influenced by reservoir not in HERA				0.7
23.142	54.075	495	990163	SpatialQMatch	3.8	1.6	CZERWONY FOLWARK	NA	-1.99	NO	Influenced by reservoir not in HERA				1.7
19.242	50.142	2094	910490	SpatialQMatch	18.1	12.3	JELEN	NA	-1.60	NO	Influenced by reservoir not in HERA				1.2
9.492	56.575	555	6934170	GRDCUpA	4.6	3.3	LOEVEL BRO	SKALS A	-0.53	NO	Influenced by reservoir not in HERA				0.2
13.658	37.475	1299	6353300	EFAS	2.4	12.4	PASSOFONDUTO	PLATANI	-3.39	NO	Influenced by reservoir not in HERA				1.2
24.658	54.692	218	6574108	GRDCUpA	2.0	0.9	SEMELISKES	STREVA	-1.96	NO	Influenced by reservoir not in HERA				2.8
22.992	54.075	184	6474107	GRDCUpA	1.3	0.8	SOBOLEWO	CZARNA HANCZA	-0.98	NO	Influenced by reservoir not in HERA				0.8
19.175	50.242	896	990138	SpatialQMatch	7.3	4.5	NIWKA	NA	-2.01	NO	Influenced river				0.8
19.125	50.258	521	990136	SpatialQMatch	4.9	4.8	SZABELNIA	NA	-0.95	NO	Influenced river				0.8
32.475	34.742	239	6196040	EFAS	0.4	1.1	AKHELIA	POTAMOS TIS EZOUSAS	-1.03	NO	Aride catchment				1.1
-0.042	51.592	1353	4038023	SpatialQMatch	2.4	8.0	Low Hall	NA	-1.42	YES	LONDON channel				1.9
-1.025	38.058	186	2007064	SpatialQMatch	4.3	1.0	BENIEL	NA	-0.81	NO	Matched wrong river pixel	14230	-1.00833	38.04167	2.0
-0.692	40.975	653	2009118	EFAS	1.1	0.3	OLIETE	NA	-0.58	NO	Matched wrong river pixel	811	-0.675	40.99167	1.9
-2.675	40.158	358	2003172	SpatialQMatch	0.6	1.2	HUETE	NA	-0.94	NO	Matched wrong river pixel	476	-2.6917	40.2083	2.9
6.825	50.742	298	6335040	GRDCUpA	0.8	3.0	WEILERSWIST	SWISTBACH	-2.50	NO	Matched wrong river pixel	300	6.8583	50.7583	3.1
-2.592	55.508	695	4021025	SpatialQMatch	2.9	15.1	Ancrum	NA	-3.25	NO	Matched wrong river pixel	183	-2.60823	55.52474	0.8
9.408	48.658	191	6335700	GRDCUpA	1.2	2.8	OBERENSINGEN	AICH	-0.46	NO	Matched wrong river pixel	169	9.2917	48.64167	1.9
13.125	56.125	1177	3001635	SpatialQMatch	3.1	8.7	KLIPPAN 2	NA	-0.93	NO	Matched wrong river pixel	150	13.1583	56.1417	2.3
-3.058	57.058	851	4012005	SpatialQMatch	3.8	16.5	Invermuick	NA	-2.34	NO	Matched wrong river pixel	102	-3.075	57.025	2.2
-0.025	51.442	123	4039056	SpatialQMatch	0.4	1.7	Catford Hill	NA	-2.66	NO	Influenced river				0.1
0.458	52.342	367	4033023	SpatialQMatch	0.2	1.2	Beck Bridge	NA	-2.99	YES	river with UpA<100km2				1.7
4.092	44.308	234	6139070	GRDCUpA	1.6	7.5	GAGNIERES (BANNES)	GANIERE	-2.65	YES	river with UpA<100km2	1			2.8
-1.558	51.425	322	4039028	SpatialQMatch	0.7	2.5	Hungerford	DUN	-1.66	YES	river with UpA<100km2				1.7
-6.358	54.225	212	4206002	SpatialQMatch	0.7	3.2	Jerretspass	NA	-2.58	YES	river with UpA<100km2				1.4
5.092	51.142	125	6220345	GRDCUpA	0.1	0.3	MEERHOUT	KLEINBROEKBEEK	-3.66	YES	river with UpA<100km2				2.4

-0.442	51.642	578	4039088	SpatialQMatch	0.5	2.8	Rickmansworth	NA	-3.41	YES	river with UpA<100km2	1.4
0.542	52.558	356	4033029	SpatialQMatch	0.5	1.2	Whitebridge	STRINGSIDE	-0.50	YES	river with UpA<100km2	2.1
16.458	48.125	126	6242715	GRDCUpA	0.7	2.8	SCHWECHAT	KALTER GANG	-2.20	YES	river with UpA<100km3	2.3
							(RATHAUSPARK)					
17.108	59.275	226	6233411	GRDCUpA	1.3	0.6	AKERS KRUTBRUK	RACKSTA A	-0.54	NO	Influenced by reservoir not in HERA	1.3
2.342	48.675	956	6122130	GRDCUpA	3.8	3.8	MORSANG-SUR-ORGE	ORGE	-0.43	NO	strong bias reduces KGE	0.9
5.275	46.175	100	6139640	EFAS	0.5	1.9	MONTAGNAT	REYSSOUZE	-1.58	YES	Upwaters of a karstic river	1.2
-1.725	52.492	132	4028066	SpatialQMatch	1.0	2.5	Coleshill	COLE	-0.67	NO	Influenced river	1.1
0.158	51.442	118	4040016	SpatialQMatch	0.5	1.2	Crayford	CRAY	-0.44	NO	Influenced river	1.3
-20.358	63.858	585	6401150	GRDCUpA	44.7	22.7	ARBAEJARFOSS	YTRI-RANGA	-1.98	NO		1.0
-0.008	41.242	3807	6226550	GRDCUpA	1.6	3.2	CASPE	RIO GUADALOPE	-0.44	NO		0.9
15.708	48.275	839	6242515	GRDCUpA	4.7	13.0	HERZOGENBURG	TRAISEN	-0.95	NO		1.0
							(STRASSENBRUECKE)					
26.342	56.358	616	6373226	GRDCUpA	3.0	6.6	KULENIEKI	USA	-0.44	NO		2.0
19.675	53.442	792	990159	SpatialQMatch	5.0	3.3	KULIGI	NA	-0.42	NO		1.7
-1.775	51.092	164	4043004	SpatialQMatch	0.8	1.8	Laverstock	NA	-0.44	NO		2.1
20.475	53.775	580	990072	SpatialQMatch	3.7	2.6	OLSZTYN-KORTOWO	NA	-0.87	NO		2.1
-0.975	38.075	14456	2007028	SpatialQMatch	6.0	15.6	ORIHUELA	NA	-0.81	NO		2.6
24.292	54.125	4294	6574721	GRDCUpA	32.4	16.8	PUVOCIAI	MERKYS	-0.51	NO		1.1
19.375	50.275	471	990137	SpatialQMatch	3.9	2.2	SLAWKÓW	NA	-2.11	NO		3.3
17.192	54.675	815	990132	SpatialQMatch	8.3	7.2	SMOLDZINO	NA	-0.46	NO		2.0
17.508	53.875	1659	990090	SpatialQMatch	10.2	8.0	SWORNEGACIE	NA	-1.19	NO		1.8
17.908	53.592	2477	6458560	GRDCUpA	19.4	11.6	TUCHOLA	BRDA	-1.09	NO		2.1
25.125	54.442	445	6574723	GRDCUpA	4.0	2.2	VOKE-ZAGARINE	MERKYS	-1.13	NO		1.3



Figure S2: Metadata of the 2448 river gauging stations used in the validation of HERA. It shows (a) the location, upstream area and record length associated to each stations and (b) the distribution of upstream area of the selected river gauging stations.

## Comparison with other hydrological datasets

#### **Reported performances**

In **Table S6**, we provide a summary of the main characteristics of HERA and three other recent hydrological reanalysis mentioned in the article: GLOFAS-ERA5 (Harringan et al., 2020), GRFR (Yang et al., 2021) and a simulation from the mHM model (Samaniego et al., 2019), hereafter referred as EUmHM. We can appreciate from **Table S6** the difference between each dataset and their validation. HERA seems to outperform the two global reanalysis in terms of KGE', which is not surprising due to the better data coverage in Europe, and to the increased diversity of landscapes and climates at global scale.

Dataset	HERA	<b>GLOFAS-ERA5</b>	EUmHM	GRFR
Reference	Tilloy et al.	Harringan et al.	Samaniego et	Yang et al.
	(2024)	(2020)	al. (2019)	(2021)
Spatial coverage	Europe	Global	Europe	Global
Temporal coverage	1951-2020	1979-Present	1960-2010	1980-2019
Spatial resolution	0.0167°	0.25 °	5km (≈0.05 °)	0.05°
validation catchments (N)	2848	1801	357	14698
Median validation	583	30 046	1 700	Not provided
catchment area (km <sup>2</sup> )	(27% < 250 km2)			(29% < 250 kn2)
KGE' (median)	0.55	0.33	0.6	Not provided
	(58% >0.5)			(27% > 0.5)
Pearson r (median)	0.73	0.61	0.8	Not provided
Bias ratio (±20%)	50	28	50	44
Variability ratio (%<1)	83	61	65	Not provided

Table S 6: Characteristics and reported performances of HERA and three recent hydrological reanalysis

The reported performances of HERA and EUmHM are very similar. A deeper comparison between HERA and EUmHM is provided below.

## Comparison with the EUmHM hydrological run over 515 European catchments

Here we compare HERA with the EUmHM run generated with the mHM model (Kumar et al., 2013; Samaniego et al., 2010). This hydrological simulation was recently used to assess flood-generating mechanisms in Europe (Tarasova et al., 2023). HERA and EUmHM use a different model, different meteorological input (bias-adjusted downscaled ERA5-land vs downscaled E-OBS) and different resolution (1' and 6-hourly vs 5km and daily). We were provided daily discharge data by Larisa Tarasova for a set of 1444 European catchments (mean upstream area=2602 km<sup>2</sup>) over the period 1960-2010. We performed a spatial matching similar to the one presented in **Section 3** of the main article, using upstream area as a matching parameter and averaged discharge as a filtering measure (same rules as in **Section 3**). Over the 2448 catchments used in the validation of HERA (**Section 3**), a total 515 common catchments between HERA and the provided EUmHM points were identified (**Figure S3**).



Figure S3: Location of the catchments used in the HERA validation (blue dots), EUmHM catchments (red circles) and common catchments obtained from the matching procedure.

As displayed in **Figure S4** and **Figure S5**, HERA outperforms EUmHM over the common catchments in terms of KGE' (KGE'<sub>med(HERA)</sub> = 0.57 and KGE'<sub>med(EUmHM)</sub> = 0.52). **Figure S4.a** display the differences in performance spatially while Figure S4.b shows the ordered difference in KGE'. From **Figure 4.b**, we can see that HERA outperforms EUmHM in 54% (280) of the catchments. EUmHM seems to be penalized by a very low KGE' in some catchments. The lower performance in mHM is driven by a higher bias (**Figure S6.b**), despite better correlations compared to HERA (**Figure S6.a**).



Figure S4: Cumulative probability distribution of KGE' for HERA (red) and EUmHM (grey) for the 515 common catchments. The green line represents the benchmark KGE' value (-0.41), the red line is the optimal value (1) and the two dashed vertical line show the median KGE' for both simulations.



Figure S5: Performance comparison between HERA and EUmHM in terms of KGE', (a) difference in KGE' at each location and (b) ordered difference from lowest (EUmHM performs better) to highest (HERA performs better).



Figure S 6: Ordered difference in the three components of KGE': (a) correlation (HERA<EUmHM for negative values), (b) absolute  $(1-\beta)$ , with 0 being no bias (HERA>EUmHM for negative values), and (c) absolute  $(1-\gamma)$  with zero meaning that the variability is perfectly reproduced (HERA>EUmHM for negative values).

#### References

LISFLOOD static and parameter maps for Europe: http://data.europa.eu/89h/f572c443-7466-4adf-87aa-c0847a169f23, last access: 11 January 2024.

CEMS-Flood online documentation: https://confluence.ecmwf.int/display/CEMS/CEMS-Flood, last access: 14 December 2023.

Kumar, R., Samaniego, L., and Attinger, S.: Implications of distributed hydrologic model parameterization on water fluxes at multiple scales and locations, Water Resources Research, 49, 360–379, https://doi.org/10.1029/2012WR012195, 2013.

Samaniego, L., Kumar, R., and Attinger, S.: Multiscale parameter regionalization of a grid-based hydrologic model at the mesoscale, Water Resources Research, 46, https://doi.org/10.1029/2008WR007327, 2010.

Samaniego, L., Thober, S., Wanders, N., Pan, M., Rakovec, O., Sheffield, J., Wood, E. F., Prudhomme, C., Rees, G., Houghton-Carr, H., Fry, M., Smith, K., Watts, G., Hisdal, H., Estrela, T., Buontempo, C., Marx, A., and Kumar, R.: Hydrological Forecasts and Projections for Improved Decision-Making in the Water Sector in Europe, Bulletin of the American Meteorological Society, 100, 2451–2472, https://doi.org/10.1175/BAMS-D-17-0274.1, 2019. Tarasova, L., Lun, D., Merz, R., Blöschl, G., Basso, S., Bertola, M., Miniussi, A., Rakovec, O., Samaniego, L., Thober, S., and Kumar, R.: Shifts in flood generation processes exacerbate regional flood anomalies in Europe, Commun Earth Environ, 4, 49, https://doi.org/10.1038/s43247-023-00714-8, 2023.