



POTSDAM INSTITUTE FOR
CLIMATE IMPACT RESEARCH





Celebrating 30 years of
integrated climate impact research
at the Potsdam Institute.

ISIMIP3

Simulation protocol and available forcing data

Katja Frieler, PIK

ISIMIP3a

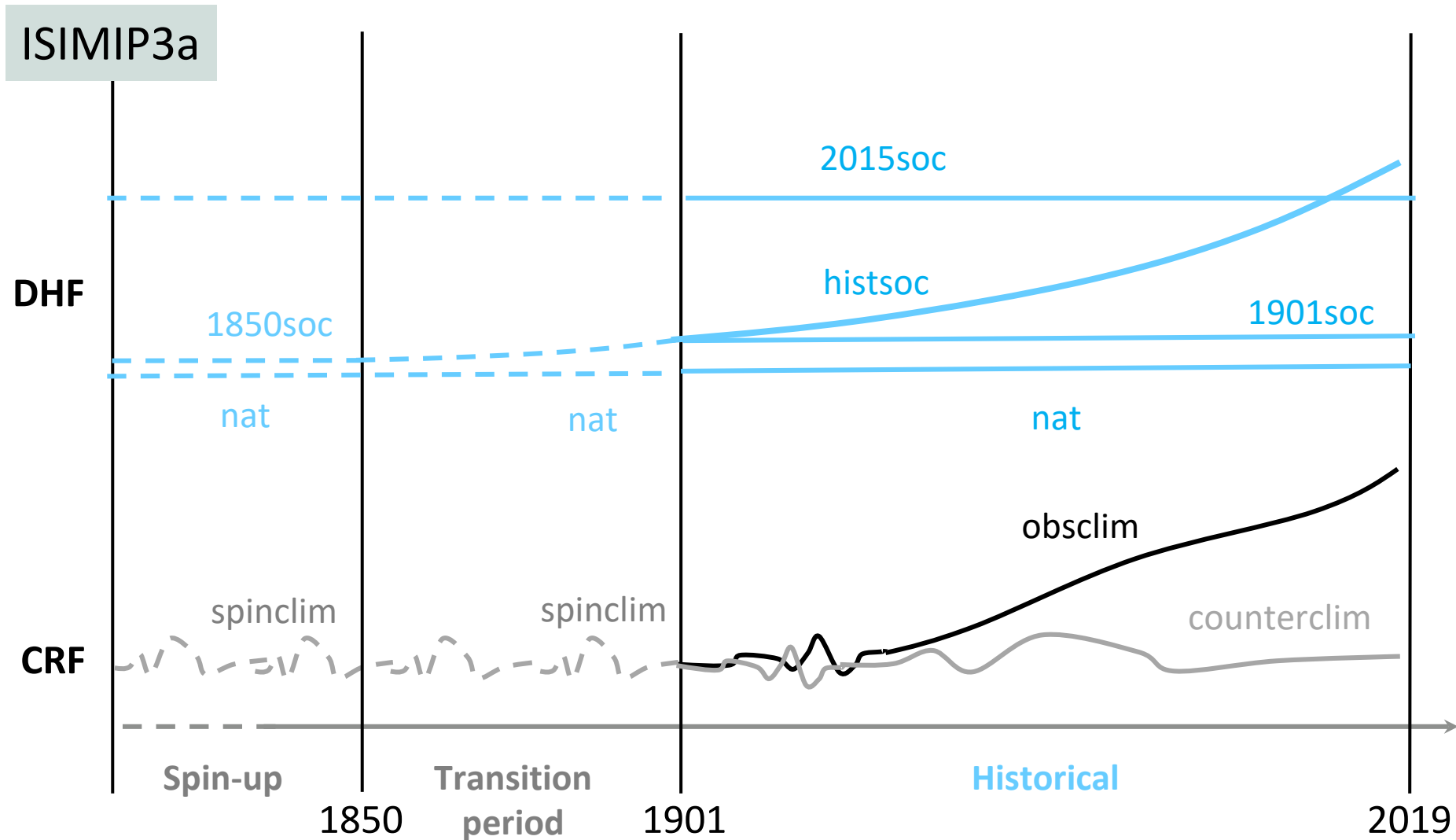
Model evaluation and impact attribution



Celebrating 30 years of
Integrated climate impact research
at the Potsdam Institute.



ISIMIP3a simulations set-up



Climate-related forcings (CRF): obsclim

Forcing	Status	Source, description
Atmospheric forcings		
Standard observation-based atmospheric climate forcing	mandatory	GSWP3-W5E5, 20CRv3-W5E5, 20CRv3-ERA5, 20CRv3,
Tropical cyclone tracks and windfields	mandatory	Tracks from IBTrACS database, windfields calculated by Holland model
Lightning	mandatory	Flash Rate Monthly Climatology, Cecil, 2006
Oceanic forcings		
Standard observation-based oceanic forcing data	mandatory	GFDL MOM6/COBALTv2 simulations driven by reanalysis-based atmospheric forcing
Coastal water levels		
Coastal water levels	mandatory	Hourly coastal water levels with long-term trends
Atmospheric composition or fluxes		
Atmospheric CO2 concentration	mandatory	1850-2005: Meinshausen et al. (2011), 2006-2021: Dlugokencky & Tans (2021);
Atmospheric CH4 concentration	mandatory	1850-2014: Meinshausen et al. (2017), 2015-2021: Dlugokencky (2021);



Climate-related forcings (CRF): counterclim

Forcing	Status	Source, description
Atmospheric forcings		
Counterfactual 'no-climate change' atmospheric climate forcing	mandatory	Detrended versions of the GSWP3-W5E5, 20CRv3-W5E5, 20CRv3-ERA5, 20CRv3 data sets derived by the Attrici method
Tropical cyclone tracks and windfields	mandatory	Tracks from IBTrACS database, windfields calculated by Holland model
Lightning	mandatory	Flash Rate Monthly Climatology, Cecil, 2006
Oceanic forcings		
Standard observation-based oceanic forcing data	mandatory	GFDL MOM6/COBALTv2 simulations driven by reanalysis-based atmospheric forcing
Coastal water levels		
Coastal water levels	mandatory	Hourly coastal water levels without long-term trends
Atmospheric composition or fluxes		
Atmospheric CO2 concentration	mandatory	1901 levels ([CO2] = 296.13 ppm) of observed atmospheric CO2 concentrations according to Meinshausen et al. (2011)
Atmospheric CH4 concentration	mandatory	1901 levels of atmospheric CH4 concentrations ([CH4] = 928.8004 ppb), according to Meinshausen et al. (2017)

Direct Human Forcings (DHF)

Forcing	Status	Source, description
Land use and irrigation data	mandatory	HYDE-based irrigated and rainfed cropland downscaled to up to 15 crops, managed pasture and grassland, urban areas
Wood harvest	optional	Historic annual country-level wood harvesting data based on the LUH2 v2h Harmonization Data Set (Hurtt et al. 2011; 2020)
Growing seasons	mandatory	AgMIP crop calendar (constant over time)
N-fertilizer inputs	mandatory	LUH2, Hurtt et al., 2020
N-deposition	optional	Tian et al., 2018;
Marine fishing efforts and fish catches	mandatory	1950-2014, Rousseau et al., 2019
Dams and reservoirs	optional	Global Reservoir and Dam Database (GRanD) v1.3 (Lehner et al., 2011a, 2011b) + set of dams provided by Dr. Jida Wang, Kansas State University.
Water abstraction	optional	Mean domestic and industrial water withdrawal and consumption generated by the WaterGAP, PCR-GLOBWB, and H08 models (1850-2018).
Lake surface area	optional	Time dependent Lake area fraction (percentage of lake surface in grid cell area) and lake mask (average and total surface area of lakes in grid cell) for 1850-2019 based on HydroLAKES polygons dataset v1.0 June 2019 and GRanD v1.3
Population data	mandatory	Census-based national data from 2019 UN World Population Prospects (WPP), downscaling on ISIMIP grid based on HYDE3.3
GDP data	mandatory	World Bank's World Development Indicator database (WDI)

ISIMIP3b

GCM-based impact simulations

group I: historical simulations, observed DHF

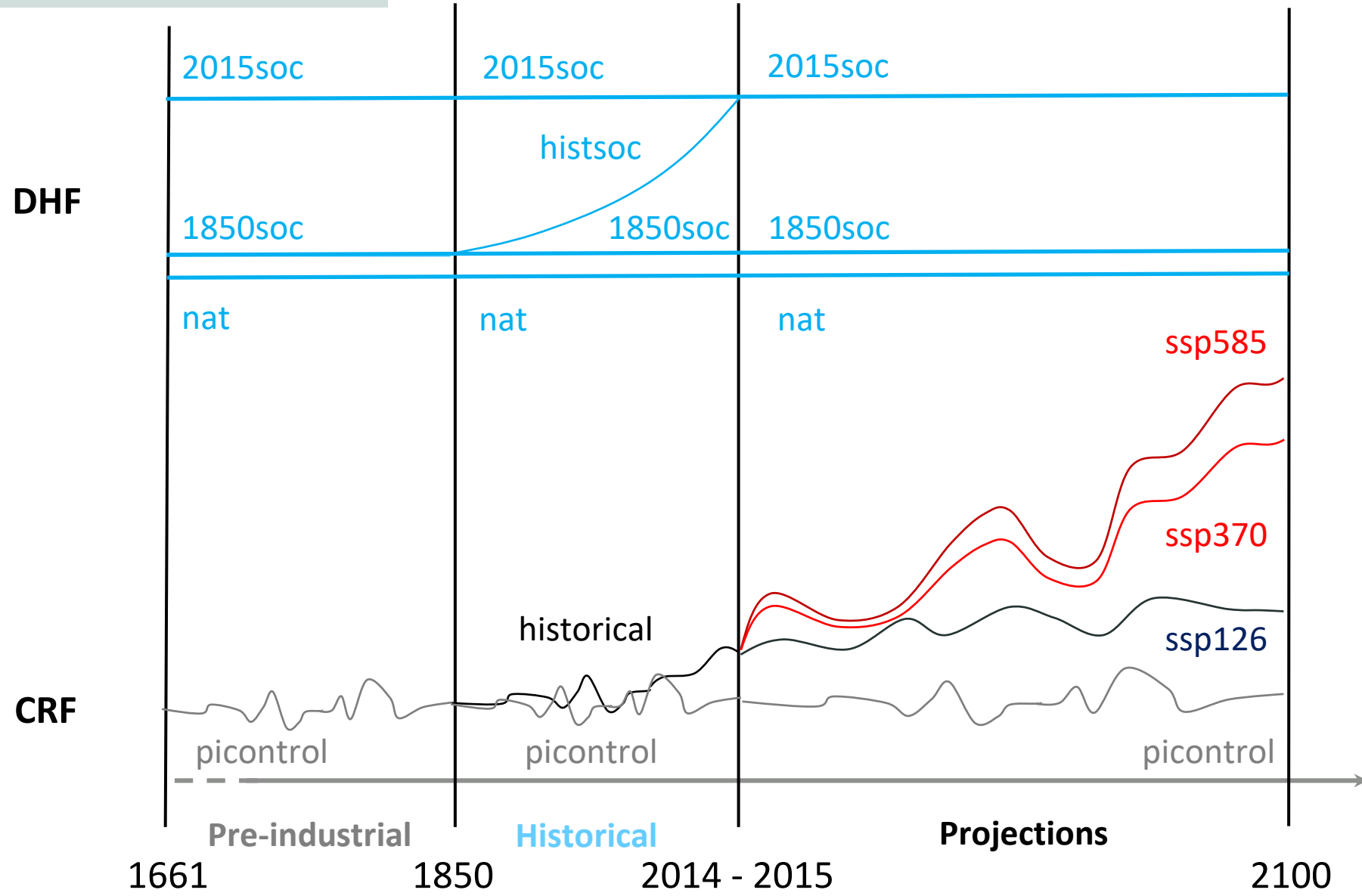
group II: future projections, constant 2015 DHF



Celebrating 30 years of
integrated climate impact research
at the Potsdam Institute.



ISIMIP3b group I + II



Climate-related forcings (CRF), ISIMIP3b

Forcing	Status	Source, description
Atmospheric forcings		
Simulated atmospheric climate forcing	mandatory	Bias-adjusted daily data from CMIP6 (GFDL-ESM4, IPSL-CM6A-LR, MPI-ESM1-2-HR, MRI-ESM2-0, UKESM1-0-LL)
Tropical cyclone tracks and windfields	mandatory	Synthetic tropical cyclone tracks derived from GFDL-ESM4, IPSL-CM6A-LR, MPI-ESM1-2-HR, MRI-ESM2-0, UKESM1-0-LL; two different downscaling approaches: Kerry Emanuel et al., 2008 + Chia-Ying Lee et al. (2018)
Lightning	mandatory	historical Flash Rate Monthly Climatology from Cecil (2006), Can we provide projections?
Oceanic forcings		
Simulated oceanic climate forcing	mandatory	Remapped monthly data from GFDL-ESM4, IPSL-CM6A-LR, MPI-ESM1-2-HR, UKESM1-0-LL.
Coastal water levels		
Coastal water levels	mandatory	Not available yet, but we plan to provide hourly water levels (Matthias Mengel)
Atmospheric composition or fluxes		
Atmospheric CO2 concentration	mandatory	1850-2005: Meinshausen et al. (2011), 2006-2014: Dlugokencky & Tans (2019); 2015-2100: Meinshausen et al. (2020)
Atmospheric CH4 concentration	mandatory	1850-2014: Meinshausen et al. (2017), 2015-2100: Meinshausen et al. (2020)

ISIMIP3b

GCM-based impact simulations

group III: Future projections with SSP-based DHF
(no-adaptation + adaptation)



Celebrating 30 years of
integrated climate impact research
at the Potsdam Institute.



Direct Human Forcings (DHF), ISIMIP3b, group III

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

