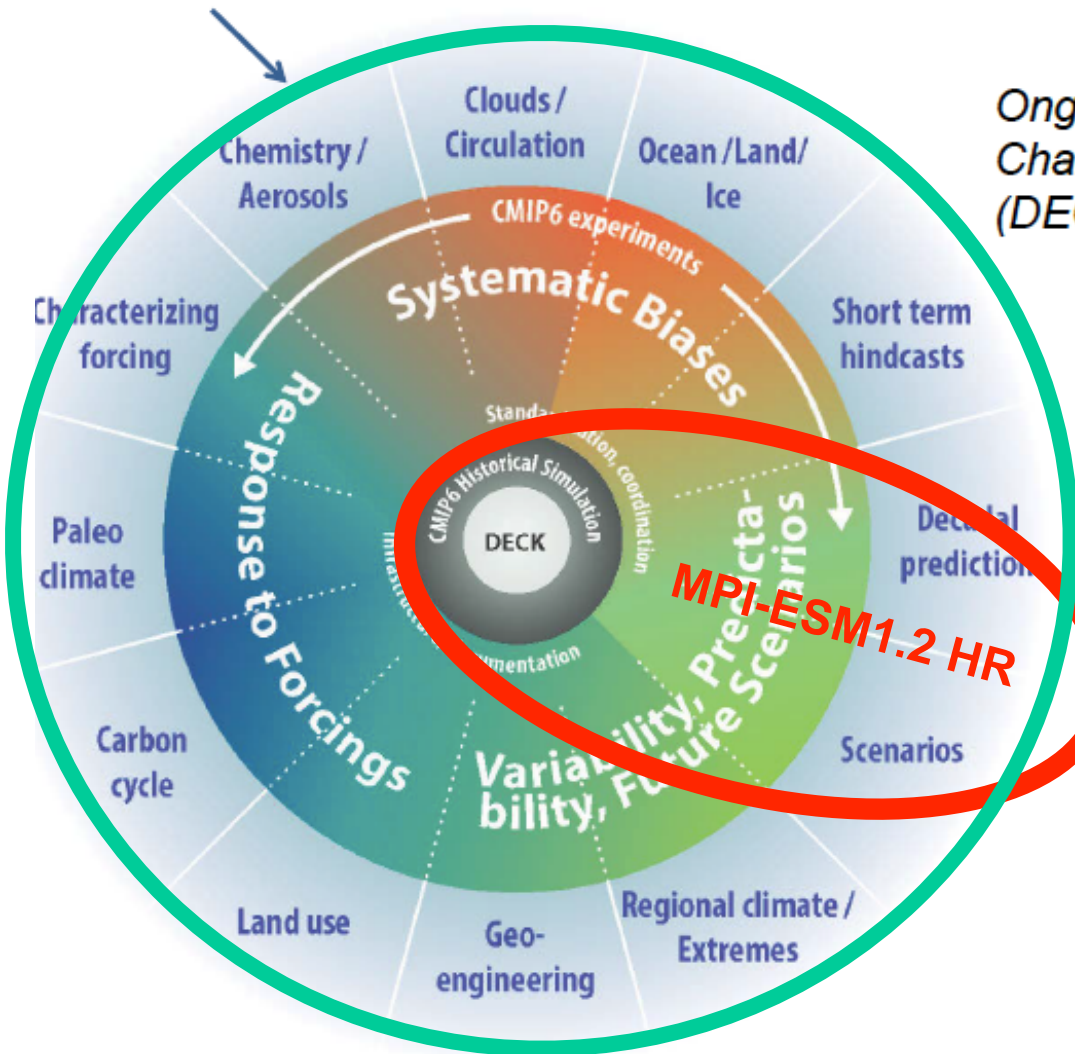


# MPI-ESM 1.2 in CMIP6-DICAD

Johann Jungclaus, Mathias Bittner, Karl-Hermann  
Wieners, Kameswarro Modali  
et al.,





*Ongoing Diagnosis, Evaluation, and Characterization of Klima (DECK) Experiments*

## DECK (entry card for CMIP)

- i. AMIP simulation (~1979-2014)
- ii. Pre-industrial control simulation
- iii. 1%/yr CO<sub>2</sub> increase
- iv. Abrupt 4xCO<sub>2</sub> run

## CMIP6 Historical Simulation (entry card for CMIP6)

- v. Historical simulation using CMIP6 forcings (1850-2014)

## MPI-ESM1.2 LR

*Note: The themes in the outer circle of the figure might be slightly revised at the end of the MIP endorsement process*

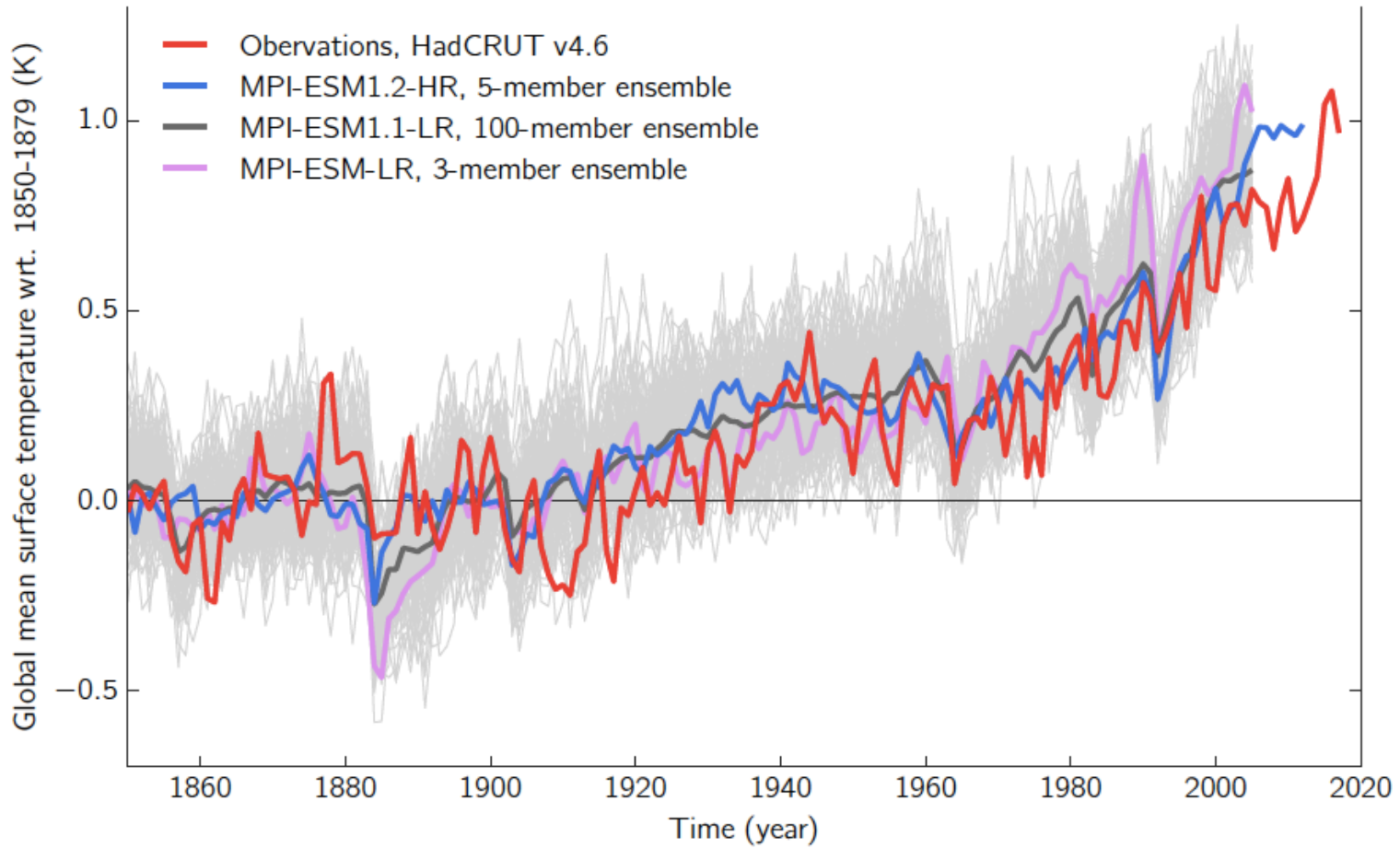
*(DECK & CMIP6 Historical Simulation to be run for each model configuration used in the subsequent CMIP6-Endorsed MIPs)*

# MPI-ESM1.2

	MPI-ESM1.2-LR	MPI-ESM1.2-HR	MPI-ESM1.2-XR*
<b>Atmosphere</b>		ECHAM6.3	
	T63 (1.9° x 1.9°) 47 vertical levels to 0.01 hPa	T127 (1.0° x 1.0°) 95 vertical levels to 0.01 hPa	T255 (0.5° x 0.5°) 95 vertical levels to 0.01 hPa
<b>Ocean</b>		MPIOM1.63	
	GR1.5 (1.5° x 1.5°) 40 levels	TP04 (0.4° x 0.4°) 40 levels	
<b>Additional components</b>	<b>Land:</b> JSBACH3.20 <u>including</u> dynamic vegetation + Carbon- and Nitrogen cycle <b>Ocean-Biogeochemistry:</b> HAMOCC	<b>Land:</b> JSBACH3.20 <u>without</u> dynamic vegetation, Carbon- and Nitrogen cycle <b>Ocean-Biogeochemistry:</b> HAMOCC	

\*MPI-ESM1.2-XR is part of HighResMIP and will not perform the full DECK simulations.

# MPI-ESM1.2-HR



# MPI-ESM1.2-HR: Current status

## MPI-ESM1-2-HR

[-----] 100% - **piControl(MiKlip)** - 500 years started/finished at 24 Jul 2017 / 5 Sep 2017  
[-----] 100% - **1ptCO2(MiKlip)** - 150 years started/finished at 11 Oct 2017 / 22 Oct 2017  
[-----] 100% - **abrupt4xCO2(MiKlip)** - 150 years started/finished at 19 Sep 2017 / 5 Nov 2017  
[-----] 100% - **historical-Real1(MiKlip)** - 165 years started/finished at 2 Aug 2017 / 21 Aug 2017  
[-----] 100% - **historical-Real2(MiKlip)** - 165 years started/finished at 3 Aug 2017 / 20 Aug 2017  
[-----] 100% - **historical-Real3(MiKlip)** - 165 years started/finished at 2 Aug 2017 / 12 Sep 2017  
[-----] 100% - **historical-Real4(MiKlip)** - 165 years started/finished at 21 Aug 2017 / 6 Sep 2017  
[-----] 100% - **historical-Real5(MiKlip)** - 165 years started/finished at 21 Aug 2017 / 11 Sep 2017

[-----.] 99% - **amip** - finished, need to clarify whether final year is correct  
[-----] 100% - **piControl** - 500 years started/finished by Dec 2018  
[-----] 100% - **1ptCO2** - started, finished Feb 2019  
[-----] 100% - **abrupt4xCO2** - finished Feb 2019  
[-----] 100% - **historical-Real1** - finished Jan 2019  
[-----] 100% - **historical-Real2** - finished Jan 2019  
[-----] 100% - **historical-Real3** - finished Jan 2019  
[-----] 100% - **historical-Real4** - finished Jan 2019  
[-----] 100% - **historical-Real5** - finished Jan 2019  
[-----] 100% - **historical-Real6** - finished Jan 2019  
[-----] 100% - **historical-Real7** - finished Jan 2019  
[-----] 100% - **historical-Real8** - finished Jan 2019  
[-----] 100% - **historical-Real9** - finished Jan 2019  
[-----] 100% - **historical-Real10** - finished Jan 2019

[.....] 0% - **RCP-2.6-Real1** - to be started by May 19 (see footnote (1))  
[.....] 0% - **RCP-2.6-Real2** - DWD to be started/finished by ?  
[.....] 0% - **RCP-4.5-Real1** - to be started by April 19  
[.....] 0% - **RCP-7.0-Real1** - to be started by May 19  
[.....] 0% - **RCP-8.5-Real1** - to be started by May 19  
[.....] 0% - **RCP-8.5-Real2** - DWD to be started/finished by ?  
[.....] 0% - **RCP-7.0-Real2** - to be started by May 19  
[.....] 0% - **RCP-7.0-Real3** - to be started by May 19  
[.....] 0% - **RCP-7.0-Real4** - to be started by May 19  
[.....] 0% - **RCP-7.0-Real5** - to be started by May 19  
[.....] 0% - **RCP-7.0-Real6** - to be started by May 19  
[.....] 0% - **RCP-7.0-Real7** - to be started by May 19  
[.....] 0% - **RCP-7.0-Real8** - to be started by May 19  
[.....] 0% - **RCP-7.0-Real9** - to be started by May 19  
[.....] 0% - **RCP-7.0-Real10** - to be started by May 19



# MPI-ESM1.2-LR: Current status

## MPI-ESM1.2-LR

Experiment	internal name	Realization	Ensemble size	from	until	final date	comment
piControl	khw0096	1	1	1850	2365	2849	
1pctCO2	khw0097	1	1	1850	2014	2014	
abrupt4xCO2	khw0098	1	1	1850	2014	2014	
historical	khw0099	1	10	1850	2013	2014	2014 has to be repeated

# MPI-ESM1.2-LR: Current status

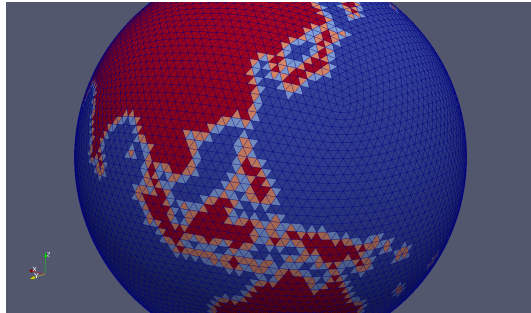
							status
amip	khw0109	1	3	1979	2014	2014	1979-1985 has to be repeated
amip		2	3	1979		2014	not yet started
amip		3	3	1979		2014	not yet started
ssp126				2015		2099	not yet started
ssp245				2015		2099	not yet started
ssp370				2015		2099	not yet started
ssp585				2015		2099	not yet started
esm-piControl	vga0220	1	1	1850		2345	last 500 years of esm to be taken official CMIP control????
esm-historical				1850		2014	not yet started
1%co2-bgc	vga0221			1850		2014	C4MIP
1%co2-rad	vga0222			1850		2014	C4MIP



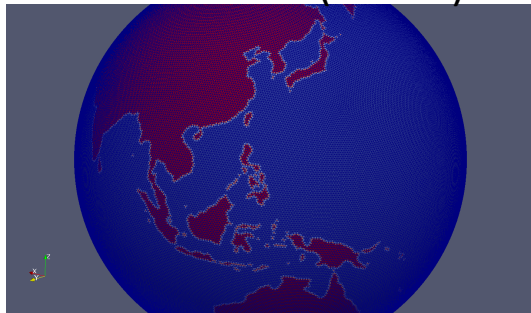
# ICON-ESM: Current status

## “Ruby-0”

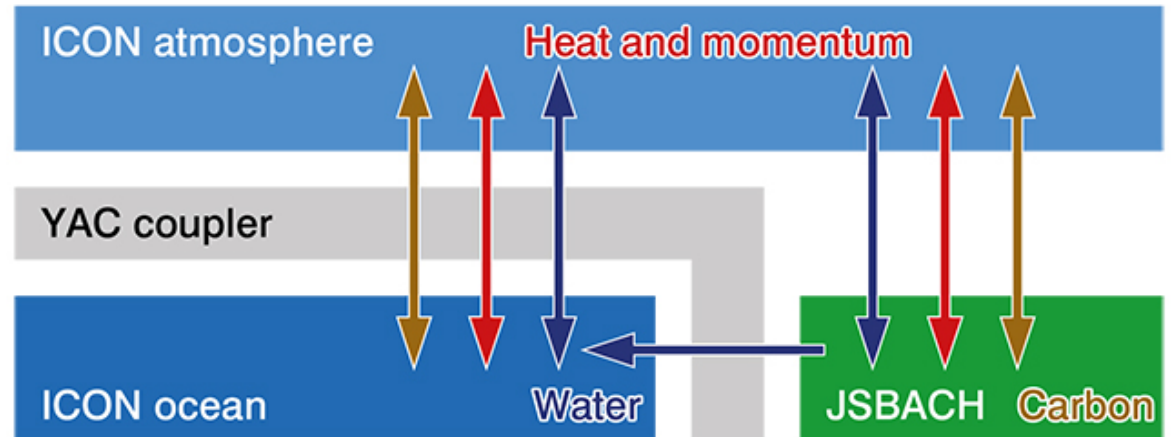
R2B4 (160 km)



R2B6 (40 km)



### ICON - ESM



### Performance:

No atm/oce/cpl/rad job/10y (60 broadwell compute2

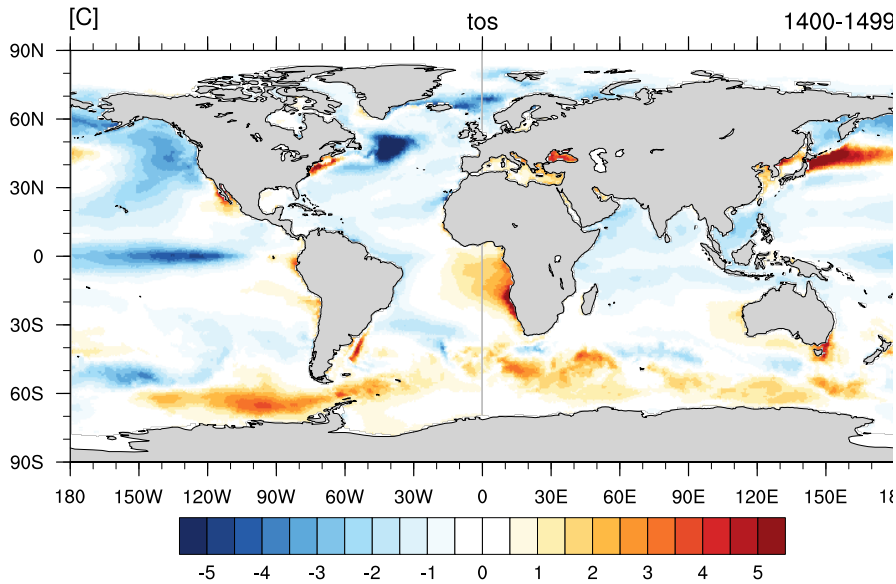
15/45/45/90 3h15m

**Simulated years per day: 75**

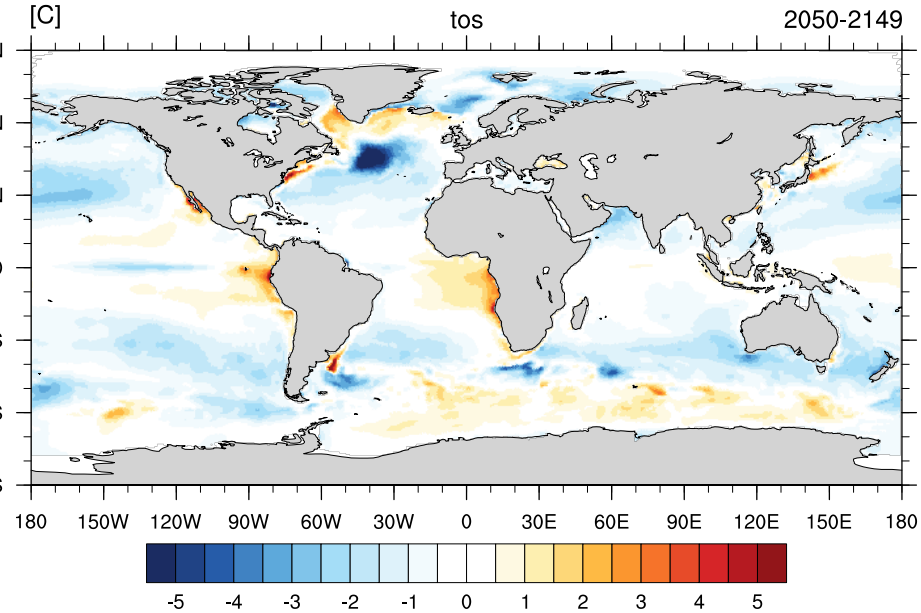


# ICON-ESM: Current status

ICON-ESM (Ruby-0)

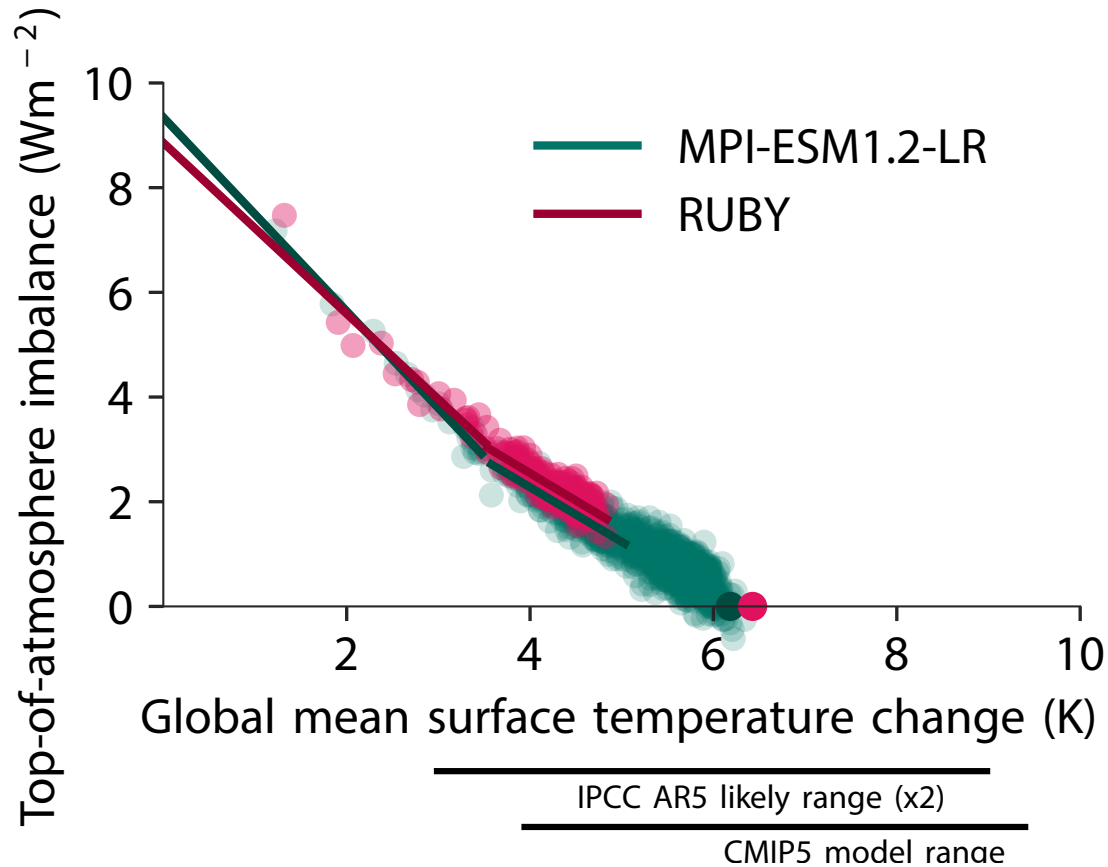


MPI-ESM-HR



Some well-known errors (upwelling, North Atlantic), some new (Kuroshio) differences in biases similar to a MPI-ESM-LR vs. HR comparison

# ICON-ESM: Current status

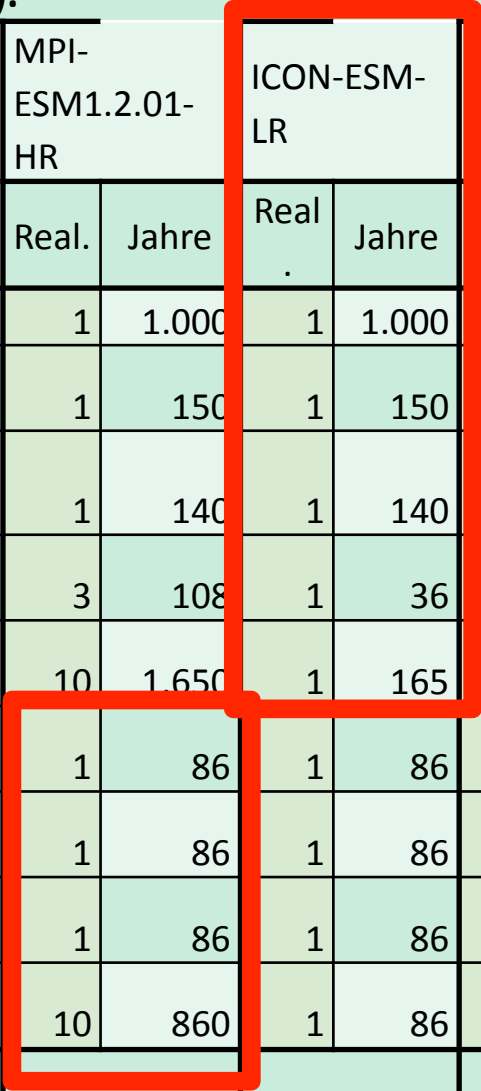


ICON-ESM and MPI-ESM have similar climate sensitivity

# MPI-ESM1.2-HR: To be done:

Tabelle 2a: In diesem DKRZ-Projekt insgesamt geplante CMIP6-Simulationsjahre (2016-2020).

	MPI-ESM1.2.01-HR		ICON-ESM-LR		AWI-CM-1-1-MR		EMAC-2-53-AerChem (Dynamik)1		EMAC-2-53-AerChem (Chemie)2		ICON-MESSy	
	Real.	Jahre	Real	Jahre	Real	Jahre	Real	Jahre	Real	Jahre	Real	Jahre
piControl	1	1.000	1	1.000	1	1.000	1	1.000	0,21	206	0	0
1ptCO2	1	150	1	150	1	150		0	1	150	0	0
abrupt4xCO2	1	140	1	140	1	140		0	1	140	0	0
amip	3	108	1	36		0	1	36	1	36	0	0
historical	10	1.650	1	165	5	825		0	1	165		0
RCP-2.6	1	86	1	86	1	86		0	0	0		0
RCP-4.5	1	86	1	86	1	86		0	0	0		0
RCP-8.5	1	86	1	86	1	86		0	0	0		0
RCP-7.0	10	860	1	86	5	430		0	0	0		0
Jahre pro Modell	4.166		1.835		2.803		1.036		697		0	



# Summary

## **MPI-ESM-HR 1.2**

- DECK (piControl, 1%CO<sub>2</sub>/yr, 4XCO<sub>2</sub>) finished
- 10 historical simulations finished
- AMIP ensemble to be extended
- Scenarios pending

**Status March 2019:**

Post-processing towards ESGF in progress

## **ICON-ESM**

DECK experiments to be started in May 2019

## **MPI-ESM-LR 1.2**

- DECK (piControl, 1%CO<sub>2</sub>/yr, 4XCO<sub>2</sub>) finished
- 10 historical simulations finished
- AMIP missing
- Scenarios pending
- ESM (interactive carbon cycle) DECK in progress

Other MIPS about to start experiments



# MPI-ESM Documentation

Müller, W., et al., 2018: A higher-resolution version of the Max Planck Institute Earth System Model(MPI-ESM1.2-HR), *Journal of Advances in Modeling Earth Systems*, 10, 1383–1413, doi: 10.1029/2017MS001217.

Mauritsen, T., et al., 2019: Developments in the MPI–M Earth System Model version 1.2 (MPI–ESM 1.2) and its response to increasing CO<sub>2</sub>. *Journal of Advances in Modeling Earth Systems*, published online, doi: 10.1029/2018MS001400.

Gutjahr, O., et al., 2019: Max Planck Institute Earth System Model (MPI-ESM) for High-Resolution Model Intercomparison Project (HighResMIP). Under review: *Geosci. Model Dev. Discuss.*, doi: 10.5194/gmd-2018-286.

