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A computationally efficient method for probabilistic local warming projections constrained by history matching and pattern scaling, demonstrated by WASP–LGRTC-1.0

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Model name	Institution
bcc-csm1-1	Beijing Climate Center, China Meteorological Administration
BNU-ESM	College of Global Change and Earth System Science, Beijing Normal University
CanESM2	Canadian Centre for Climate Modelling and Analysis
CCSM4	National Center for Atmospheric Research
CESM1-BGC	Community Earth System Model Contributors
CNRM-CM5	Centre National de Recherches Meteorologiques / Centre Europeen de Recherche et Formation Avancees en Calcul Scientifique
CSIRO-Mk3-6-0	Commonwealth Scientific and Industrial Research Organisation in collaboration with the Queensland Climate Change Centre of Excellence
GFDL-ESM2G	Geophysical Fluid Dynamics Laboratory
GFDL-ESM2M	Geophysical Fluid Dynamics Laboratory
GISS-E2-R	NASA Goddard Institute for Space Studies
HadGEM2-ES	Met Office Hadley Centre (additional HadGEM2-ES realizations contributed by Instituto Nacional de PesquisasEspaciais)
INM-CM4	Institute for Numerical Mathematics
IPSL-CM5A-LR	Institut Pierre-Simon Laplace
IPSL-CM5A-MR	Institut Pierre-Simon Laplace
IPSL-CM5B-LR	Institut Pierre-Simon Laplace
MIROC-ESM	Japan Agency for Marine-Earth Science and Technology, Atmosphere and Ocean Research Institute (The University of Tokyo), and National Institute for Environmental Studies
MIROC5	Atmosphere and Ocean Research Institute (The University of Tokyo), National Institute for Environmental Studies, and Japan Agency for Marine-Earth Science and Technology
MPI-ESM-LR	Max-Planck-InstitutfürMeteorologie (Max Planck Institute for Meteorology)
MPI-ESM-MR	Max-Planck-InstitutfürMeteorologie (Max Planck Institute for Meteorology)
MRI-CGCM3	Meteorological Research Institute
NorESM1-M	Norwegian Climate Centre
NorESM1-ME	Norwegian Climate Centre

Supplementary Table S1. CMIP5 models and the institutions that provided the model data used in this study.

Observational constraint	**Observation-consistent range**	**Comment/References**	**Posterior model ensemble, 95 % range**
Global mean temperature anomaly, 1986-2005 relative to 1850-1900	0.55 to 0.67 °C	Constraint amended from 2003-2012 period in Goodwin et al. (2018b) to 1986-2005 period here, so that the final time-average includes a significant volcanic eruption. Range based on 90% observational range from IPCC (2013).	0.55 to 0.67 °C
Global mean temperature anomaly, 2007-2016 relative to 1971-1980	0.56 to 0.69 °C	Constraints and ranges as used in Goodwin et al. (2018b). Based on: (Morice et al. 2012; GISTEMP, 2018; Hansen et al., 2010; Smith et al., 2008; Vose et al., 2012)	0.56 to 0.68 °C
Global mean temperature anomaly, 2007-2016 relative to 1951-1960	0.54 to 0.78 °C		0.61 to 0.78 °C
Global mean sea-surface temperature anomaly, 2003-2012 relative to 1850-1900	0.56 to 0.68 °C	Constraint and range as used in Goodwin et al. (2018b). Based on (Kennedy et al., 2011; Huang et al., 2015)	0.56 to 0.68 °C
Whole ocean heat content anomaly, 2010 relative to 1971	117 to 332 ZJ	Constraints and ranges as used in Goodwin et al. (2018b). Based on (Levitus et al., 2012; Giese et al., 2011; Balmaseda et al., 2013; Good et al., 2013; Smith et al., 2018; Cheng et al., 2017)	128 to 325 ZJ
Upper 700m ocean heat content anomaly, 2010 relative to 1971	98 to 170 ZJ		98 to 170 ZJ
Terrestrial carbon uptake, 2011 relative to preindustrial	70 to 250 PgC	Constraint and range as used in Goodwin et al. (2018). Based on IPCC (2013)	97 to 254 PgC
Rate of terrestrial carbon uptake, 2000 to 2009	1.4 to 3.8 PgC yr^{-1}	Constraint and range as used in Goodwin et al. (2018b). Based on IPCC (2013)	1.4 to 3.7 PgC yr^{-1}
Ocean carbon uptake, 2011 relative to preindustrial	125 to 185 PgC	Constraint and range as used in Goodwin et al. (2018b). Based on IPCC (2013)	125 to 182 PgC

Supplementary Table S2: The observational consistency tests used to extract WASP simulations, and 95 % range of simulated values in the final WASP ensemble. Following the method outlined in Goodwin et al. (2018b) a simulation is deemed observation consistent provided that: (1) all simulated quantities lie within 90 to 95 % uncertainty ranges for the observed quantities, or (2) the sum total of the deviation from the 90 to 95 % uncertainty ranges across all constraints is less than a small permitted level (Goodwin et al, 2018b). This permitted deviation allows the tails of the observational uncertainty distributions to be present within the observation-constrained simulations