

Supplementary Information
for
“Drivers of persistent changes in the global methane cycle
under aggressive mitigation action”

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Supplementary Table

Table S1: Methane feedback factor in UKESM1-conc and UKESM-ems. Listed are the variables used in the calculation of the methane feedback factor f , including the whole-atmosphere methane burden, the methane atmospheric lifetime with respect to reaction with OH (whole-atmosphere $\text{CH}_4 + \text{OH}$ rxn-flux), estimated stratospheric methane lifetime, estimated methane lifetime with respect to soil uptake (for consistency with O'Connor et al., 2021, and previous publications on the methane feedback factor), and the methane feedback factor f .

Config.	Burden / $\text{Tg}(\text{CH}_4)$	τ wrt OH / yrs	τ wrt strat / yrs	τ wrt soil / yrs	f
Conc-driven	2211.3/5018.1	9.19/11.56	120/120	160/160	1.32
Ems-driven	2256.7/4084.0	8.99/10.45	120/120	160/160	1.28

Supplementary Figures

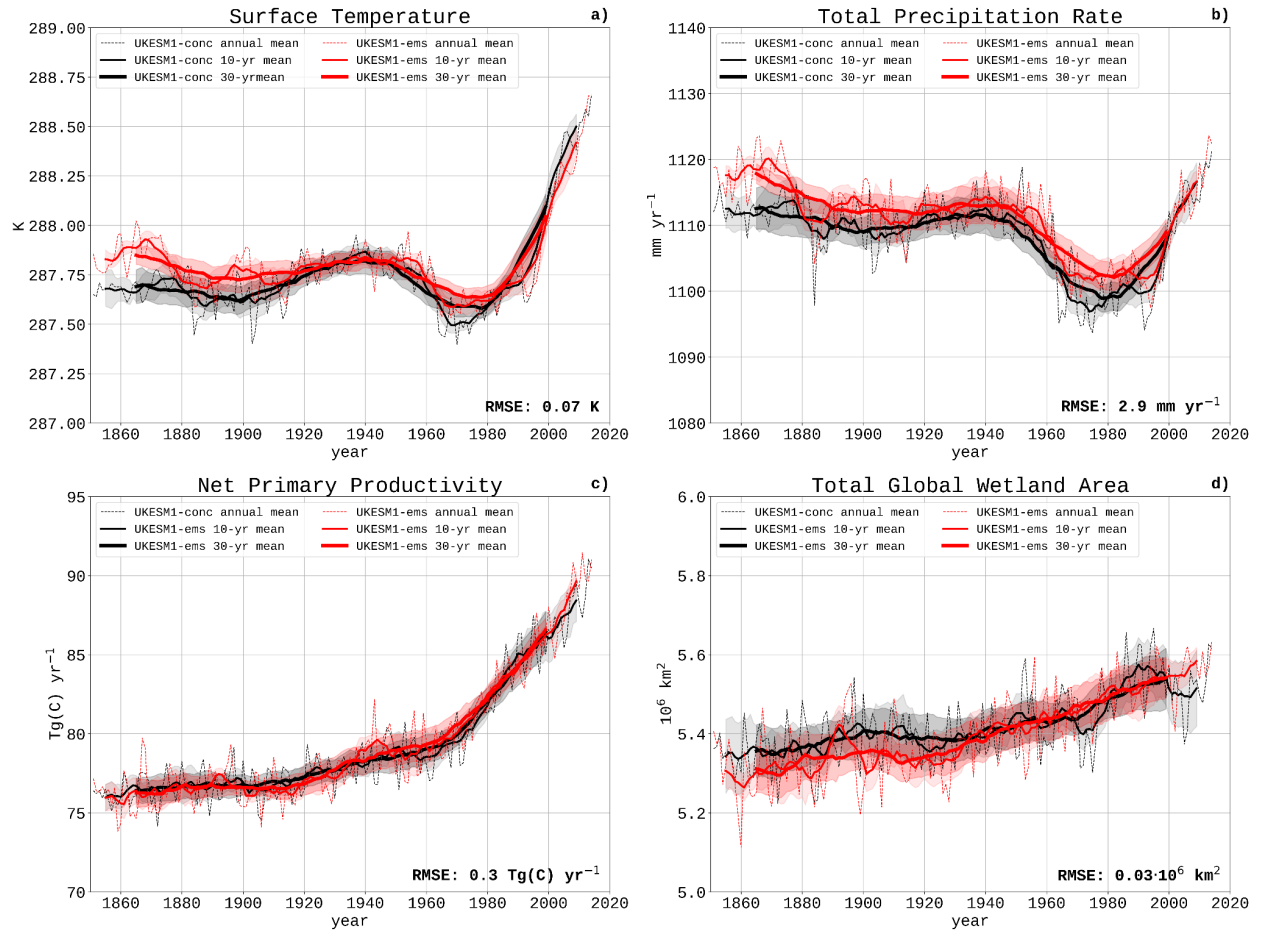


Figure S1: Comparison of primary climate metrics and key land-surface drivers between UKESM1-ems (red) and UKESM1-conc (black). Shown are annual mean (dotted), decadal mean (dashed) and 30-year mean (solid) time series for a) surface temperature, b) total precipitation rate, c) net primary productivity (NPP) and d) total global wetland area (in million square kilometers). Root mean squared errors are calculated from the 30-year mean time series in each case and denote the deviation of UKESM1-ems from the UKESM1-conc reference.

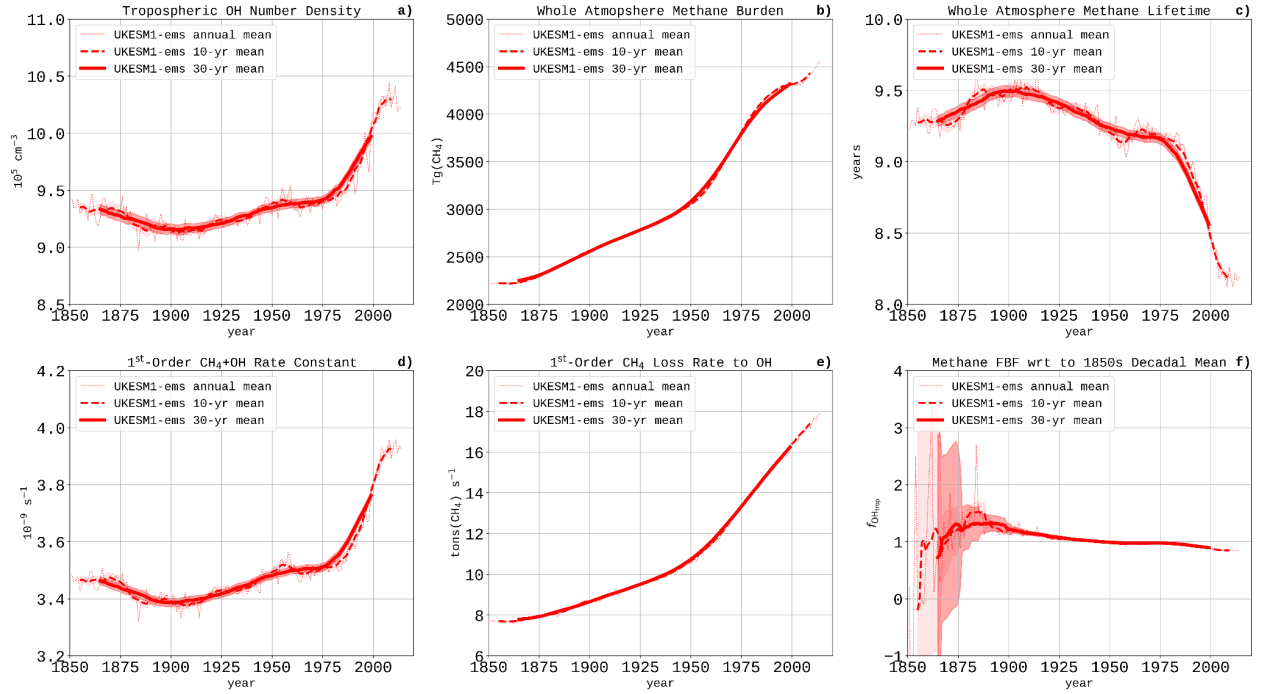


Figure S2: Trends in OH, methane burden, lifetime, and the transient feedback factor over the historic period 1850-2015. **a** Whole-atmosphere methane burden. **b** Tropospheric OH number density. **c** Whole-atmosphere methane lifetime defined as whole-atmosphere methane burden divided by the total global annual tropospheric methane loss through reaction with OH. **d** First order rate constant for atmospheric methane loss through reaction with OH in the troposphere (equivalent to the inverse of the whole-atmosphere lifetime). **e** First order methane loss rate to OH, calculated as the product of whole-atmosphere methane burden (**a**) with the first order rate constant for atmospheric methane loss (**d**). **f** Transient methane feedback factor with respect to the pre-industrial (1851-1860 decadal mean). All time series shown here are ensemble means. Results are plotted as trends in the annual mean (dotted), decadal mean (dashed) and 30-year mean (solid) time series. Envelopes indicate one standard deviation in the 10-year (light shading) and 30-year mean (dense shading) rolling means.

Supplementary Table and Figure Captions

Table Captions

- 1 Methane feedback factor in UKESM1-conc and UKESM-ems.**
Listed are the variables used in the calculation of the methane feedback factor f , including the whole-atmosphere methane burden, the methane atmospheric lifetime with respect to reaction with OH (whole-atmosphere $\text{CH}_4 + \text{OH}$ rxn-flux), estimated stratospheric methane lifetime, estimated methane lifetime with respect to soil uptake (for consistency with O'Connor et al., 2021, and previous publications on the methane feedback factor), and the methane feedback factor f p. 1

Figure Captions

- 1 Comparison of primary climate metrics and key land-surface drivers between UKESM1-ems (red) and UKESM1-conc (black).**
Shown are annual mean (dotted), decadal mean (dashed) and 30-year mean (solid) time series for a) surface temperature, b) total precipitation rate, c) net primary productivity (NPP) and d) total global wetland area (in million square kilometers). Root mean squared errors are calculated from the 30-year mean time series in each case and denote the deviation of UKESM1-ems from the UKESM1-conc reference. p. 2
- 2 Trends in OH, methane burden, lifetime, and the transient feedback factor over the historic period 1850-2015. a** Whole-atmosphere methane burden. **b** Tropospheric OH number density. **c** Whole-atmosphere methane lifetime defined as whole-atmosphere methane burden divided by the total global annual tropospheric methane loss through reaction with OH. **d** First order rate constant for atmospheric methane loss through reaction with OH in the troposphere (equivalent to the inverse of the whole-atmosphere lifetime). **e** First order methane loss rate to OH, calculated as the product of whole-atmosphere methane burden (**a**) with the first order rate constant for atmospheric methane loss (**d**). **f** Transient methane feedback factor with respect to the pre-industrial (1851-1860 decadal mean). All six time series shown here are ensemble means. Results are plotted as trends in the annual mean (dotted), decadal mean (dashed) and 30-year mean (solid) time series. Envelopes indicate one standard deviation in the 10-year (light shading) and 30-year mean (dense shading) rolling means. p. 3