Supplement of Adv. Stat. Clim. Meteorol. Oceanogr., 6, 205–221, 2020
https://doi.org/10.5194/ascmo-6-205-2020-supplement

ASCMO
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Supplement of

Nonstationary extreme value analysis for event attribution combining climate models and observations

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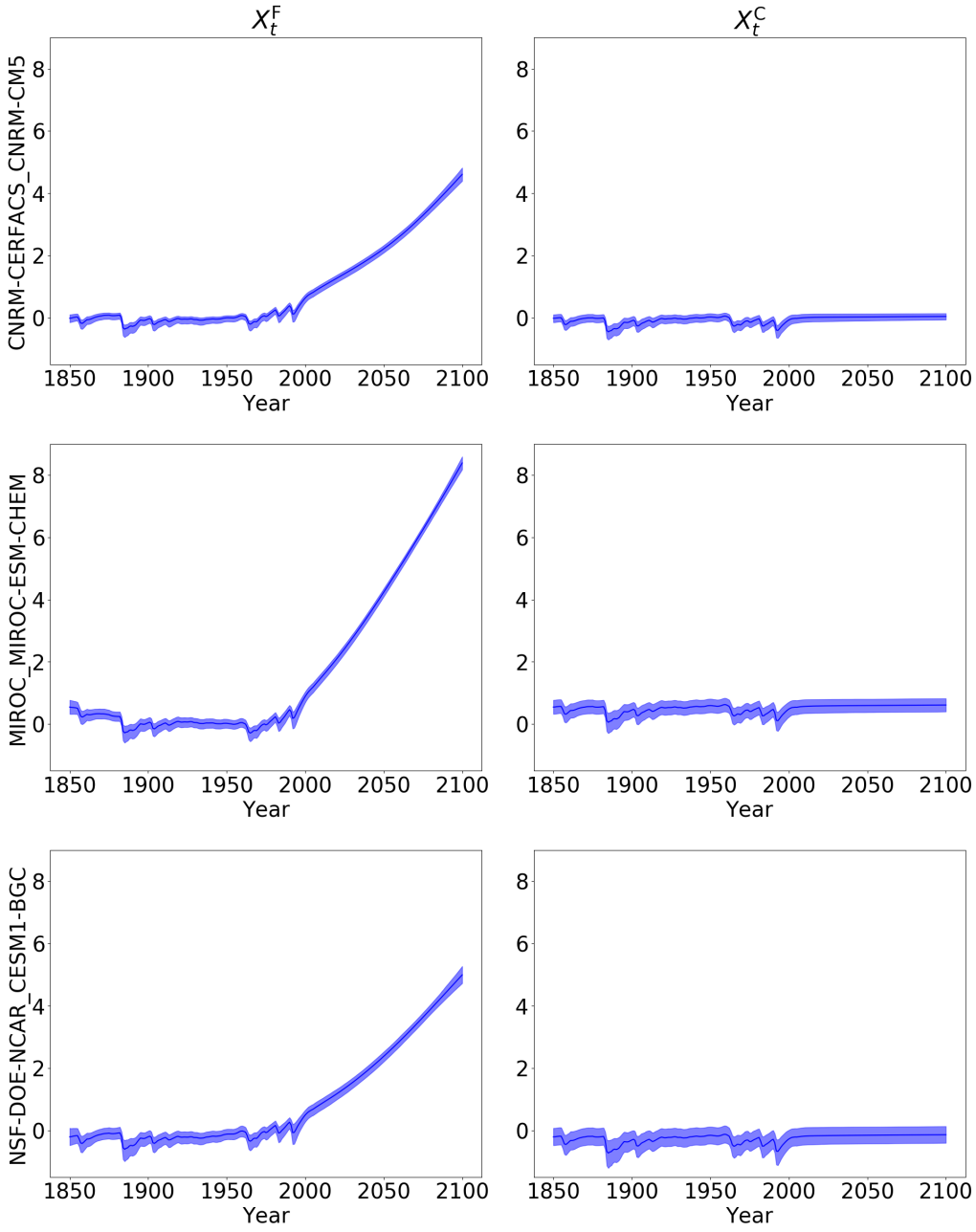

Figure S1. Exemple of covariates X_t^{F} (left column) and X_t^{C} (right column) for three models representing the external forcing in factual and counter factual world, respectively, and their uncertainty. These covariates have been estimated with a GAM decomposition.

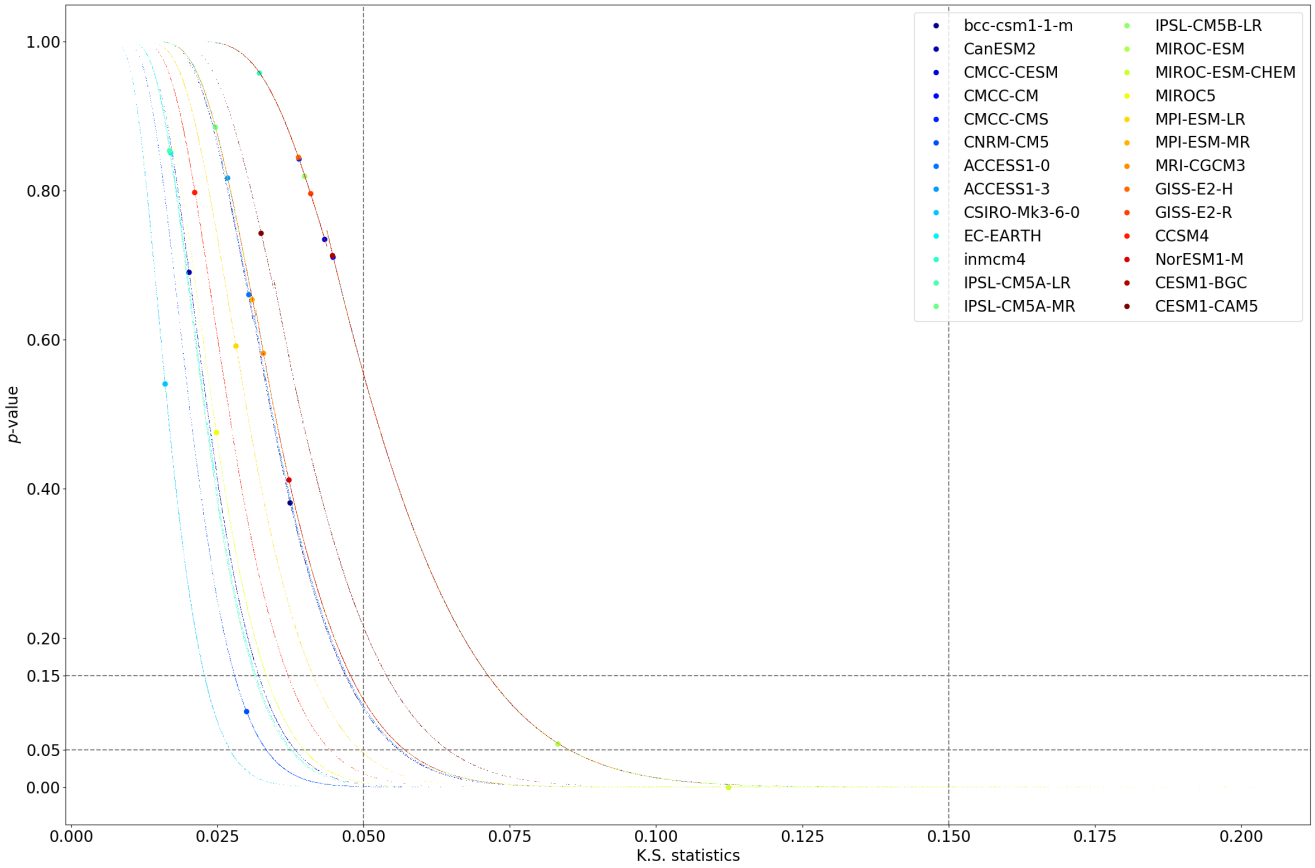

Figure S2. Goodness of fit of the model $\mathcal{M}_{\mu,\sigma}$. The Kolmogorov-Smirnov (K.S.) test is performed between the model $\mathcal{M}_{\mu,\sigma}$ with the parameters estimated (for the best estimate - the big point - and each re-sample) and the $T_{\max}$ time series for each CMIP models. The x axis is the K.S. statistics, i.e. the maximal difference between the Cumulative Distribution Function (C.D.F.) of $\mathcal{M}_{\mu,\sigma}$ and the empirical C.D.F. of $T_{\max}$. The y-axis is the p-values. The vertical and horizontal dotted grey lines are the confidence level at 95% and 85%, respectively. The model is considered as good if the p-value is high (higher than grey lines) or if the K.S. statistics are small (i.e. lower than the grey lines). Both these cases are summarized in Tab. S1.

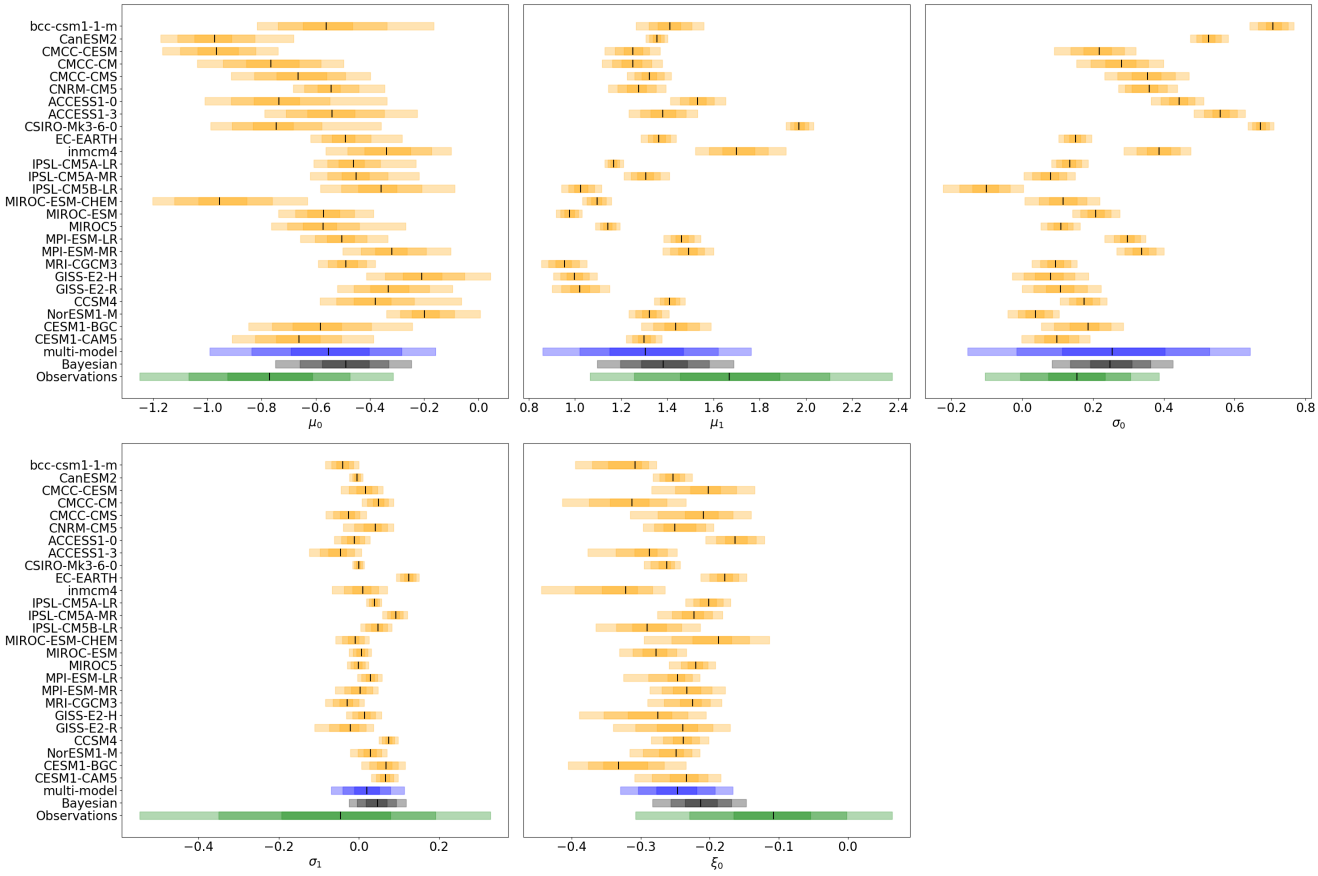

Figure S3. GEV distribution parameters μ_0, μ_1, σ_0, σ_1 and ξ_0 of the model $\mathcal{M}_{\mu,\sigma}$ estimated for each CMIP models (orange), for the multi-model synthesis (blue), after applying the Bayesian constraint (black) and from observations (green). The color gradient represents the quantiles 0.025, 0.1, 0.25, 0.75, 0.9 and 0.975. The vertical black line is the best estimate (the median for the Bayesian constraint).

CMIP5 models	95%	85%
bcc-csm1-1-m	0.89	1.0
CanESM2	1.00	1.0
CMCC-CESM	0.94	1.0
CMCC-CM	0.93	1.0
CMCC-CMS	0.95	1.0
CNRM-CM5	0.96	1.0
ACCESS1-0	0.93	1.0
ACCESS1-3	0.97	1.0
CSIRO-Mk3-6-0	1.0	1.0
EC-EARTH	1.00	1.0
inmcm4	0.97	1.0
IPSL-CM5A-LR	1.00	1.0
IPSL-CM5A-MR	0.97	1.0
IPSL-CM5B-LR	0.93	1.0
MIROC-ESM	0.55	1.00
MIROC-ESM-CHEM	5×10^{-2}	0.88
MIROC5	0.99	1.0
MPI-ESM-LR	0.96	1.0
MPI-ESM-MR	0.93	1.0
MRI-CGCM3	0.96	1.0
GISS-E2-H	0.96	1.0
GISS-E2-R	0.94	1.0
CCSM4	0.99	1.0
NorESM1-M	0.93	1.0
CESM1-BGC	0.97	1.0
CESM1-CAM5	0.92	1.0

Table S1. Goodness of fit of the model $\mathcal{M}_{\mu,\sigma}$. The first (resp. second) column is the percentage of re-sample such that the p-values is greater than 0.05 (resp. 0.15) or the K.S. statistics is lower than 0.05 (resp. 0.15). See Fig. S1.