Supplementary information

Data and code availability

All simulation data have been made publicly-available through a Water Cycle Integrator portal (WCI) at https://wci.eartH2Observe.eu/. Requests for further data are very welcome and may be addressed to the corresponding author.

Global maps were calculated for sections of the globe using a custom script written in Python v.2.7.5 and then knitted together using NetCDF Operators (NCO) Tools (Zender, 2008) called from a custom script written in R v.3.5.1 (R Core Team, 2018) (scripts are available on request from the corresponding author). Visualisations were created using Panoply v.4.4.1 and R v.3.5.1 (R Core Team, 2018).

Uncertainty maps

Absolute uncertainty numbers may not be comparable between this study and other simulations, but our results give a first estimate of the relative uncertainties of predictions from particular models and precipitation products of evapotranspiration highs (Fig. S1), evapotranspiration lows (Fig. S2), runoff highs (Fig. S3) and runoff lows (Fig. S4).

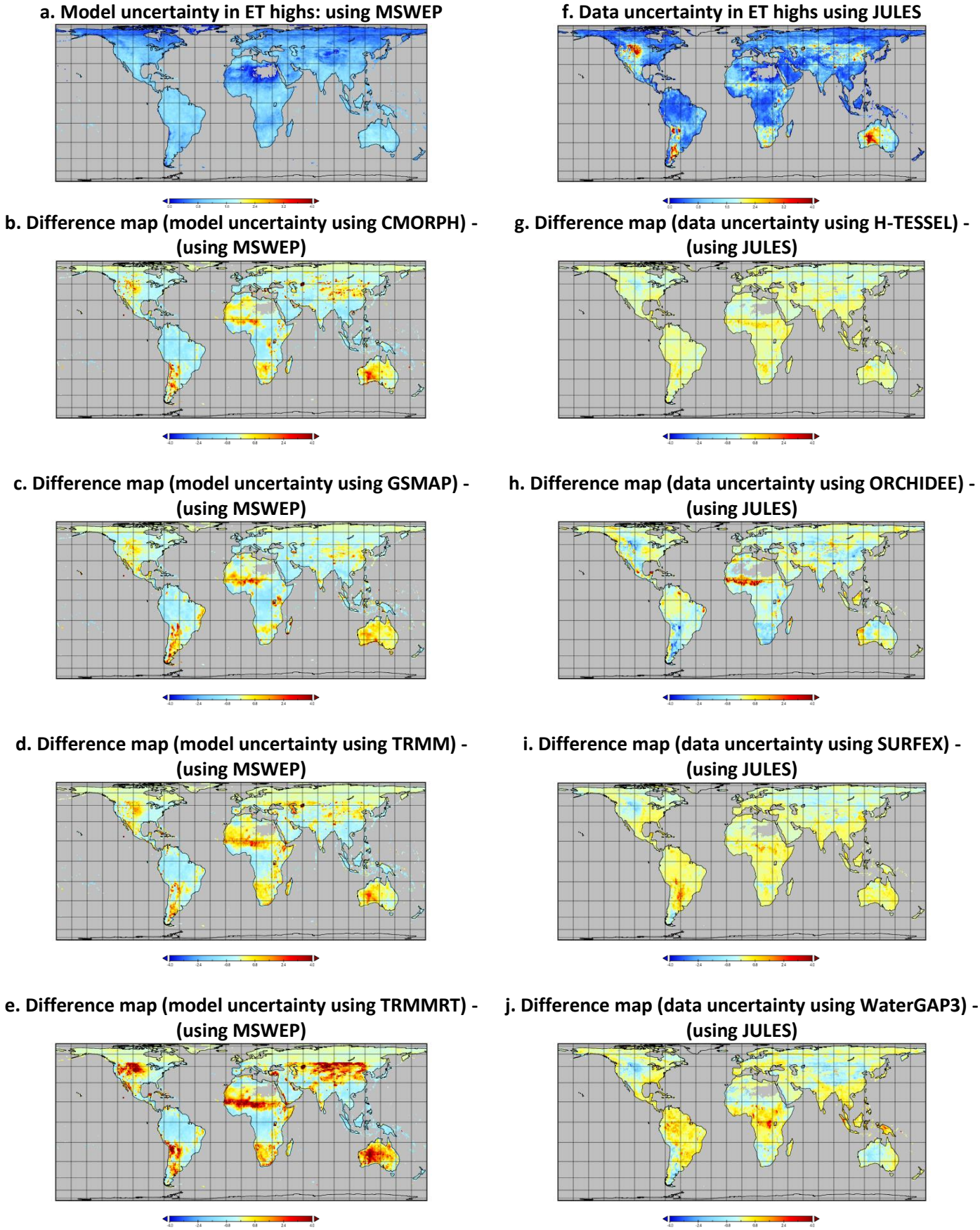

Fig. S1: Evapotranspiration (ET) highs. Note the differing scales: plots in top row scale ranges 0.0-4.0 extreme events per year (EE/yr) while the remaining rows ranging -4.0 to 4.0 EE/yr.

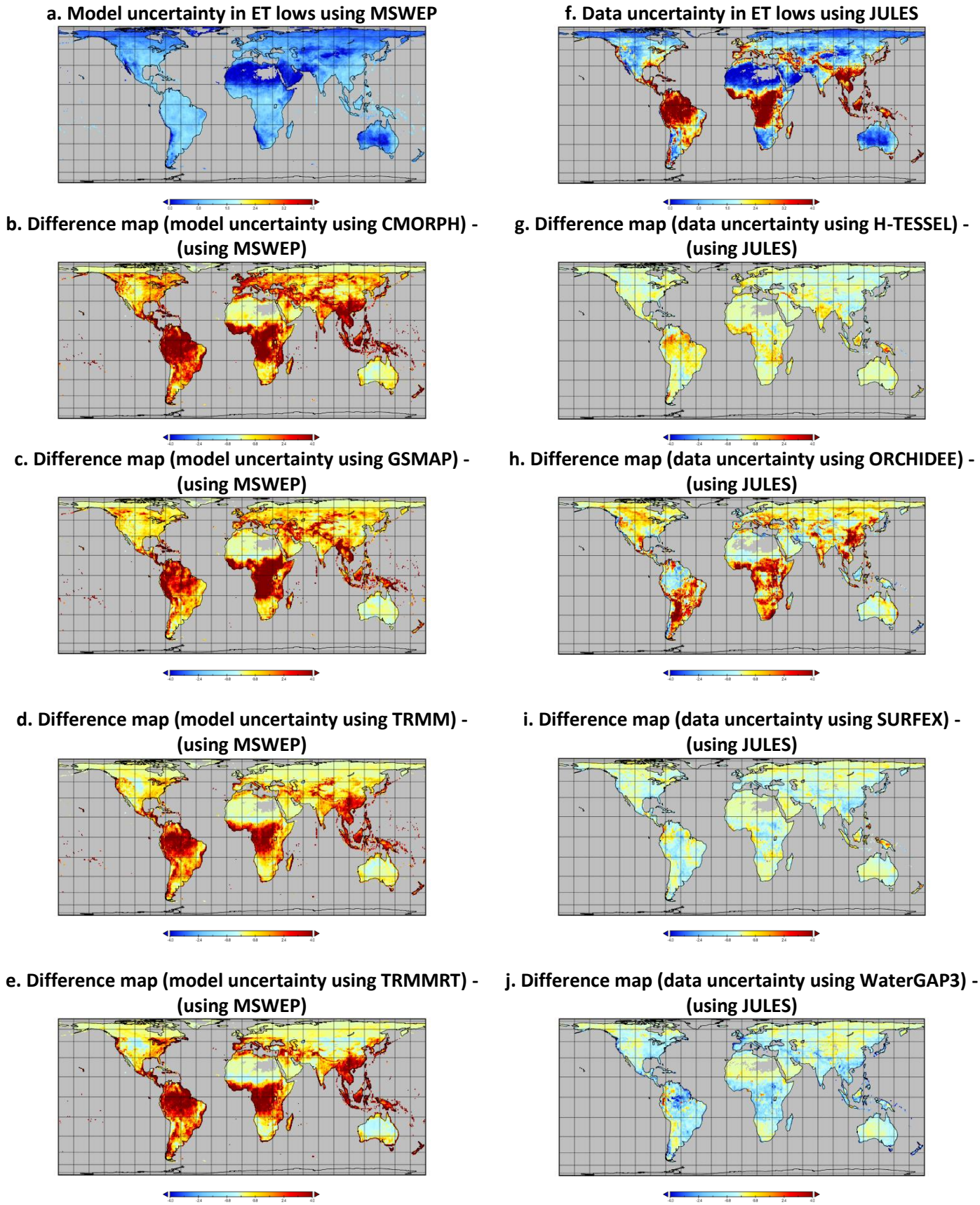

Fig. S2: Evapotranspiration (ET) lows. Note the differing scales: plots in top row scale ranges 0.0-4.0 extreme events per year (EE/yr) while the remaining rows ranging -4.0 to 4.0 EE/yr.

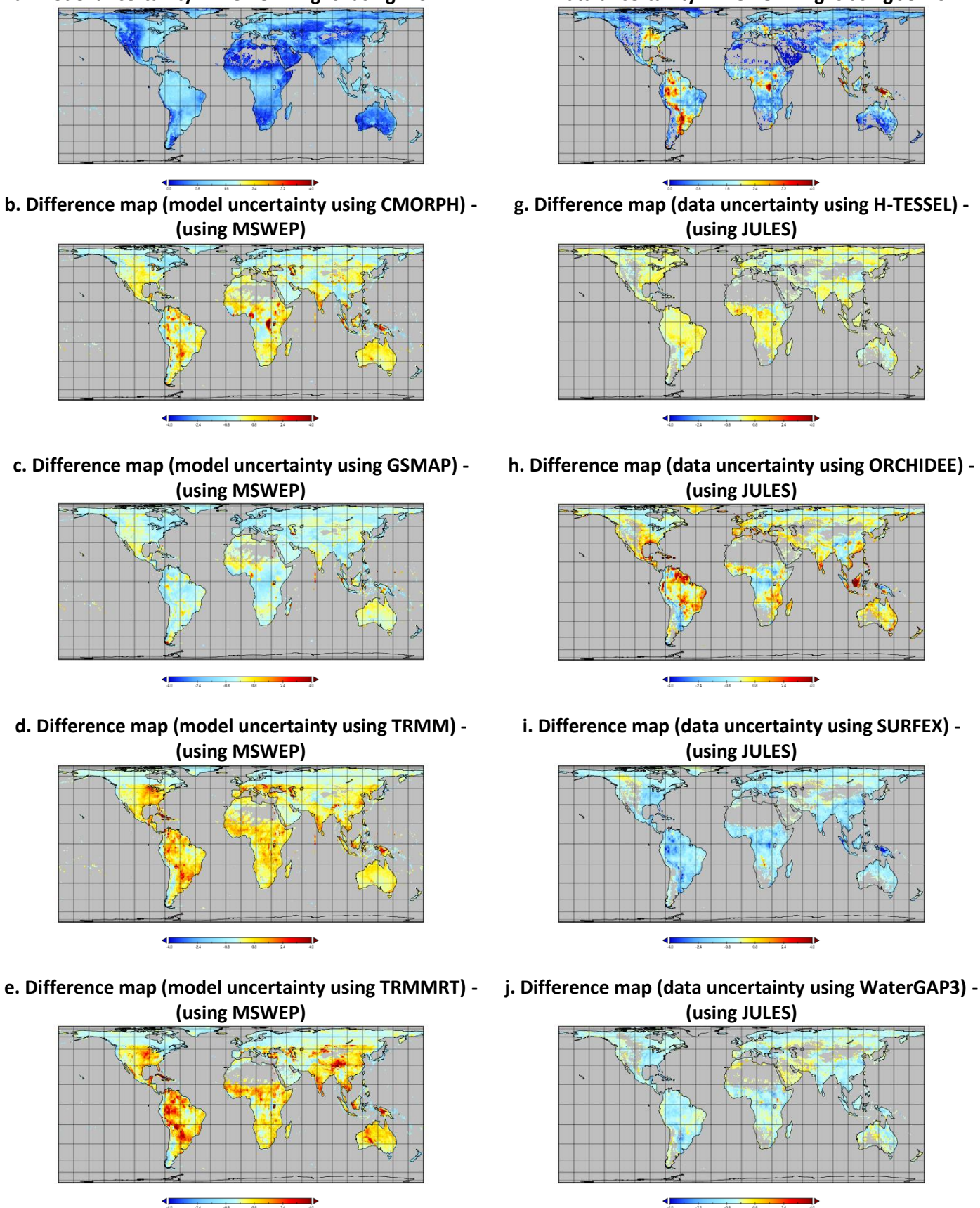

Fig. S3: Runoff highs. Note the differing scales: plots in top row scale ranges 0.0-4.0 extreme events per year (EE/yr) while the remaining rows ranging -4.0 to 4.0 EE/yr.

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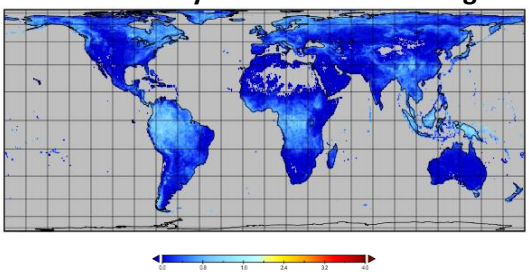
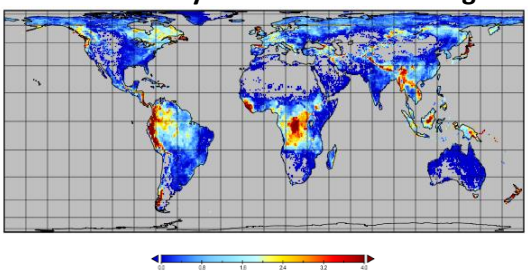
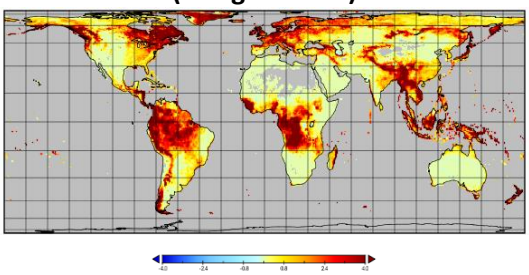
a. Model uncertainty in RUNOFF lows using MSWEP



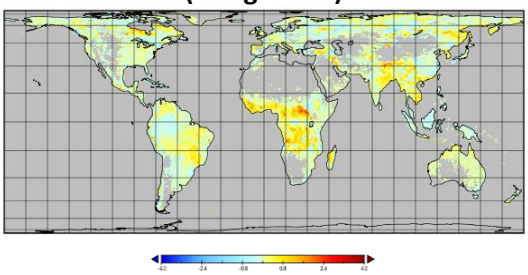
f. Data uncertainty in RUNOFF lows using JULES



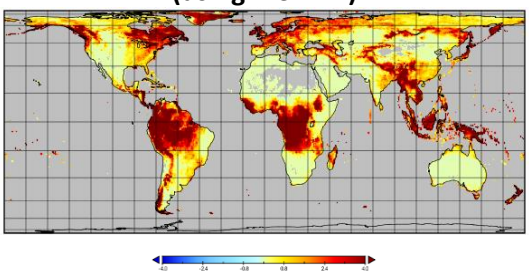
b. Difference map (model uncertainty using CMORPH) - (using MSWEP)



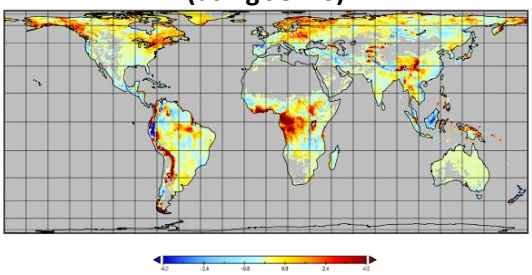
g. Difference map (data uncertainty using H-TESSEL) - (using JULES)



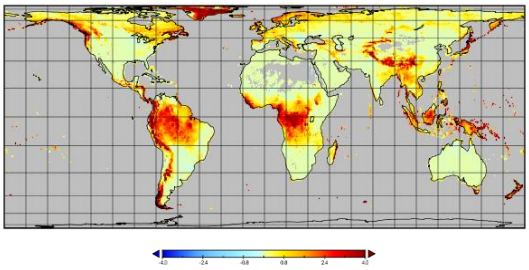
c. Difference map (model uncertainty using GSMAP) - (using MSWEP)



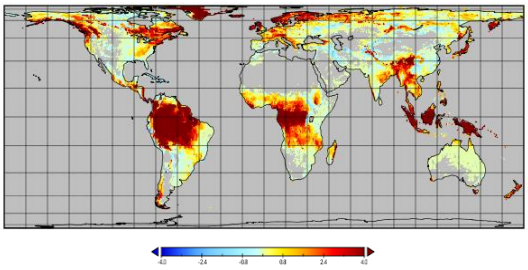
h. Difference map (data uncertainty using ORCHIDEE) - (using JULES)



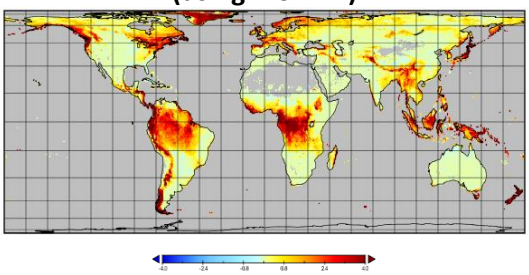
d. Difference map (model uncertainty using TRMM) - (using MSWEP)



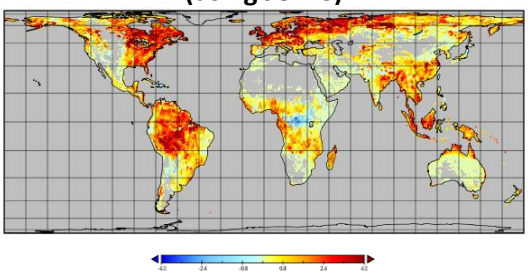
i. Difference map (data uncertainty using SURFEX) - (using JULES)



e. Difference map (model uncertainty using TRMMRT) - (using MSWEP)



j. Difference map (data uncertainty using WaterGAP3) - (using JULES)



34 **Fig. S4**: Runoff lows. Note the differing scales: plots in top row scale ranges 0.0-4.0 extreme events per
35 year (EE/yr) while the remaining rows ranging -4.0 to 4.0 EE/yr.
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