water MDPI

SUPPLEMENTARY INFORMATION

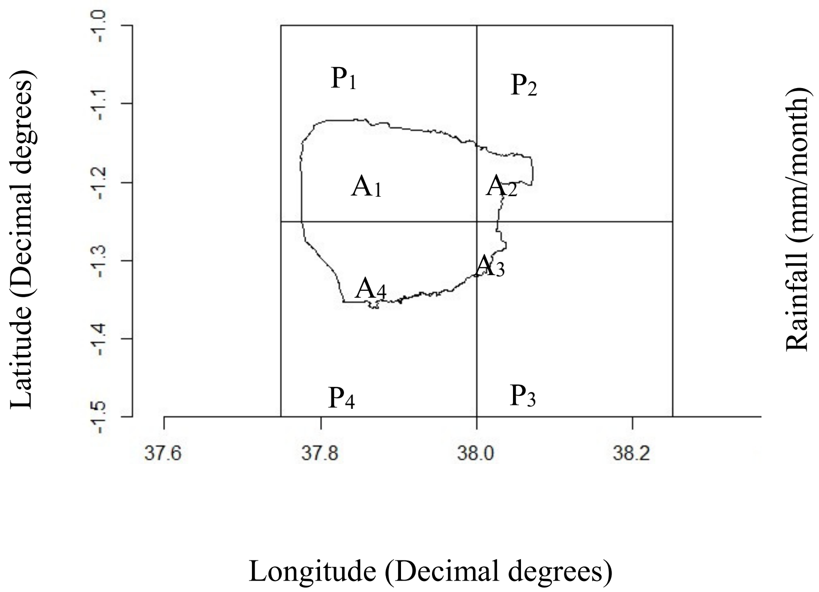


Figure S1. Illustration of the areal weighting approach. P_1 to P_4 represent rainfall in the four grid cells in this example that make up the case study area, while A_1 to A_4 represent the areas of the case study area (Kitui West, thin outline; -1.120123 N, 1.360901 S, 38.072226 E and 37.773460 W), overlapping with the respective grid cells.

$$A = A_1 + A_2 + A_3 + A_4 + \ldots + A_n$$
$$f_1 = \frac{A_1}{A}; f_2 = \frac{A_2}{A}; f_3 = \frac{A_3}{A}; f_4 = \frac{A_4}{A}; \ldots; f_n = \frac{A_n}{A} \qquad \text{(S1)}$$
$$P_t = f_1.P_1 + f_2.P_2 + f_3.P_3 + f_4.P_4 + \cdots + f_n.P_n$$

Equation $A = A_1 + A_2 + A_3 + A_4 + \ldots + A_n$ $f_1 = \frac{A_1}{A}; f_2 = \frac{A_2}{A}; f_3 = \frac{A_3}{A}; f_4 = \frac{A_4}{A}; \ldots; f_n = \frac{A_n}{A}$ $P_t = f_1.P_1 + f_2.P_2 + f_3.P_3 + f_4.P_4 + \cdots + f_n.\ Pn$ (S1 elaborates the steps used in the weighting illustrated in **Error! Reference source not found.**. A represents the total shape file area, $f_1 \ldots f_n$ are the proportions of the shapefile that belong to each grid cell, $P_1 \ldots P_4$ are the grid-level rainfall values, and P_t is the total, area-weighted rainfall. The same scheme applies to the maximum (*Tmax*) or minimum temperature (*Tmin*) data.

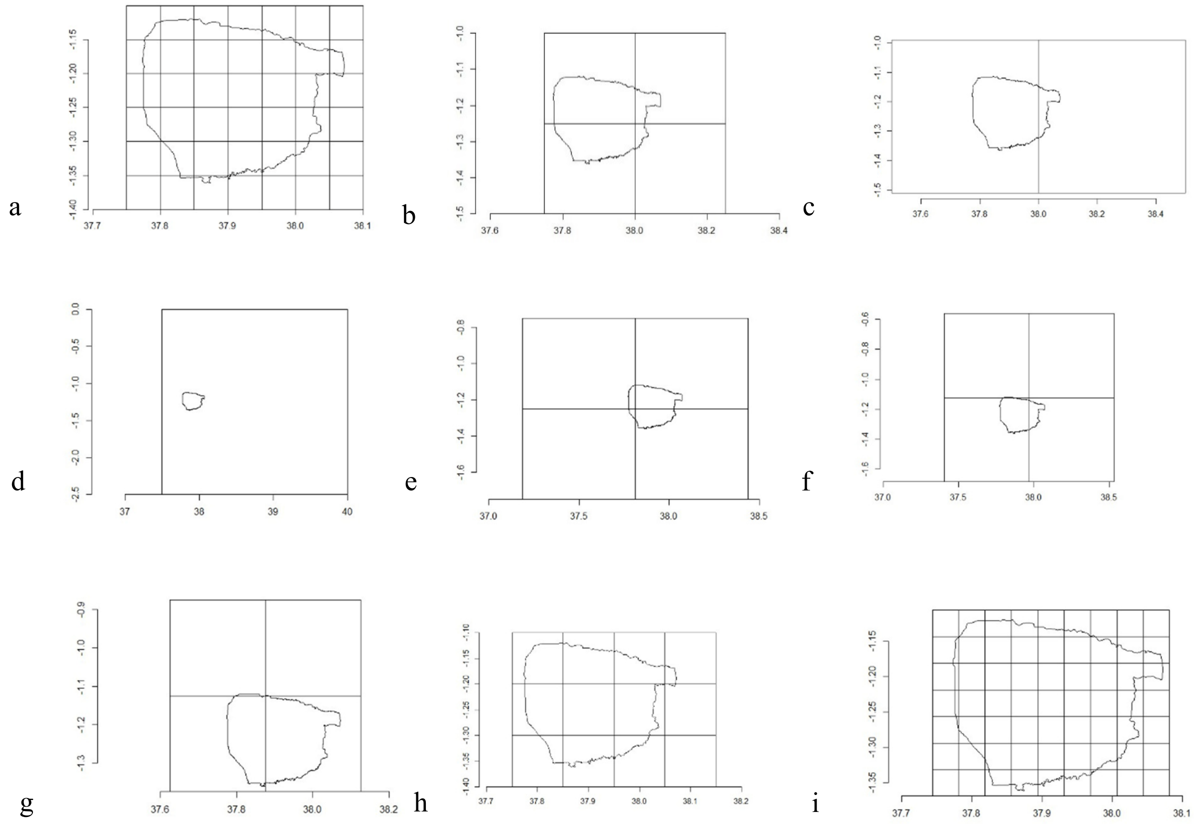
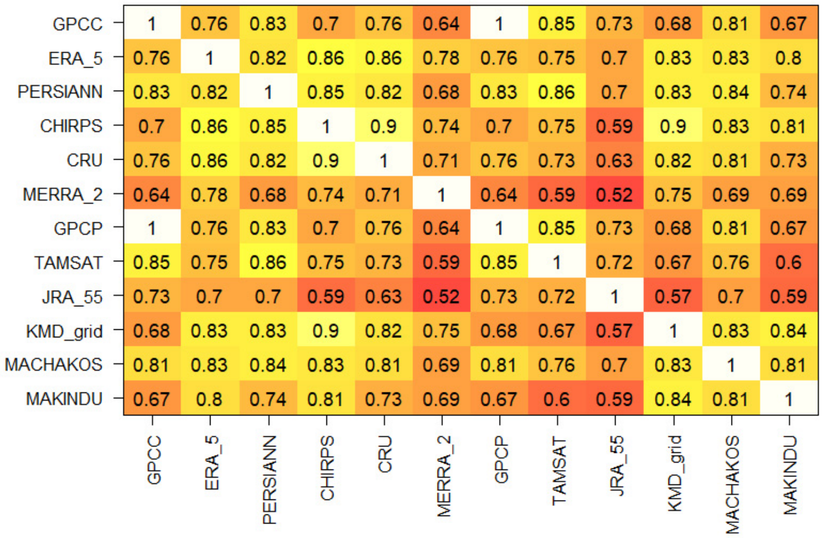


Figure S2. Various grid resolutions of the data products used and their contribution to the areal average over the study area shape file: (a) CHIRPS 2.0, (b) GPCC 2018, (c) CRU TS 4.03, (d) GPCP 2.03, (e) MERRA-2, (f) JRA-55, (g) PERSIANN-CDR, (h) ERA5, (i) TAMSAT 3.1.

a



b

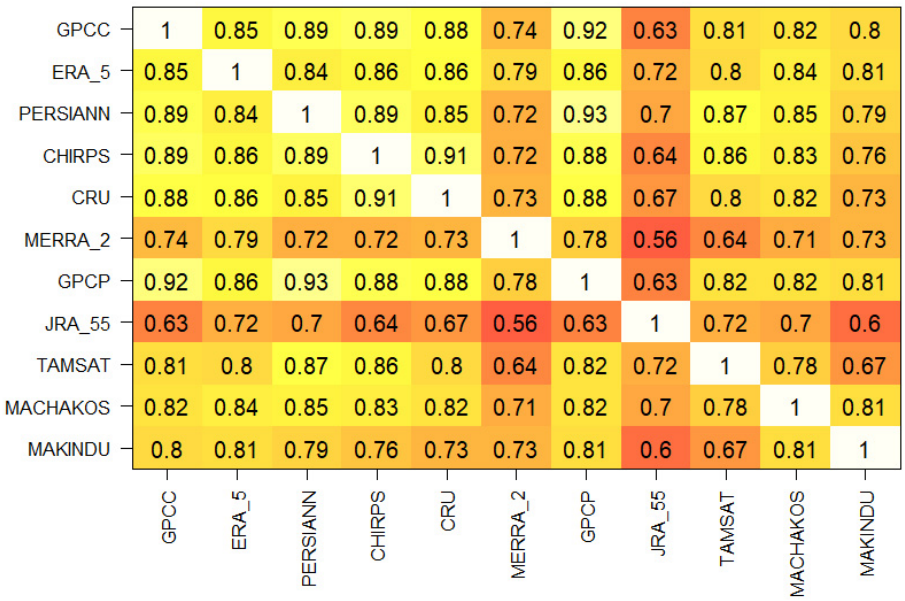


Figure S3. Correlation matrices between the (a) unweighted and (b) weighted gridded rainfall products and the two ground-stations Makindu and Machakos.

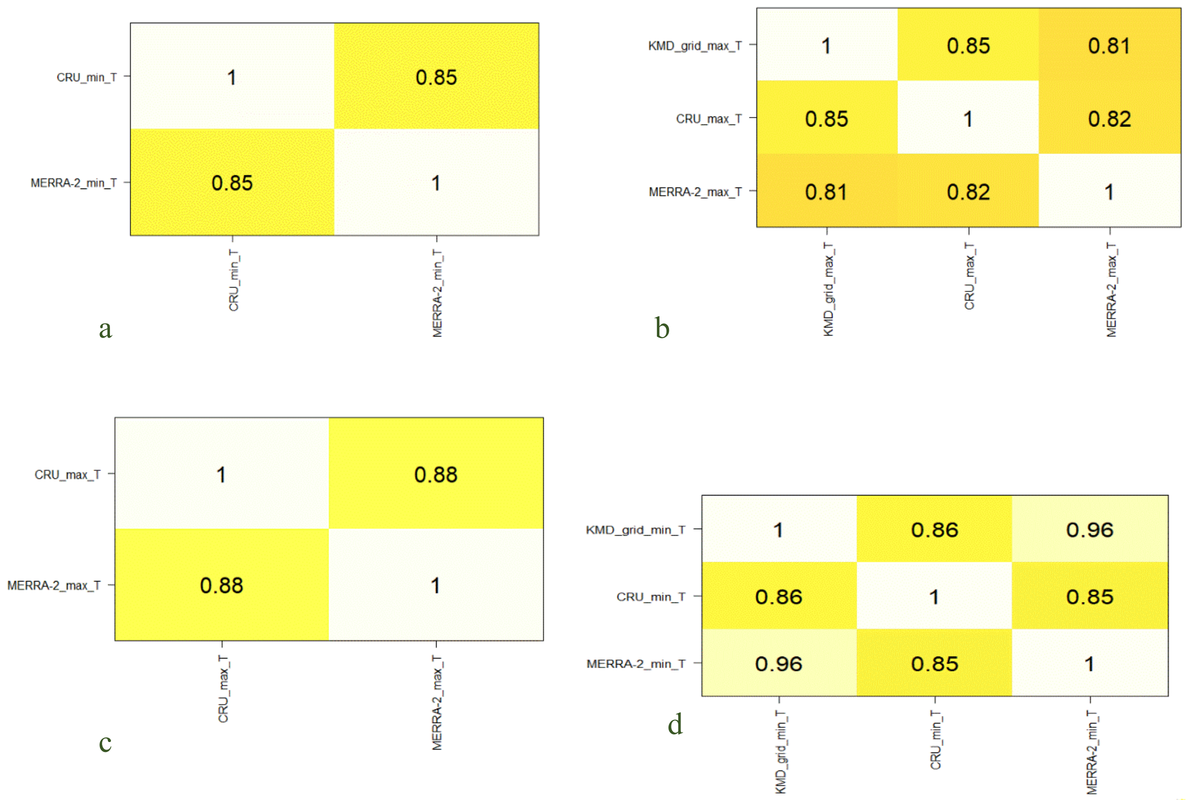


Figure S4. Max (b and c) and min (a and d) temperature correlations between the (b and d) unweighted and (a and c) weighted gridded products. The KMD data were received in an already averaged form, which includes some form of weighting, even if here shown together with the unweighted products.

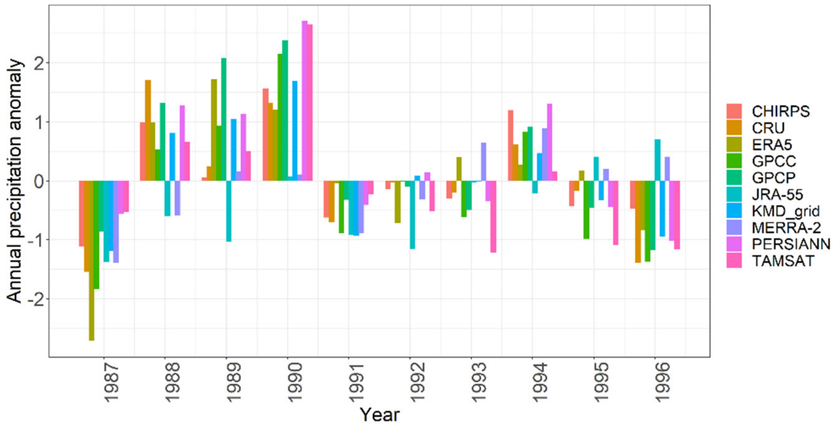
Table S1. Maximum and minimum temperature statistics of the gridded products.

Gridded product	Mean(°C)	Coefficient of variation (CV) (%)
KMD_grid Tmin	18.6	1.7
KMD_grid Tmax	30.8	2.1
CRU Tmin	16.5	1.9
CRU Tmax	28.4	1.0
MERRA-2 Tmin	17.2	1.9
MERRA-2 Tmax	31.0	1.7
JRA-55 Tmin	17.9	1.3
JRA-55 Tmax	29.5	1.7

Table S2. Annual and seasonal rainfall statistics for the gridded products. MAM is the rainfall season March-April-May and OND is the rainfall season October-November-December.

Gridded product	Annual mean (mm)	MAM mean (mm)	OND mean (mm)	Annual coefficient of variation (CV) (%)	MAM coefficient of variation (CV) (%)	OND coefficient of variation (CV) (%)
GPCC	854	303	454	32	47	42
ERA5	827	300	375	23	32	32
PERSIANN	530	212	245	38	46	55
CHIRPS	750	283	412	30	32	46
CRU	864	323	419	25	30	40
MERRA-2	659	207	289	26	30	46
GPCP	540	192	264	37	42	52
TAMSAT	672	316	295	37	40	62
JRA-55	377	175	131	31	41	57
KMD_grid	489	153	287	39	50	47

a



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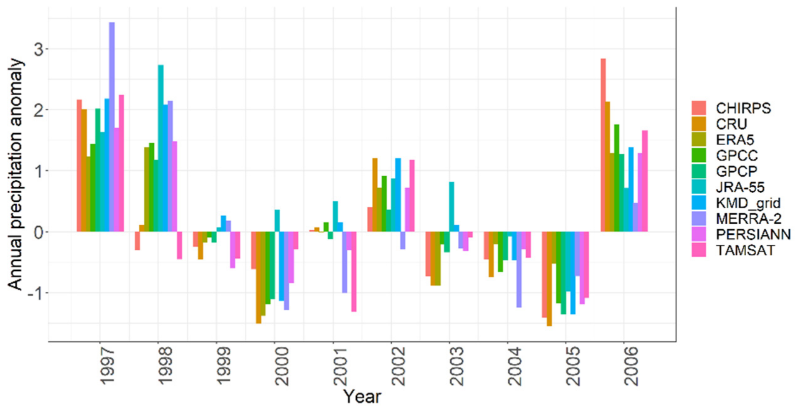

c

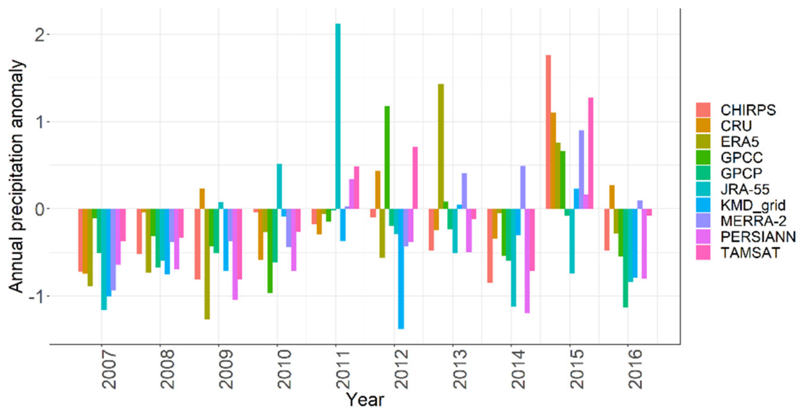

Figure S5. Rainfall anomalies Zoomed in at the respective decades in the study period, 1987-2016; (a) 1987-1996 (b) 1997-2006 and (c) 2007-2016.

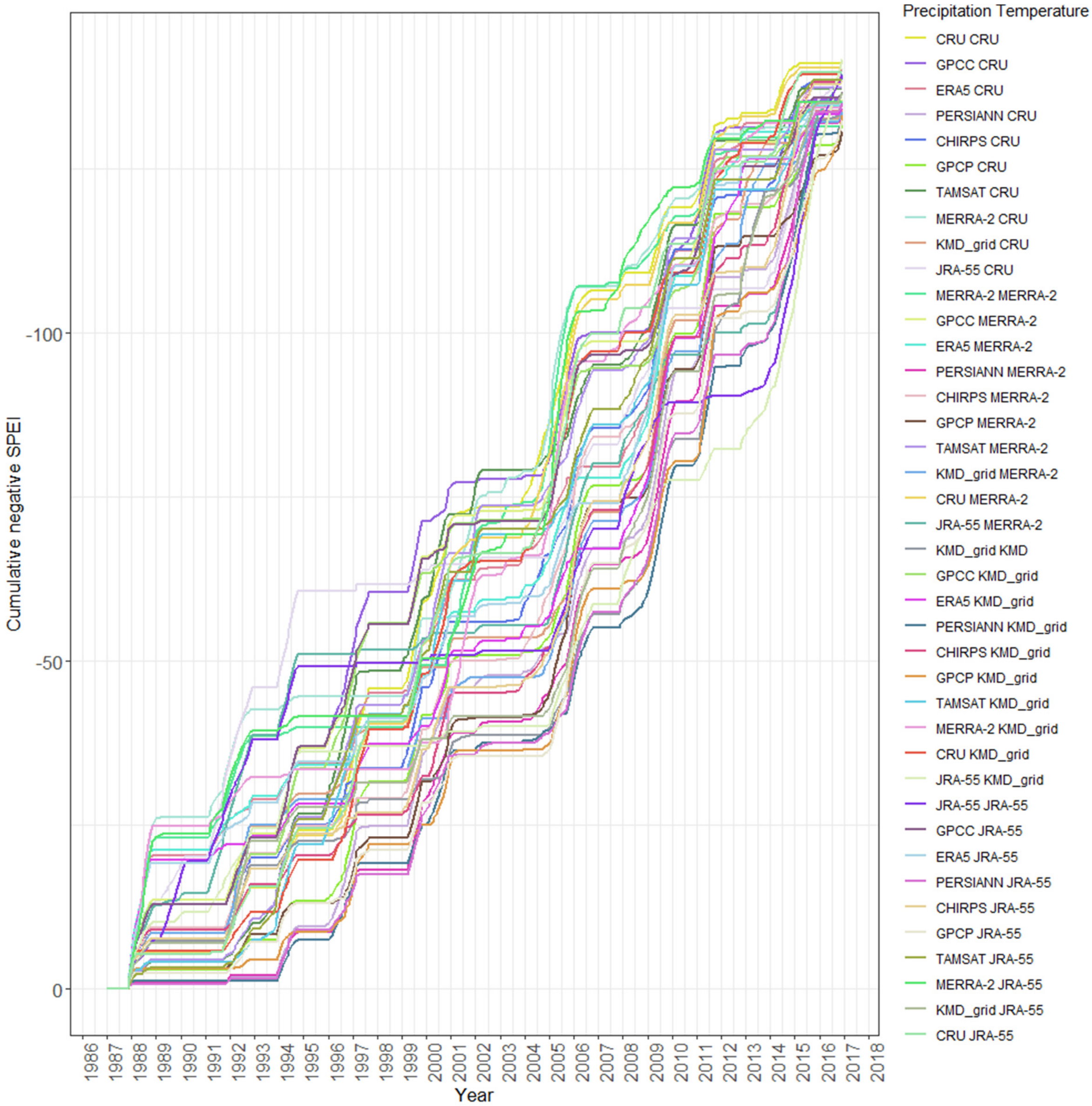

Figure S6. Cumulative negative SPEI (dry conditions) for all 40 product blends. Rising sections indicate droughts with steeper rises indicating greater magnitudes. Differences in onset and duration can also be discerned

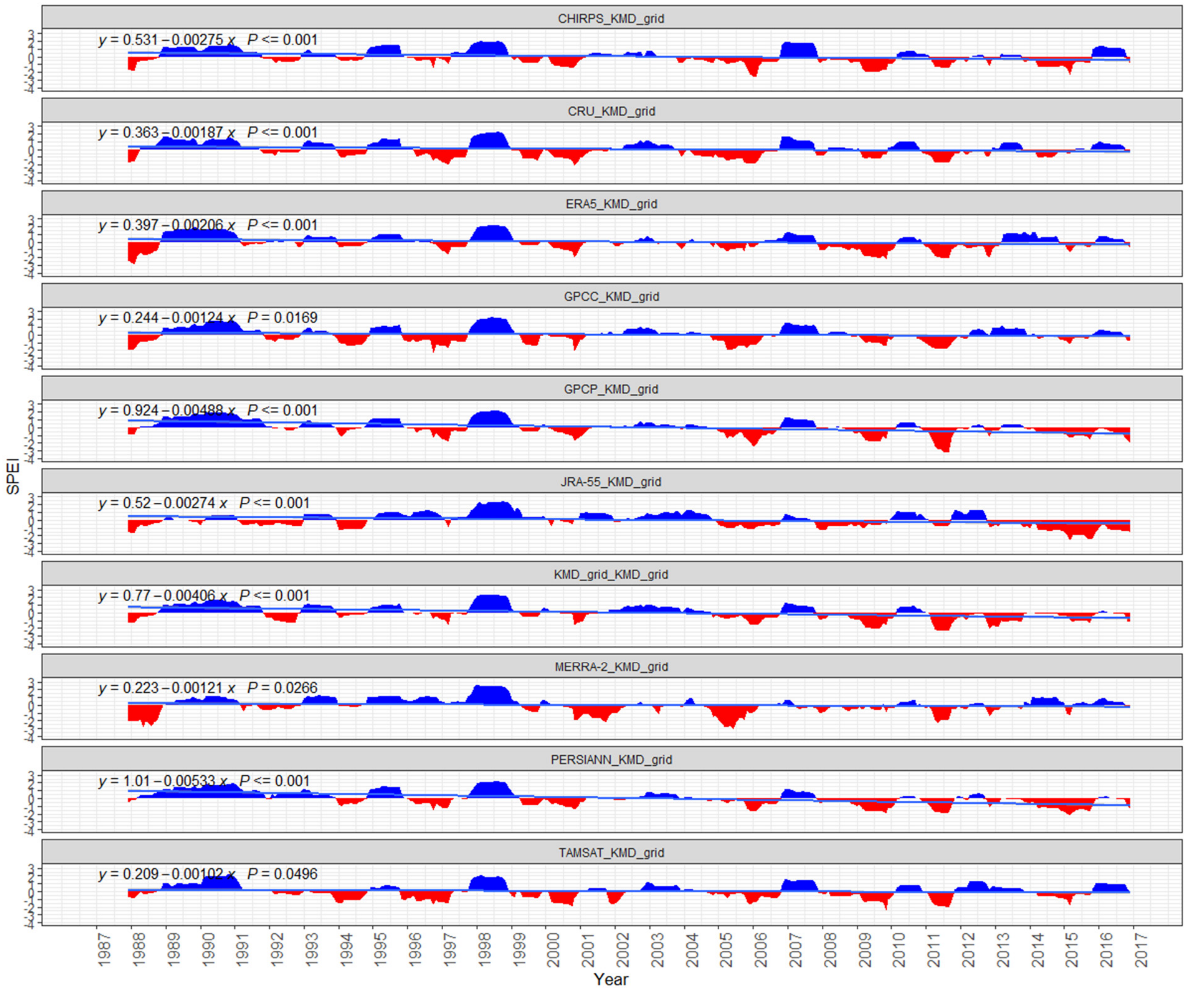

Figure S7. SPEI outputs using KMD_grid Tmax/Tmin with the 10 rainfall products, with linear trend superimposed.

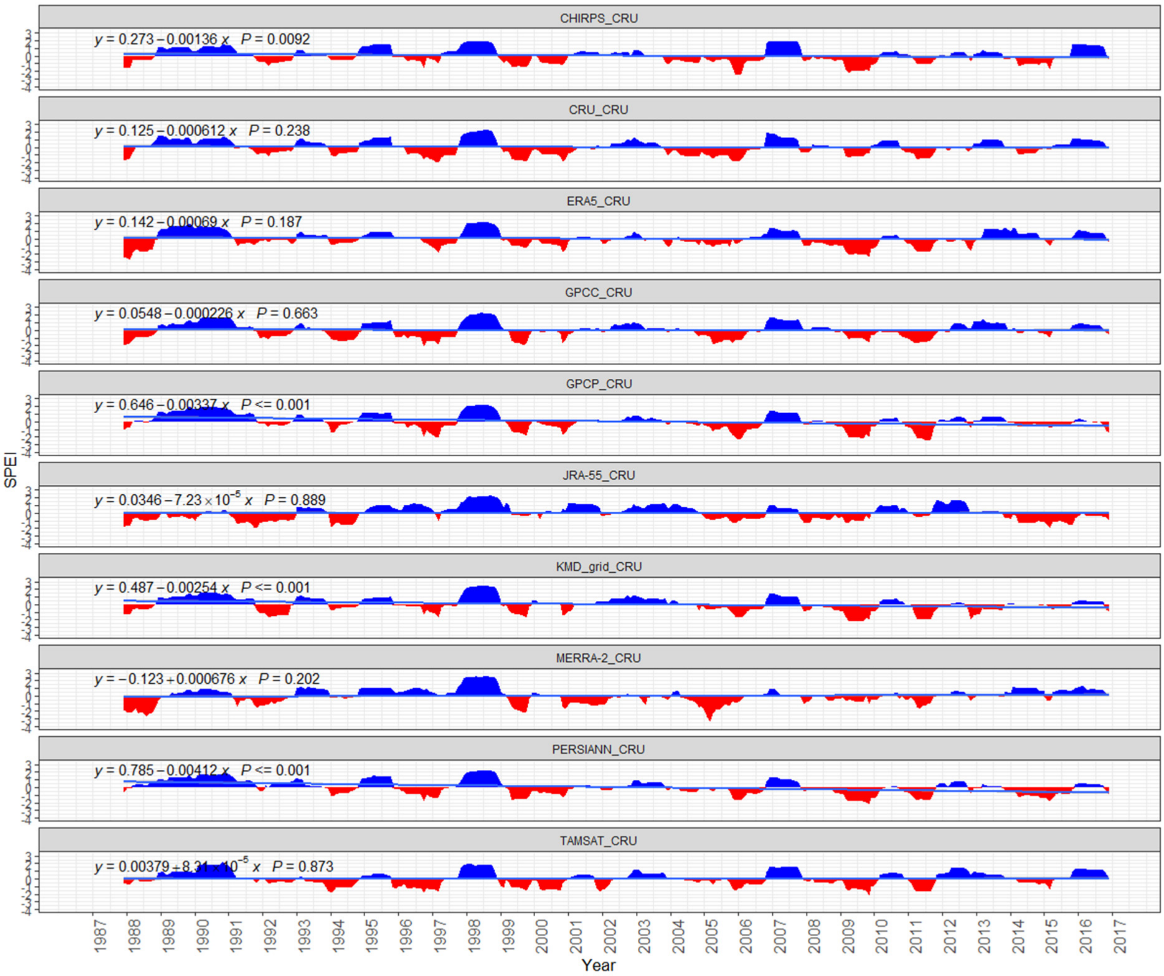

Figure S8. SPEI outputs using CRU Tmax/Tmin with the 10 rainfall products, with linear trend superimposed.

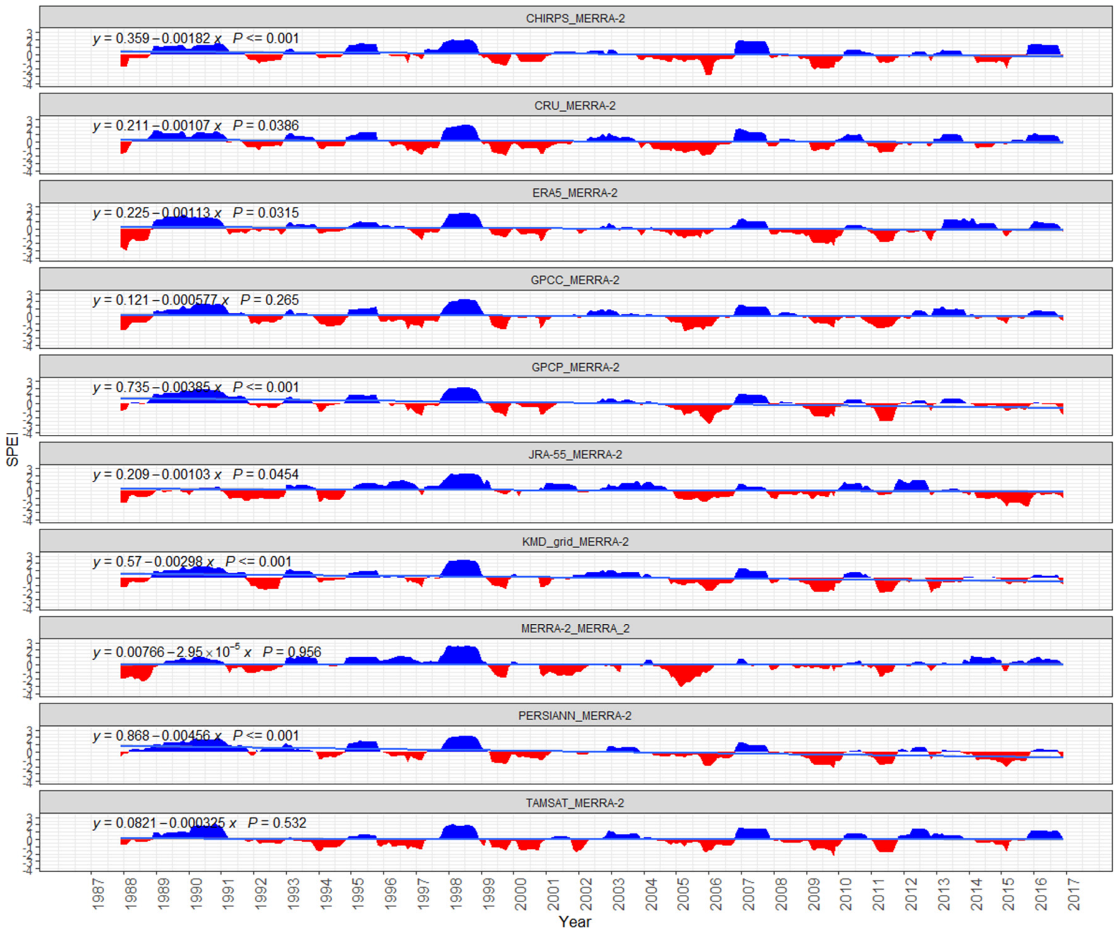

Figure S9. *SPEI outputs using MERRA-2 Tmax/Tmin with the 10 rainfall products, with linear trend superimposed.*

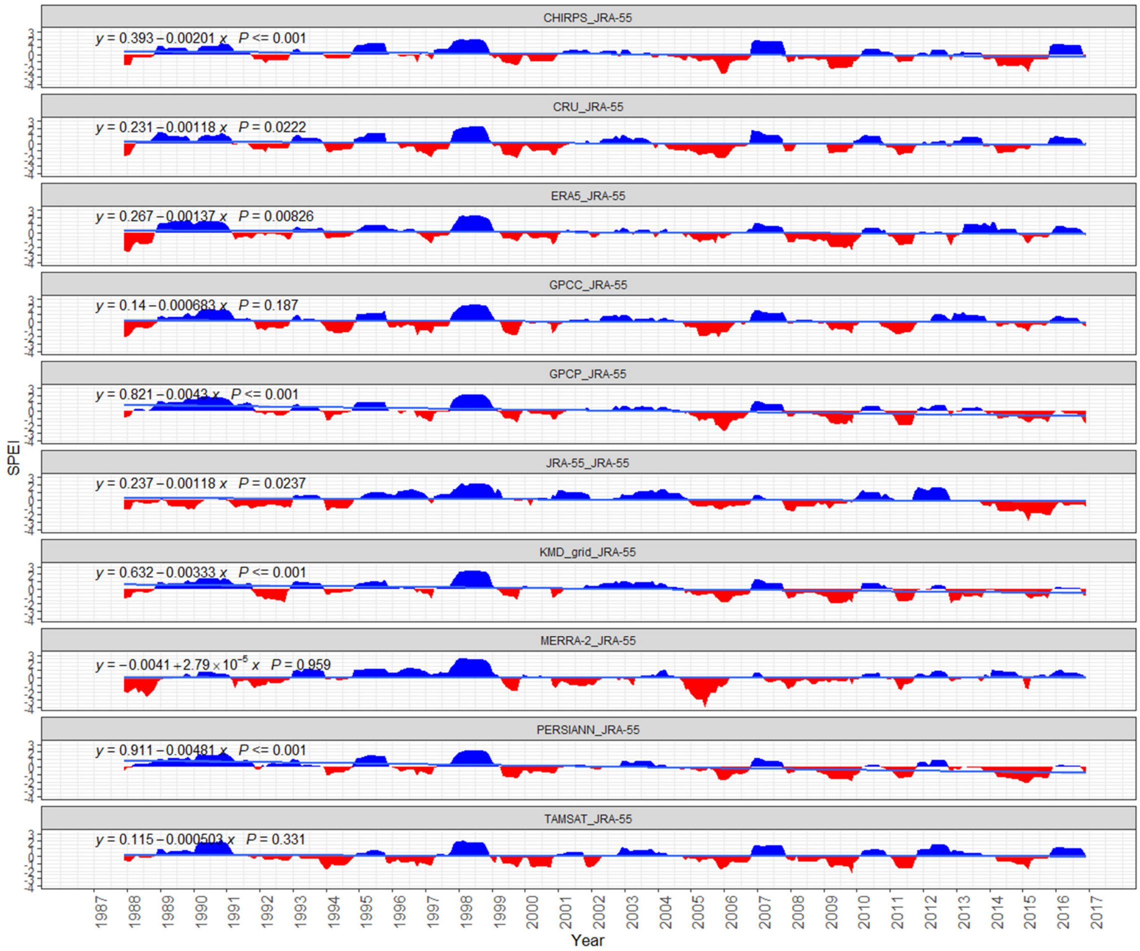

Figure S10. SPEI outputs using JRA-55 Tmax/Tmin with the 10 rainfall products, with linear trend superimposed.

water

Breakdown S1 Guiding questions used for key informant interviews.

INTERVIEW GUIDING QUESTIONS

Main Objective:

Understanding of drought dynamics, impacts on water storage in and synergies with agricultural intensification practices in South Eastern Kenya to contribute to triangulation of rainfall estimates and later household interviews.

Sub objectives:

- An understanding of drought as a disaster in South eastern Kenya including impacts on livelihoods, water and food security, trends and frequency.
- The role of ______Kenya in response and other partners involved in the context of livelihood improvement
- The response by the community to manage the disaster, organization and resilience building perhaps structural or institutional
- Typical community water storage structures supported and reasons for prioritizing
- The existing and/or intended relationship/linkages/synergies between community water storage and agricultural intensification practices. e.g. conservation agriculture, zai pits*, mixed crops farming, agroforestry. And further linkages with energy sources such as widespread charcoal burning
- Any differences or convenience with the devolved units in place
- Finally, and importantly, the history of drought occurrence over the last decade or thereabout with regard to your interventions and observations.
- Suggestions on organizations such as NGOs and CBOs for further interviews.