Data Sets for: Quantifying the Impacts of Compound Extremes on Agriculture and Irrigation Water Demand

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Introduction

Here we describe the main variables in the Data Set showing individual and compound extreme conditions for agriculture. This includes heat extremes, soil moisture conditions, and their interactions. The data covers 1981-2015 period for all corn-growing counties in the United States. The heat conditions are calculated based on PRISM (Parameter-elevation Regressions on Independent Slopes Model) daily data on maximum and minimum temperature at 2.5 arcmin resolution. The soil moisture conditions are calculated based on (WBM) Water Balance Model daily outputs at 2.5 arcmin grid cells. We aggregate the data for the growing season (Apr-Sep) and then to US counties by FIPS (Federal Information Processing Standard) codes. General variables showing FIPS, year, corn yields, and area are described in Table 1. Several metrics of individual heat or water conditions are described in Table 2 including mean precipitation, mean soil moisture, and growing degree days. Finally, the metrics of compound conditions are introduced and summarized in Table 3. For more details about the calculations please refer to:

> Haqiqi, Iman (2019): IRRIGATION, ADAPTATION, AND WATER SCARCITY. Purdue University Graduate School. Thesis. https://doi.org/10.25394/PGS.9971558.v1

Note: the square term of some variables may appear in the Data Set with “sqr” or “2” at the end of original variable names.

Table 1: General variables

Variable	Description	Mean	Std.Dev.	Min	Max
fips	county fips code	30172.73	13826.25	1001	56045
state	state fips code	30.08	13.82	1	56
longitude	longitude (crop-area weighted average)	-89.97	9	-124.19	-72.54
latitude	latitude (crop-area weighted average)	38.78	4.34	26.18	48.83
year	year	1996.71	9.92	1981	2015
t	time since 1950	46.71	9.92	31	65
cornYield	yield of corn for grain (bushel/acre)	109.77	37.85	4.55	246
cornArea	harvested area of corn for grain	35805.52	50182.89	10	394000
cornAreaIrrig	harvested irrigated area of corn	4233.43	18823.84	0	233000
cornAreaNonIrrig	harvested non-irrigated area of	31602.99	47552.09	0	394000
irAreaShr	share of irrigated corn area	.13	.32	0	1

Table 2: Individual heat and water metrics

Variable	Description	Mean	Std.Dev.	Min	Max
dday10C	Degree days above 10C	1908.82	482.56	692.79	3710.27
dday29C	Degree days above 29C	60.71	60.65	0	722.95
dday10_29C	Degree days from 10C to 29C	1848.11	434.39	692.66	3083.35
prec	Cumulative precipitation Apr-Sep	564.24	183.35	.8	1468.64
mrso	Mean daily soil moisture content	46.54	39.09	.12	262.33
mrso_alt	Mean daily soil moisture (mm), alternative	46.57	39.02	.15	261.31
smf	Mean daily soil moisture fraction	.71	.18	.01	1
smf_sd	Soil moisture fraction, within season SD	.23	.09	0	.47
et	Mean daily evapotranspiration (mm)	.55	.58	0	2.95
et_sd	Evapotranspiration, within season SD	.46	.45	0	2.15
smdPos	Index of soil moisture above normal	2369.83	2135.07	0	20319.19
smdNeg	Index of soil moisture below normal	-2384.16	2146.77	-23978.29	0
mrLo	Index of deficit (sum of deviations SMD < -25)	-1637.07	2274.98	-23383.41	0
mrHi	Index of surplus (sum of deviations SMD > +25)	1778.66	2146.27	0	19591.08
mrNl	Index of normal soil moisture	-218.63	512.6	-2919.49	1768.23
nd0xSM_m_gt025	Number of days with soil moisture high	26.63	29.59	0	181.83
nd0xSM_m_lt025	Number of days with soil moisture low	27.32	34.6	0	183

Table 3: Compound heat and water metrics

Variable	Description	Mean	Std.Dev.	Min	Max
mrLoTvg00_25	Index of moisture deficit when T is 0 to 25	-1132.47	1723.14	-21710.76	0
mrLoTvg25_50	Index of moisture deficit when T is 25 to 50	-515.07	936.36	-14762.06	0
mrHiTvg00_25	Index of moisture surplus when T is 0 to 25	1589.76	1927	0	19716.4
mrHiTvg25_50	Index of moisture surplus when T is 25 to 50	242.81	522.37	0	10802.16
mrNlTvg00_25	Index of normal soil moisture when T is 0 to 25	-89.14	409.76	-2415.83	1887.17
mrNlTvg25_50	Index of normal soil moisture when T is 25 to 50	-118.51	240.15	-2331.85	1413.28
mrsoAprMay	Mean daily soil moisture content Apr-May	20.08	16.46	0	90.09
mrsoJunJul	Mean daily soil moisture content Jun-Jul	16.29	15.45	0	89.83
mrsoAugSep	Mean daily soil moisture content Aug-Sep	10.17	10.44	0	87.56
dd10_29smLo	Degree days from 10C to 29C & soil moisture low	396.6	430.35	0	2628.69
dd10_29smHi	Degree days from 10C to 29C & soil moisture high	330.28	346.07	0	2665.04
dd10_29smNl	Degree days from 10C to 29C & soil moisture normal	1111.83	572.43	0	3043.91
dd29smLo	Degree days above 29C & soil moisture low	18.03	31.29	0	399.83
dd29smHi	Degree days above 29C & soil moisture high	4.68	8.95	0	140.03
dd29smNl	Degree days above 29C & soil moisture normal	36.79	48.11	0	680.33
gdd29smxxx_75b	dday29C & SM 75+ mm below normal	2.29	10.5	0	232.11
gdd29sm75a_xxx	dday29C & SM 75+ mm above normal	.39	1.95	0	75.88
gdd29sm75b_25b	dday29C & SM 25-75 mm below normal	15.74	28.24	0	399.83
gdd29sm25b_25a	dday29C & SM 0-25 mm around normal	36.79	48.11	0	680.33
gdd29sm25a_75a	dday29C & SM 25-75 mm above normal	4.29	7.93	0	97.18
shrDD29nl	Share of DD29C at normal soil moisture	.61	.31	0	1
shrDD10_29nl	Share of DD10-29C at normal soil moisture	.61	.28	0	1