From global drought assessment to drought climate services.

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Concepts and mechanisms

DROUGHT VERSUS ARIDITY AND WATER SCARCITY

	Natural	Man Induced
Temporary	Drought	•Water shortage
Permanent	Aridity	•Water scarcity •Desertification

THE COMPLEXITY OF DROUGHT QUANTIFICATION AND ANALYSIS

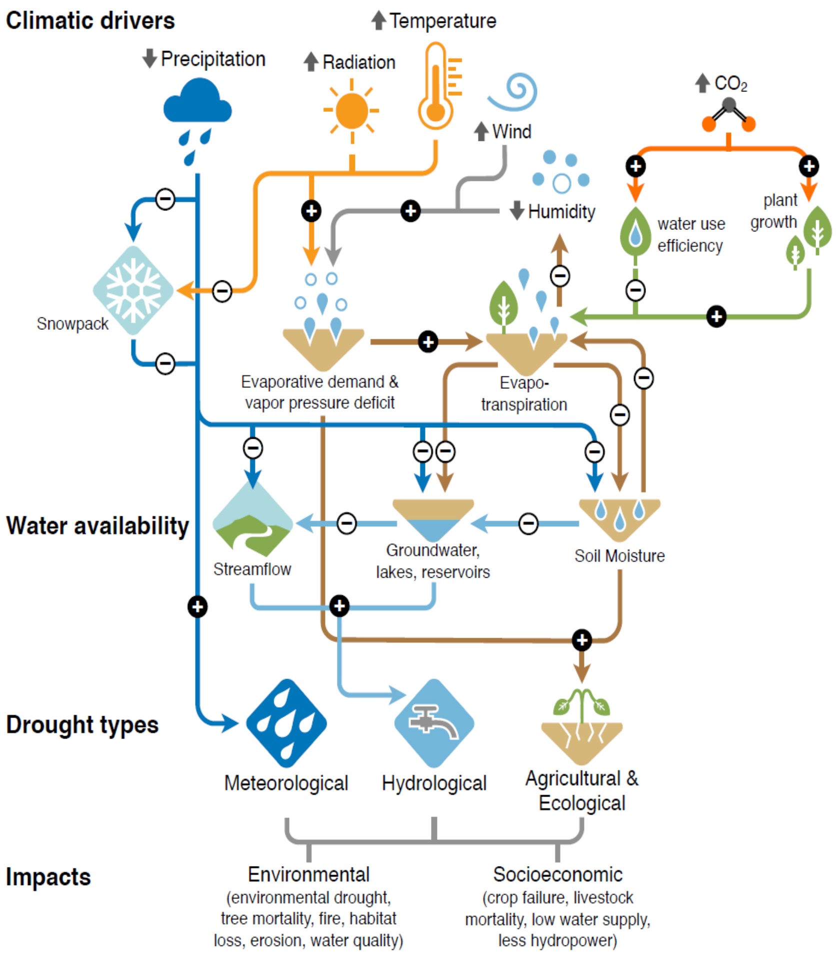
- Drought is among the most complex extreme meteorological phenomena affecting society and the environment.

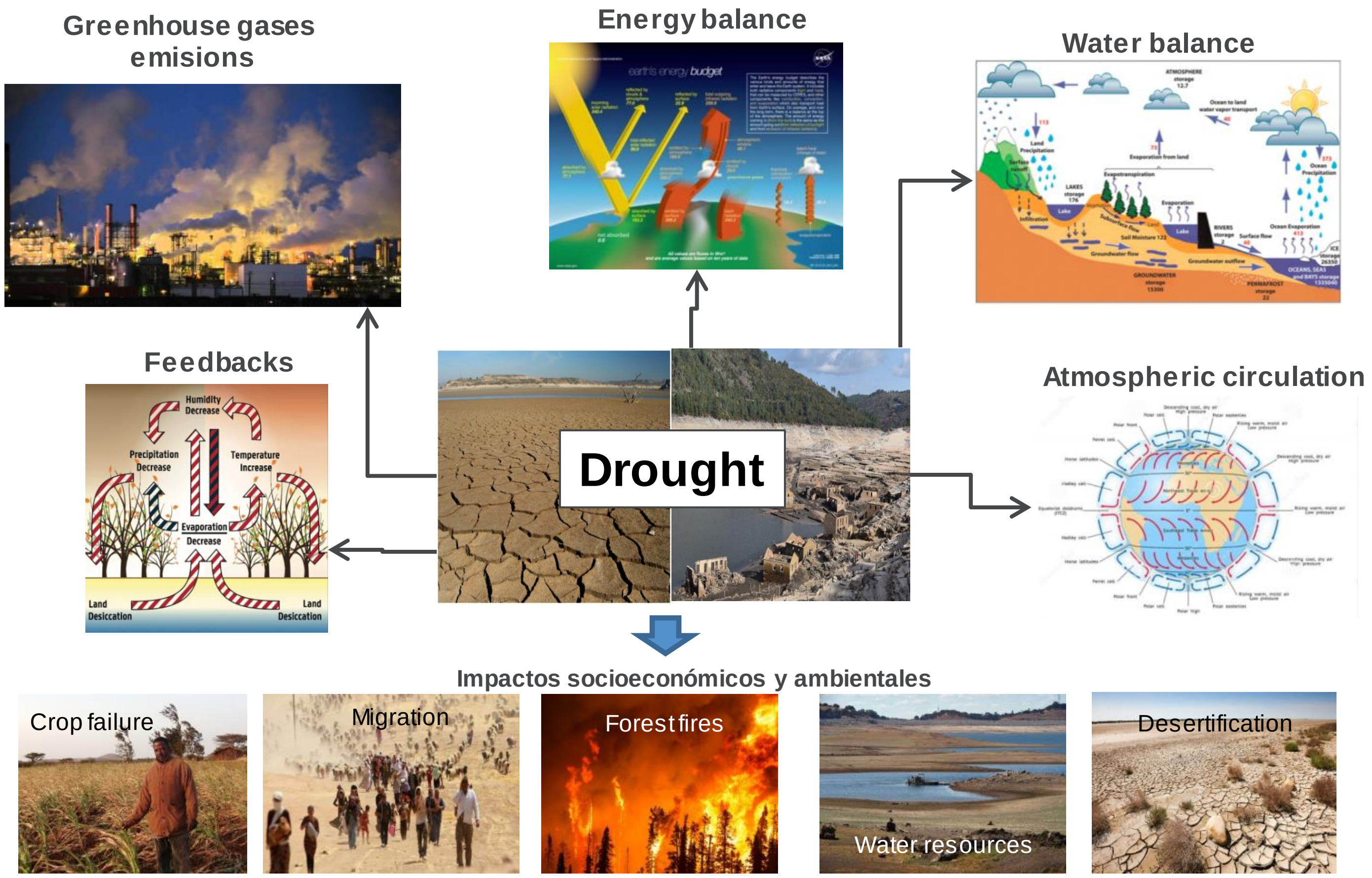
- It is very complex to identify the moment when a drought starts and ends and also to quantify its duration, magnitude, and spatial extent.

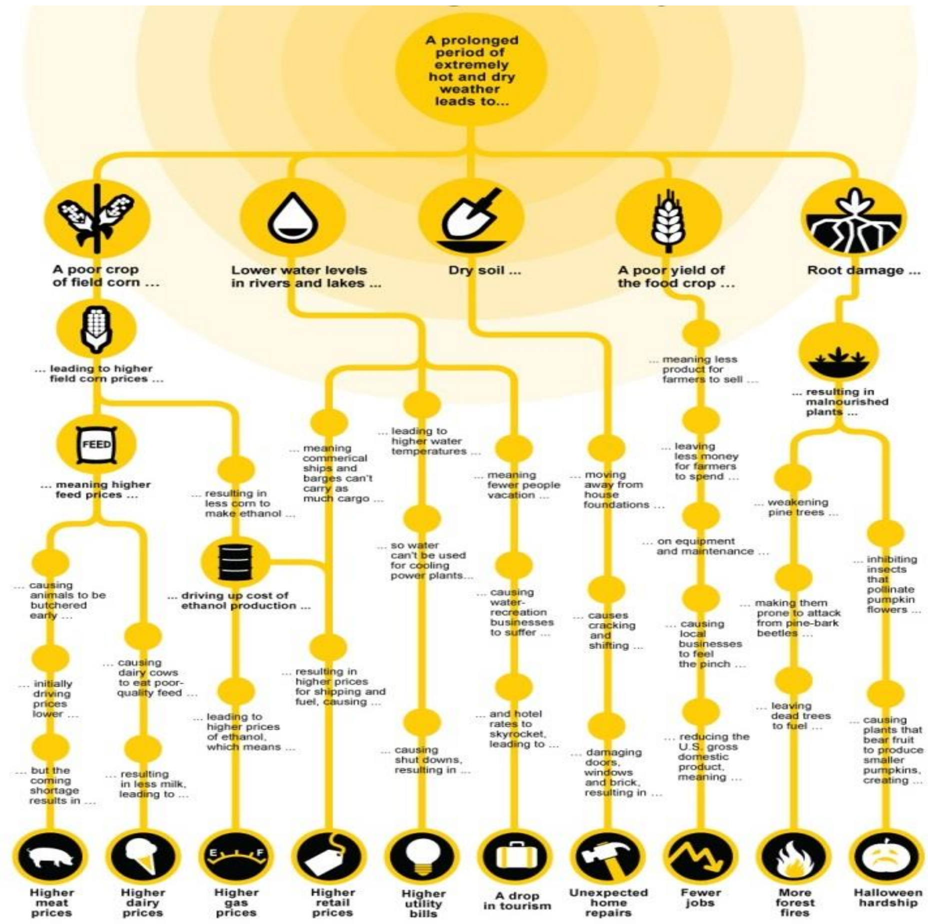
- Drought is an impact-dependent phenomenon so it is difficult to pinpoint in time and space given different economic sectors and natural systems affected.

- There is difficulty of quantifying drought severity since we identify a drought by its effects or impacts on different types of systems (agriculture, water resources, ecology, forestry, economy, etc.), but there is not a unique physical variable we can measure to quantify droughts to derive impacts.

- **Strong complexity and interactions between physical processes and drought types.**




Greenhouse gases emisions
Energy balance
Water balance
Feedbacks
Humidity Decrease
Precipitation Decrease
Temperature Increase
Evaporation Decrease
Land Desiccation
Land Desiccation
Drought
Atmospheric circulation
Impactos socioeconómicos y ambientales
Crop failure
Migration
Forest fires
Water resources
Desertification



Sources: Brian Fuchs, National Drought Mitigation Center; Alex Sisnowski, Accuweather; Jay Famiglietti, University of California-Irvine; Aon Benfield; George Kilgore, University of Tennessee Institute of Agriculture; Texas Parks and Wildlife Department

By Kevin A. Kepple, Anne R. Carey, Maureen Linke, Joan Murphy, Jerry Mosemak, Denny Gainer, Doyle Rice, USA Today

Several ecologic and environmental impacts:

Soil erosion, tree mortality, forest fires, wildlife alteration, wetland degradation, etc.

Drought around the world (1900-2022)

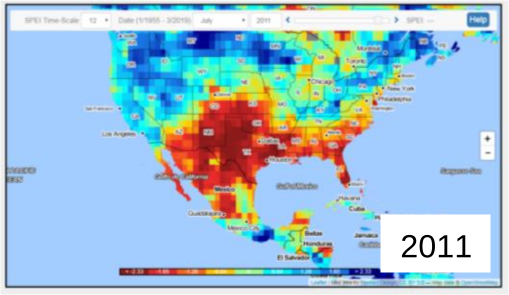
- More than 10 million people lost their lives due to major drought events in the past century, causing several hundred billion USD in economic losses worldwide, and the numbers are rising (Guha-Sapir, D. et al., 2021)

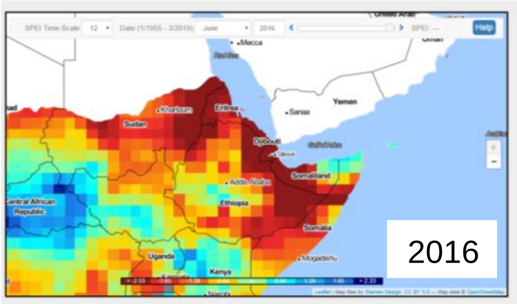
- Severe drought affects Africa more than any other continent, with more than 300 events recorded in the past 100 years, accounting for 44 percent of the global total. More recently, sub-Saharan Africa has experienced the dramatic consequences of climate disasters becoming more frequent and intense (Taylor et al., 2017; Guha-Sapir, D. et al., 2021)

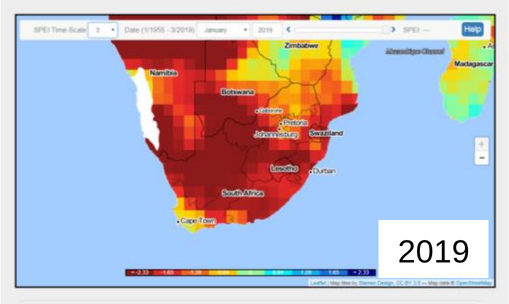
- In the past century, 45 major drought events occurred in Europe, affecting millions of people and resulting in more than USD 27.8 billion in economic losses. Today, an annual average of 15 percent of the land area and 17 percent of the population within the European Union is affected by drought (Guha-Sapir, D. et al., 2021; European Environment Agency, 2017)

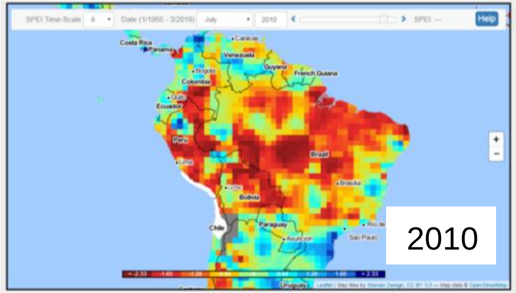
- In the U.S., crop failures and other economic losses due to drought have totaled several hundred billion USD over the last century – USD 249 billion alone since 1980 (NOAA-NCEI, 2021)

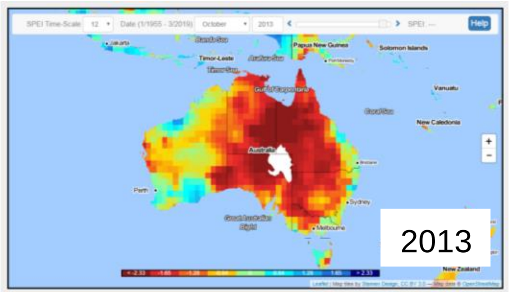
Drought trends

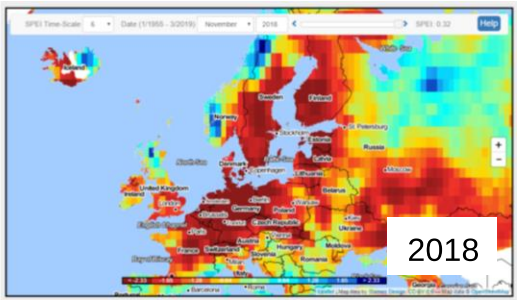

2011


2016


2019


2010

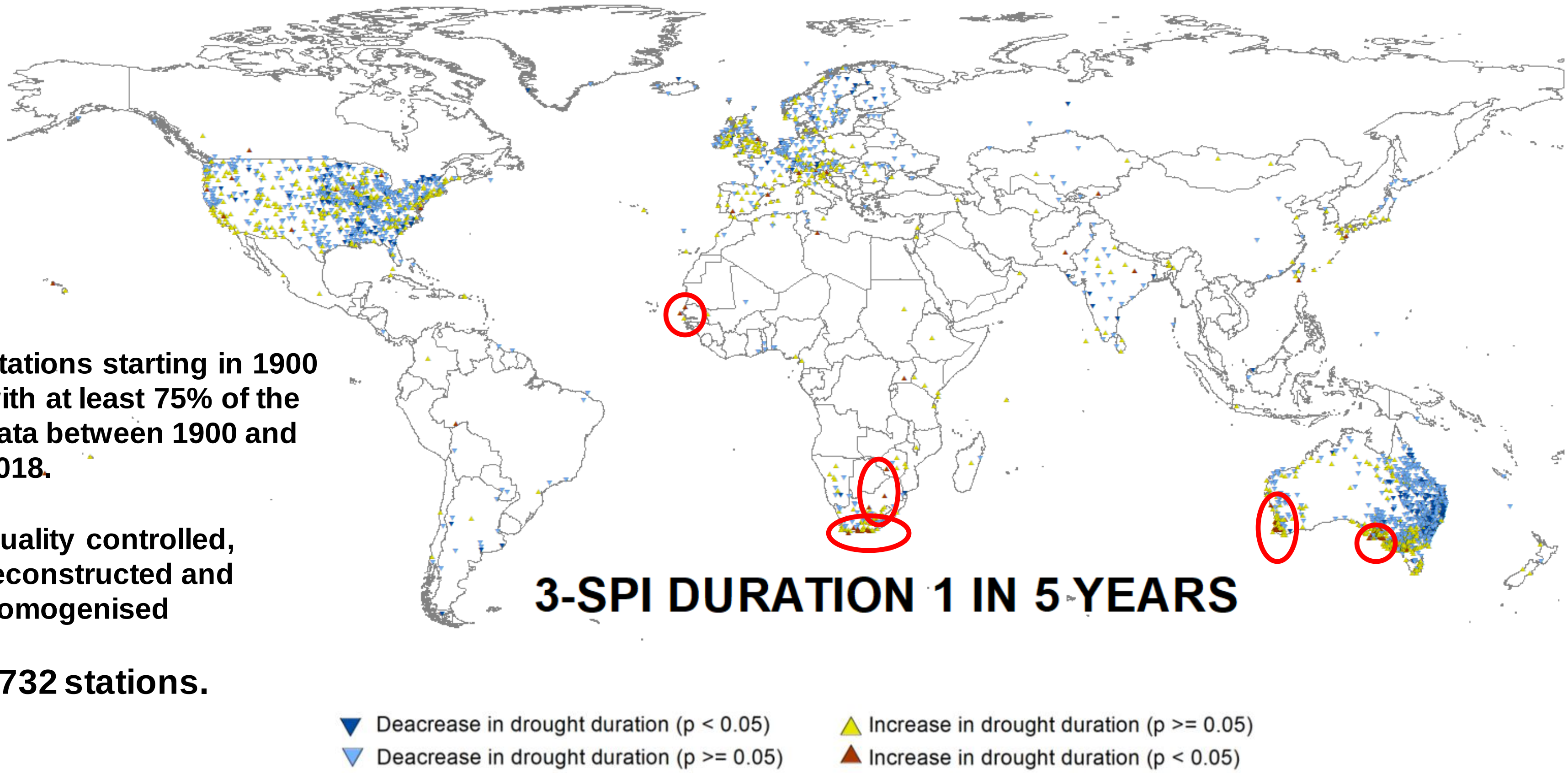

2013


2018

Stations starting in 1900 with at least 75% of the data between 1900 and 2018.

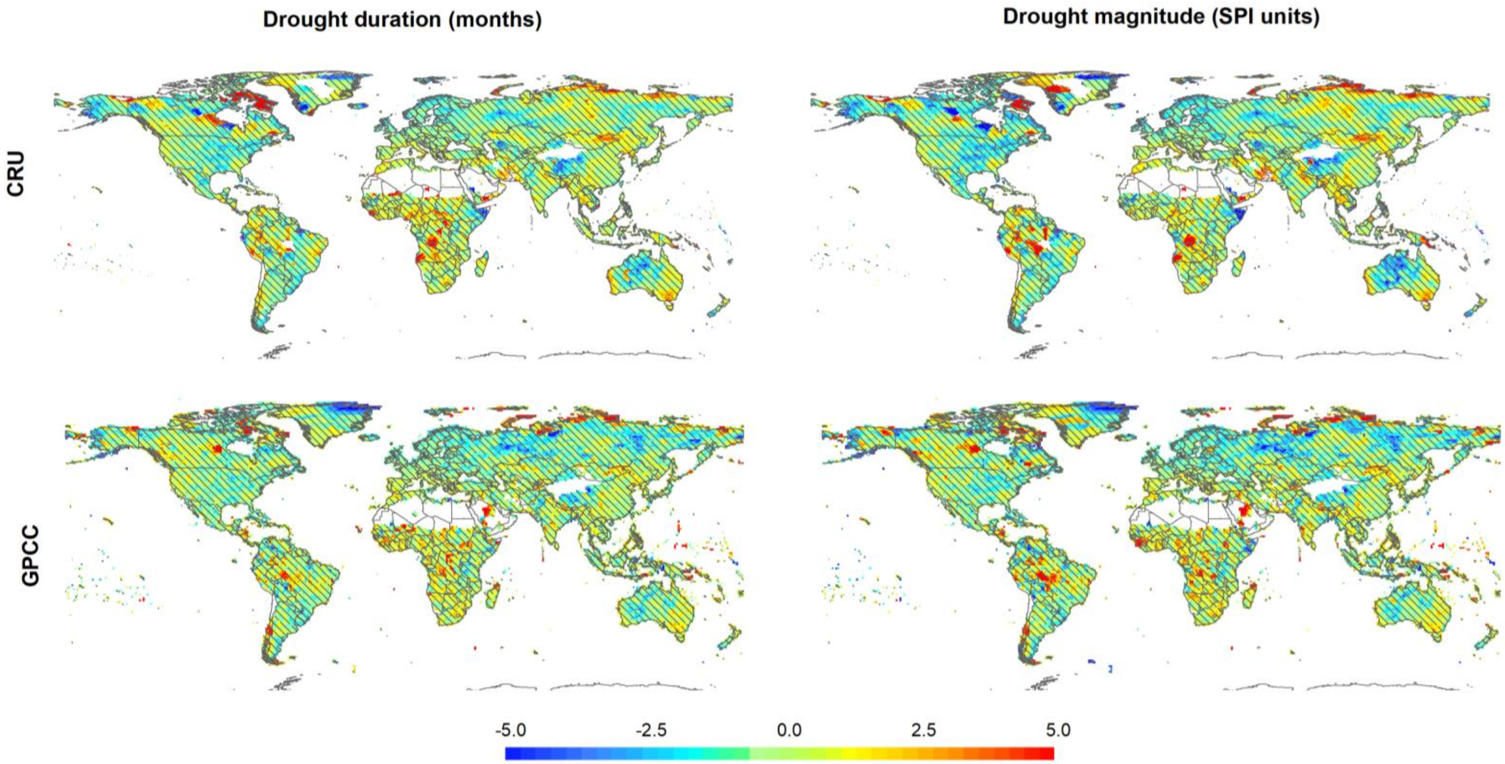
Quality controlled, reconstructed and homogenised

2732 stations.

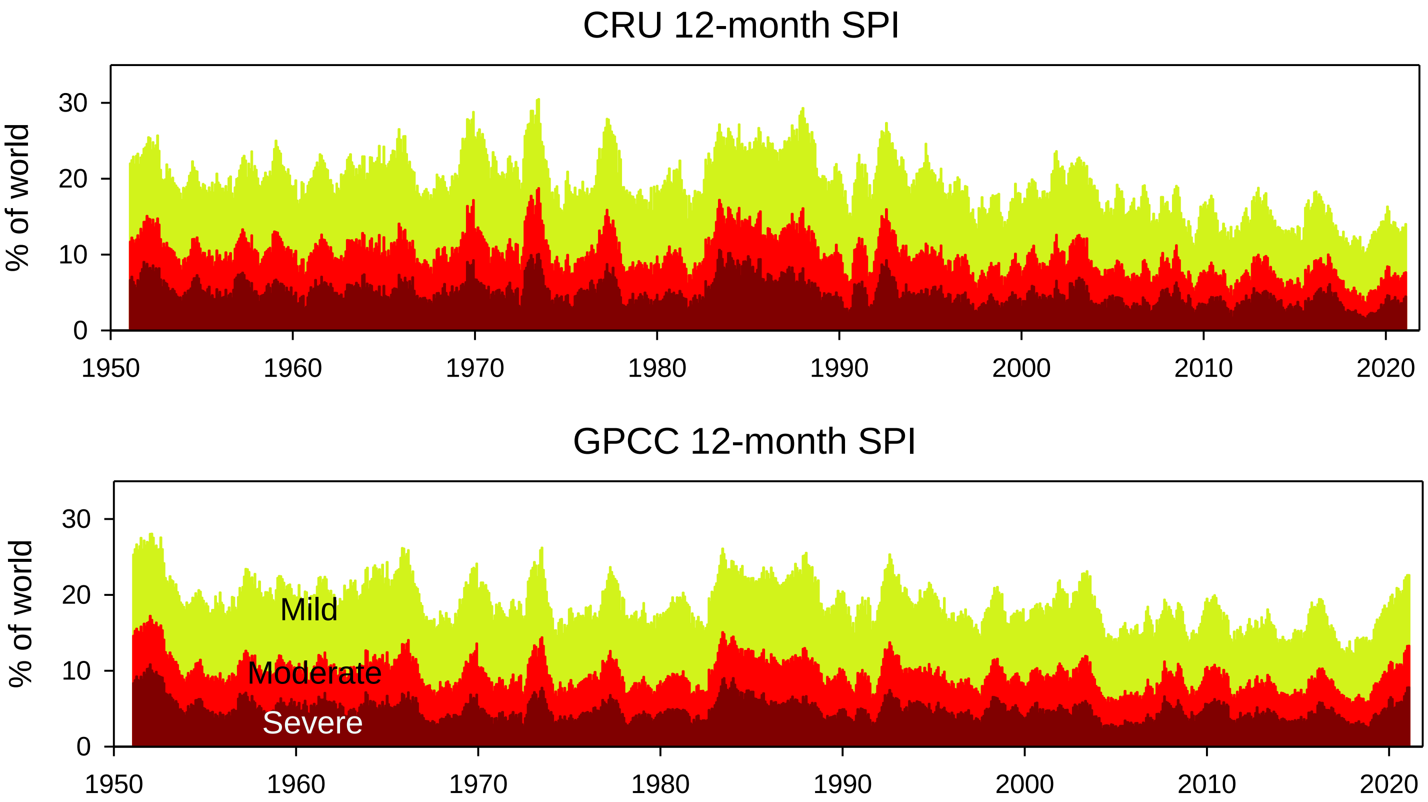


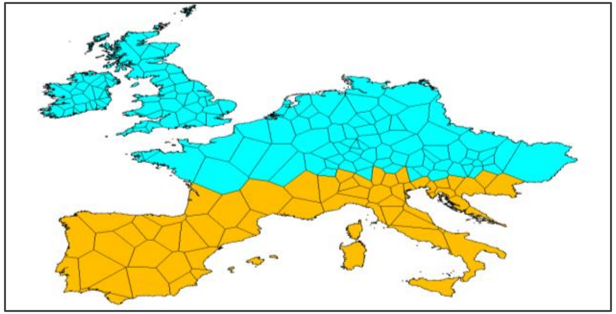
Analysis from gridded datasets. Evolution of drought events.

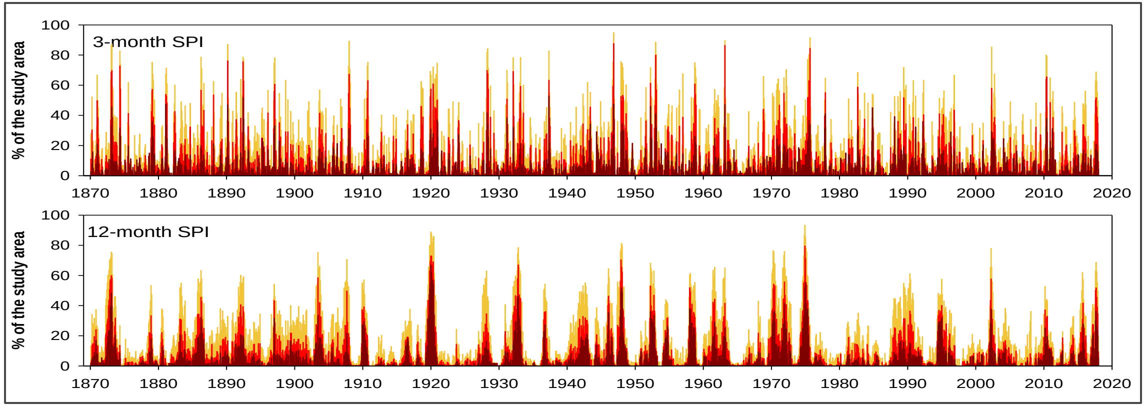
12-month SPI 1950-2020. Threshold = 0



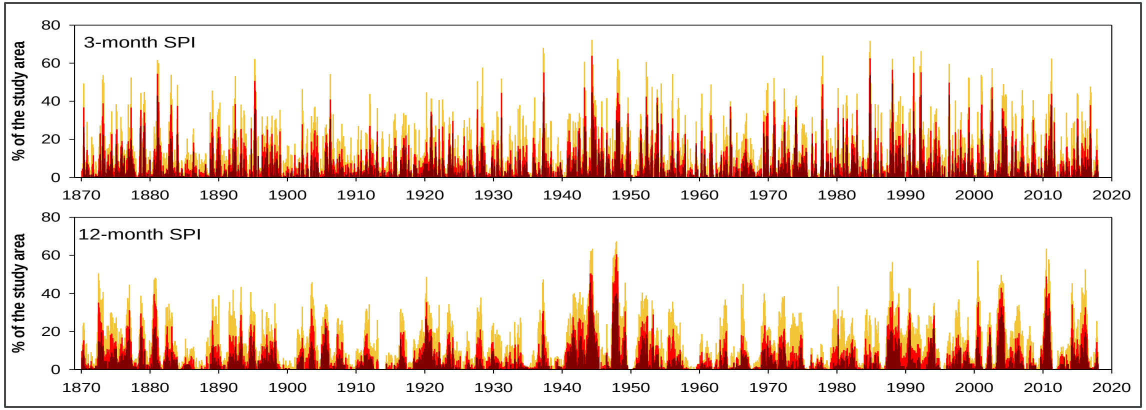
Based on precipitation data there is not a global increase in the areas affected by drought severity







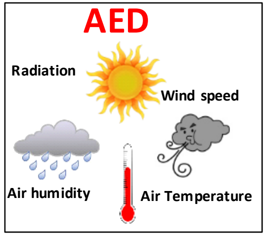
3-month SPI
% of the study area
0
20
40
60
80
100
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
12-month SPI
% of the study area
0
20
40
60
80
100
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020

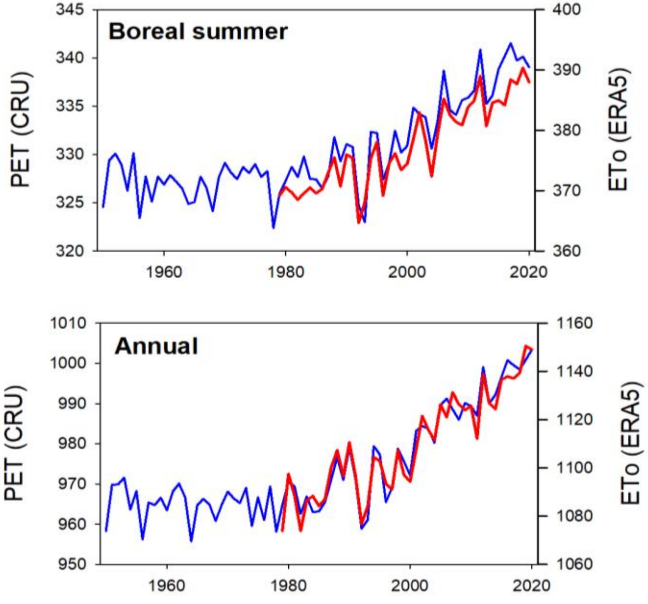


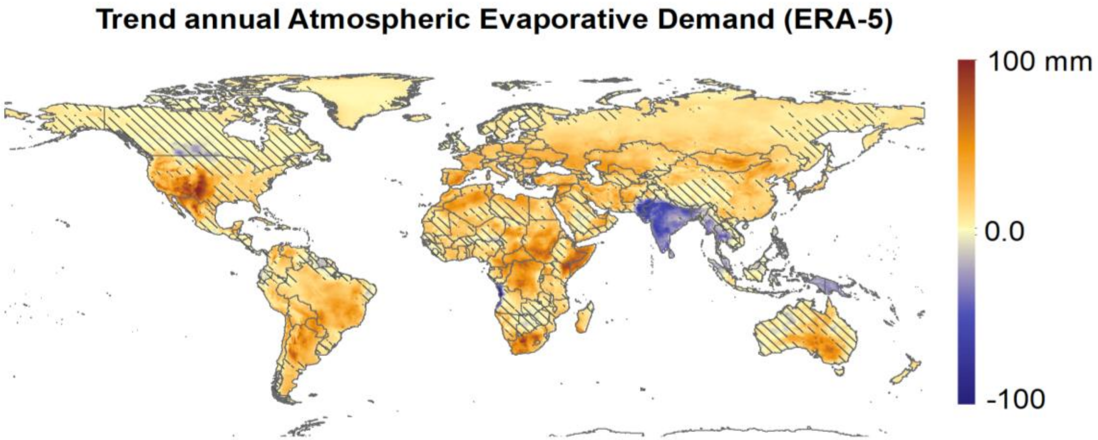
3-month SPI
% of the study area
0
20
40
60
80
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
12-month SPI
% of the study area
0
20
40
60
80
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020

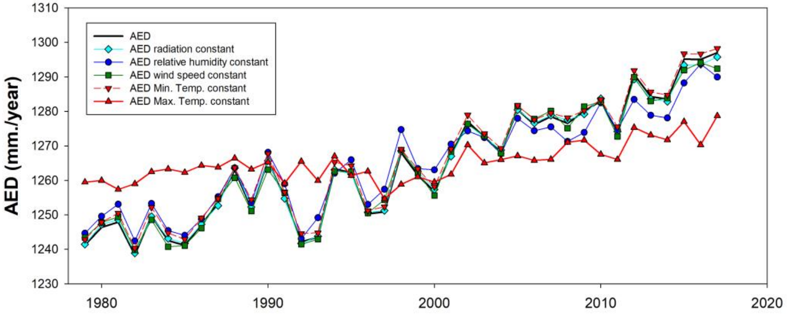
Impact of global warming

Atmospheric Evaporative Demand shows increase

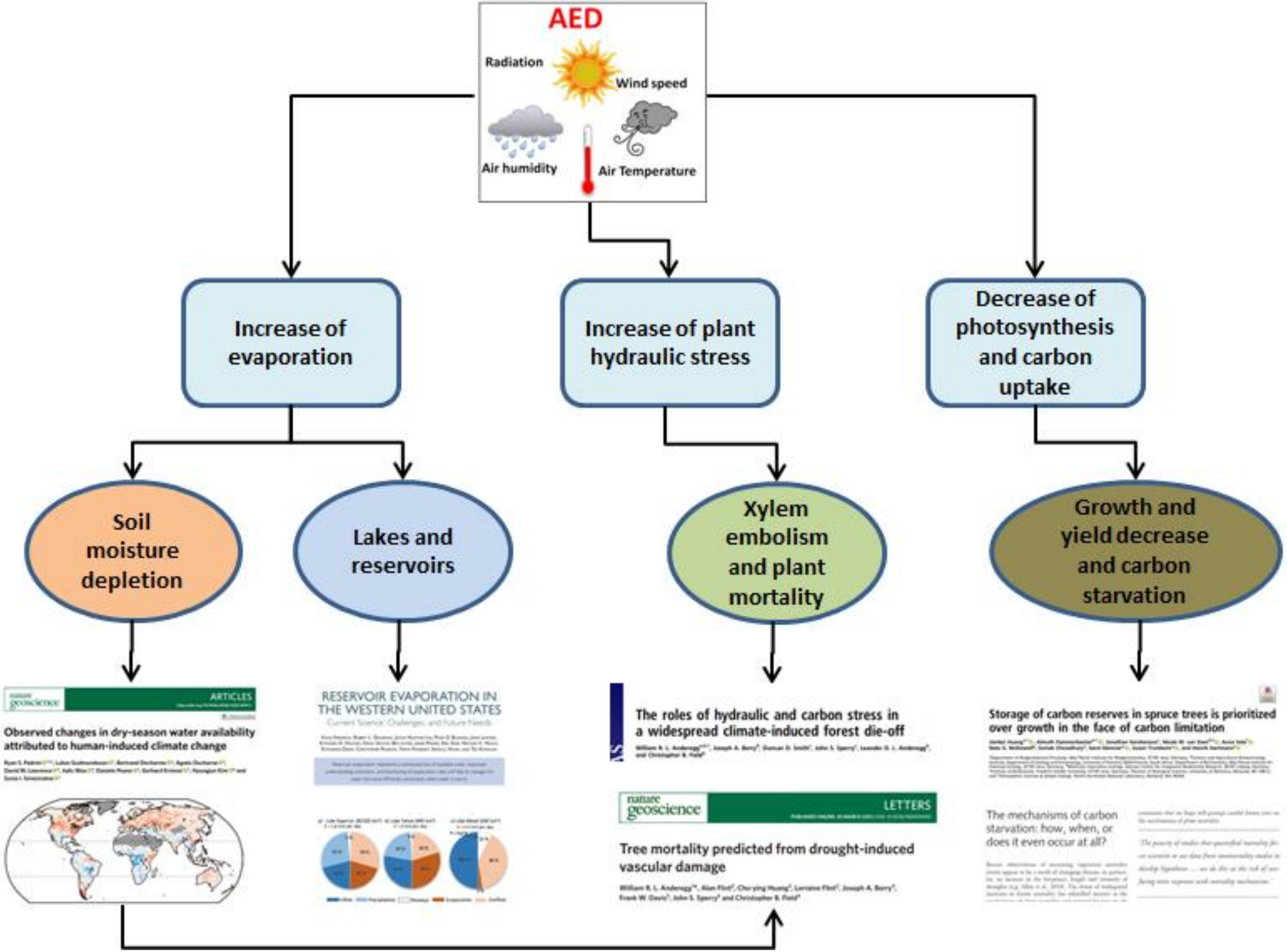


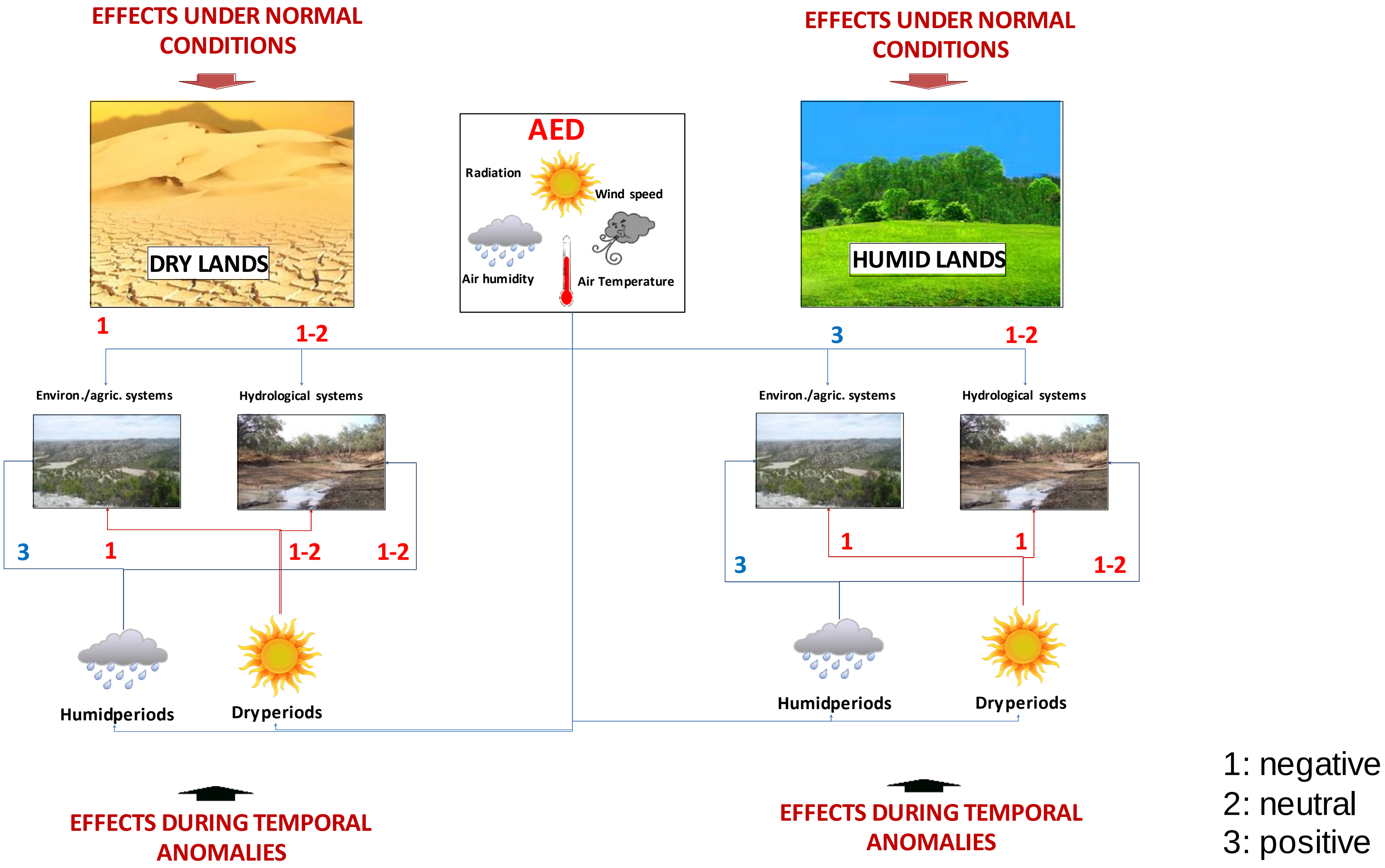




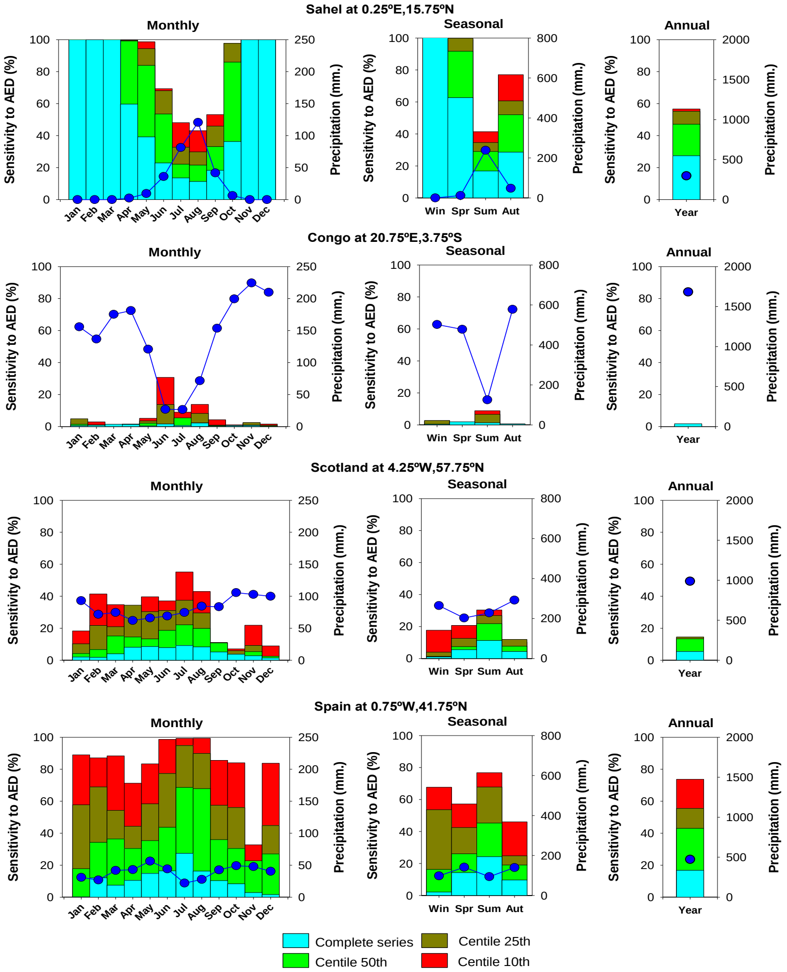


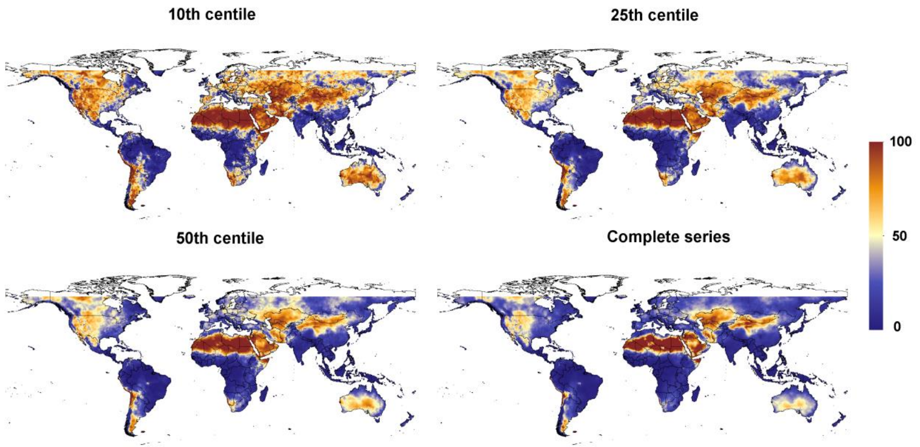
Basically this is consequence of the temperature increase

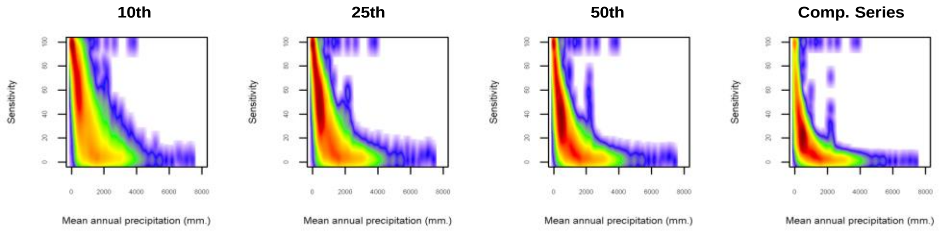

AED
Radiation
Wind speed
Air humidity
Air Temperature
Increase of evaporation
Increase of plant hydraulic stress
Decrease of photosynthesis and carbon uptake
Soil moisture depletion
Lakes and reservoirs
Xylem embolism and plant mortality
Growth and yield decrease and carbon starvation
Observed changes in dry-season water availability attributed to human-induced climate change
RESERVOIR EVAPORATION IN THE WESTERN UNITED STATES
The roles of hydraulic and carbon stress in a widespread climate-induced forest die-off
Tree mortality predicted from drought-induced vascular damage
Storage of carbon reserves in spruce trees is prioritized over growth in the face of carbon limitation
The mechanisms of carbon starvation: how, when, or does it even occur at all?

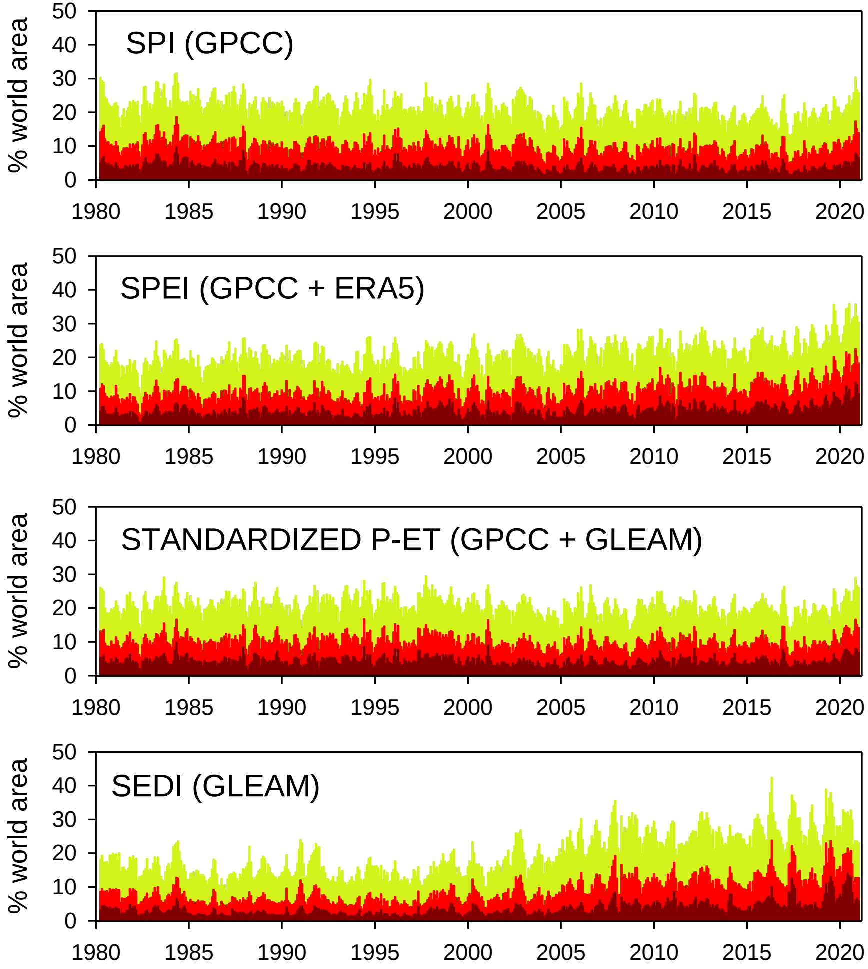

EFFECTS UNDER NORMAL CONDITIONS
DRY LANDS
AED
Radiation
Wind speed
Air humidity
Air Temperature
EFFECTS UNDER NORMAL CONDITIONS
HUMID LANDS
1
1-2
3
1-2
Environ./agric. systems
Hydrological systems
Environ./agric. systems
Hydrological systems
3
1
1-2
1-2
1
1
3
1-2
Humidperiods
Dryperiods
Humidperiods
Dryperiods
EFFECTS DURING TEMPORAL ANOMALIES
EFFECTS DURING TEMPORAL ANOMALIES
1: negative
2: neutral
3: positive

Sensitivity of the SPEI (P-AED) to the AED









SPI (GPCC)
SPEI (GPCC + ERA5)
STANDARDIZED P-ET (GPCC + GLEAM)
SEDI (GLEAM)
% world area
0
10
20
30
40
50
1980
1985
1990
1995
2000
2005
2010
2015
2020

CHANGES IN DROUGHT MAGNITUDE

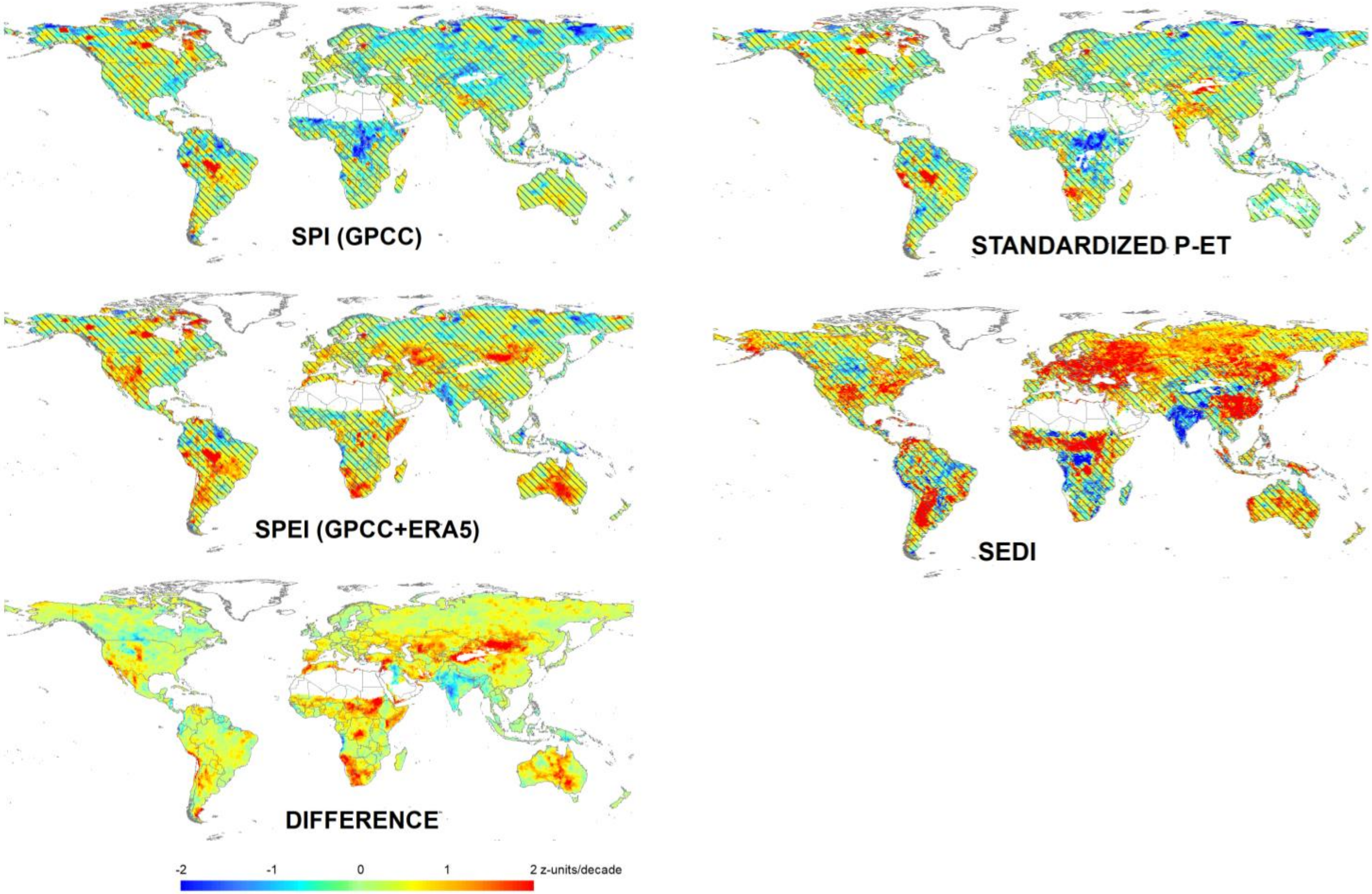
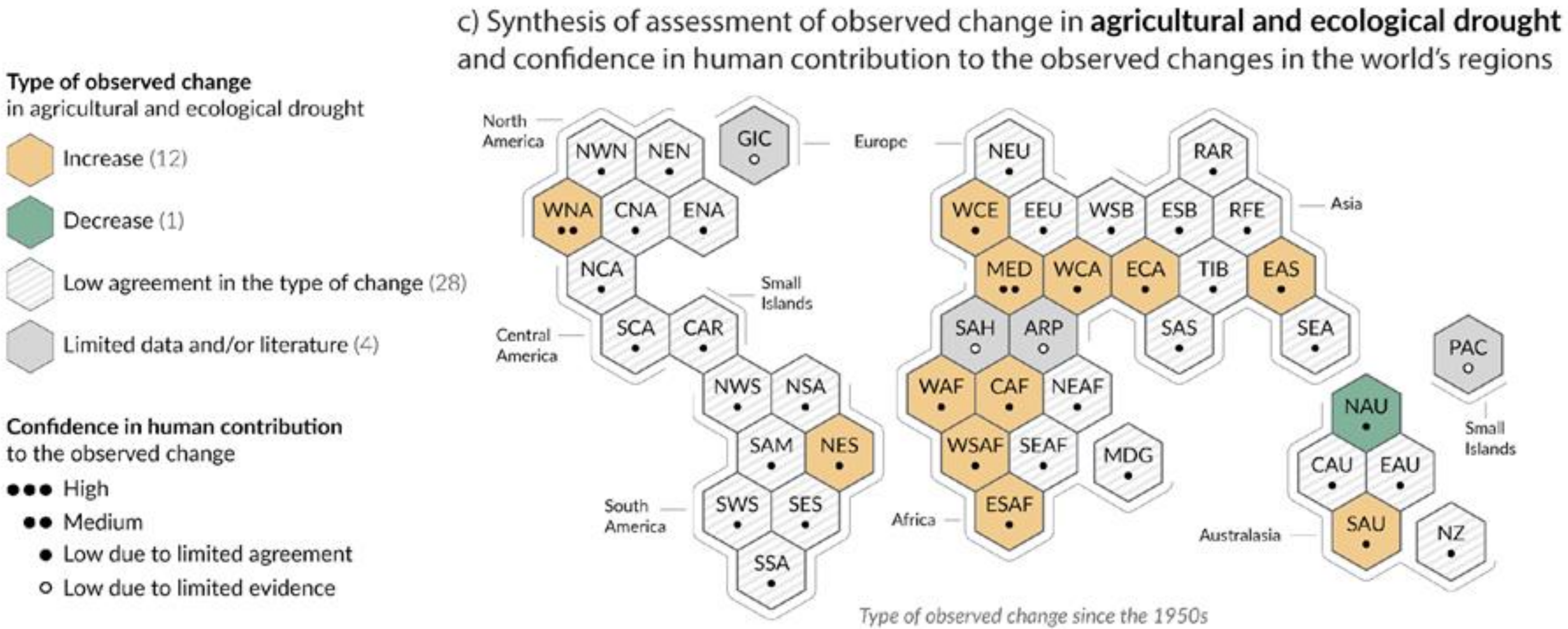


Figure SPM.3 From IPCC AR6, WGI



Is this supported by impact data?

Forest Ecology and Management 259 (2010) 660–684

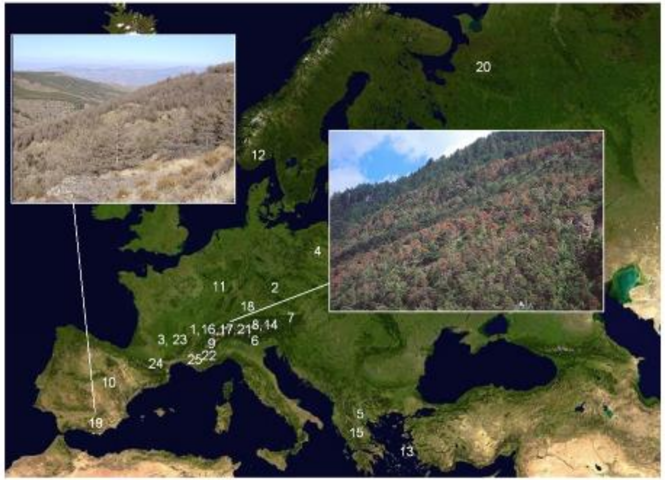
Contents lists available at ScienceDirect

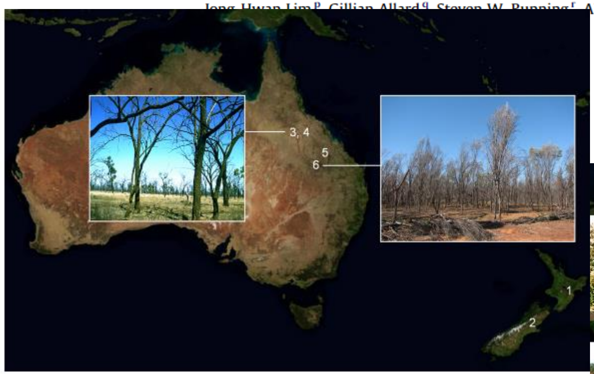
Forest Ecology and Management

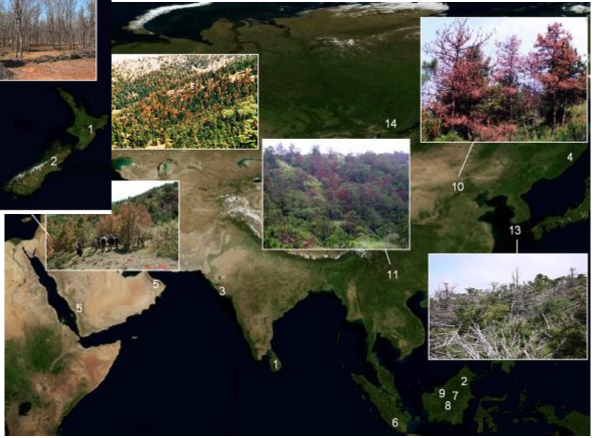
journal homepage: www.elsevier.com/locate/foreco

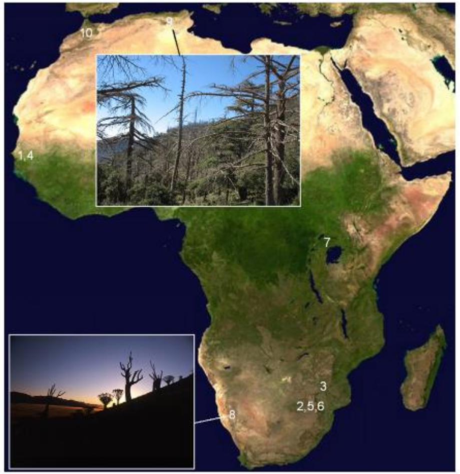
A global overview of drought and heat-induced tree mortality reveals emerging climate change risks for forests

Craig D. Allen[a,*], Alison K. Macalady[b], Haroun Chenchouni[c], Dominique Bachelet[d], Nate McDowell[e], Michel Vennetier[f], Thomas Kitzberger[g], Andreas Rigling[h], David D. Breshears[i], E.H. (Ted) Hogg[j], Patrick Gonzalez[k], Rod Fensham[l], Zhen Zhang[m], Jorge Castro[n], Natalia Demidova[o], Jong-Hwan Lim[p], Gillian Allard[q], Steven W. Running[r], Akkin Semerci[s], Neil Cobb[t]







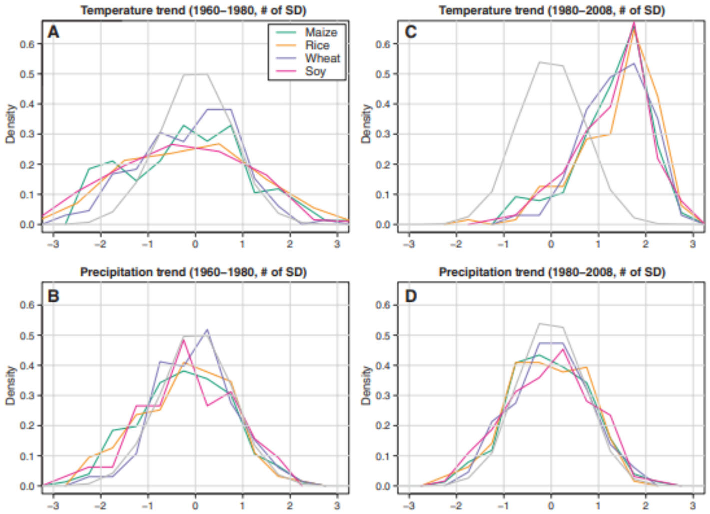


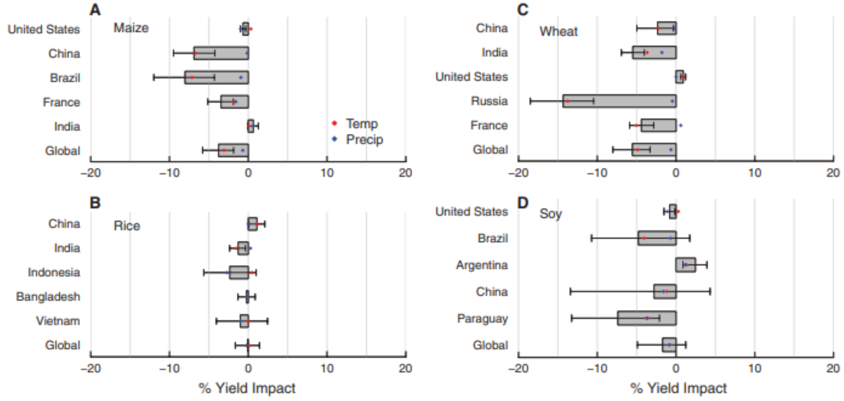
Is this supported by impact data?

Climate Trends and Global Crop Production Since 1980

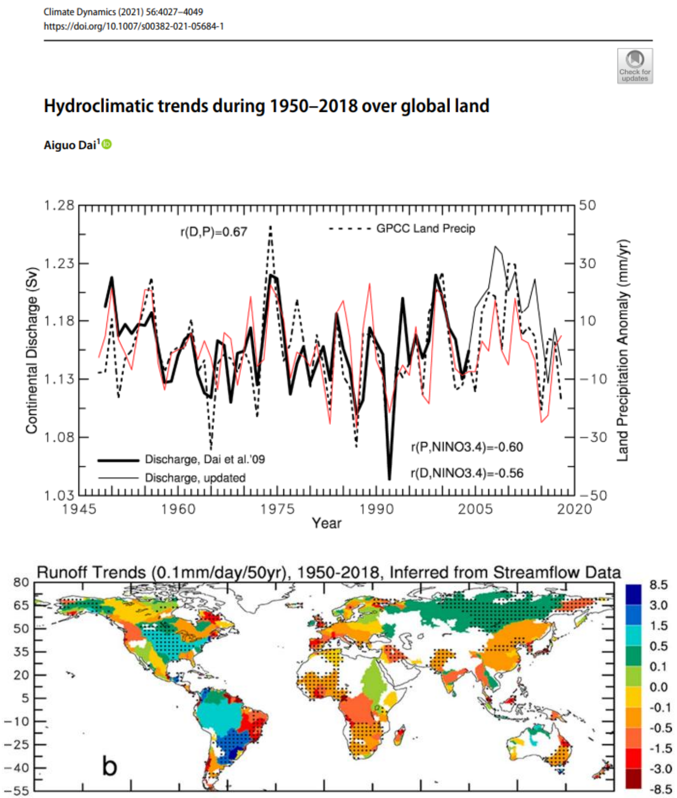
David B. Lobell,[1*] Wolfram Schlenker,[2,3] Justin Costa-Roberts[1]

Efforts to anticipate how climate change will affect future food availability can benefit from understanding the impacts of changes to date. We found that in the cropping regions and growing seasons of most countries, with the important exception of the United States, temperature trends from 1980 to 2008 exceeded one standard deviation of historic year-to-year variability. Models that link yields of the four largest commodity crops to weather indicate that global maize and wheat production declined by 3.8 and 5.5%, respectively, relative to a counterfactual without climate trends. For soybeans and rice, winners and losers largely balanced out. Climate trends were large enough in some countries to offset a significant portion of the increases in average yields that arose from technology, carbon dioxide fertilization, and other factors.



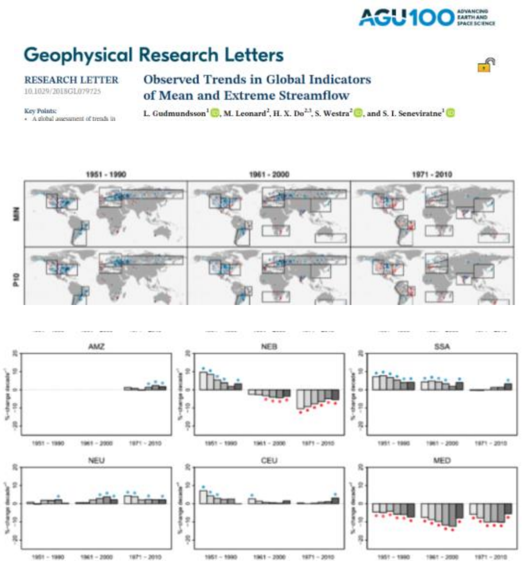


Assessment of hydrological drought trends is more complex


Climate Dynamics (2021) 56:4027–4049
https://doi.org/10.1007/s00382-021-05684-1

Hydroclimatic trends during 1950–2018 over global land

Aiguo Dai[1]

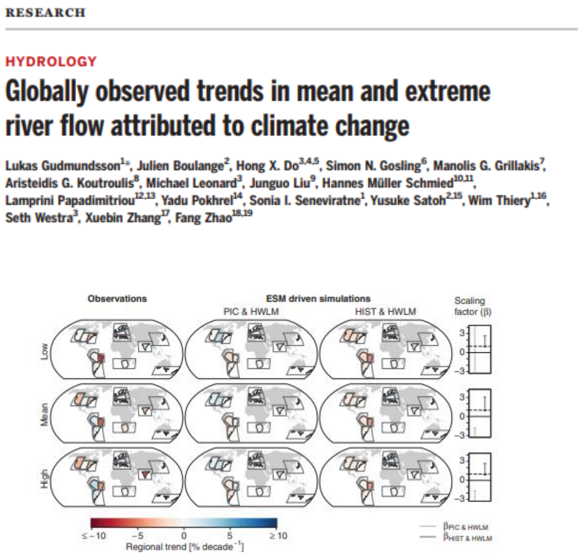

AGU100

Geophysical Research Letters

RESEARCH LETTER

Observed Trends in Global Indicators of Mean and Extreme Streamflow

L. Gudmundsson[1], M. Leonard[2], H. X. Do[2,3], S. Westra[2], and S. I. Seneviratne[1]


RESEARCH

HYDROLOGY

Globally observed trends in mean and extreme river flow attributed to climate change

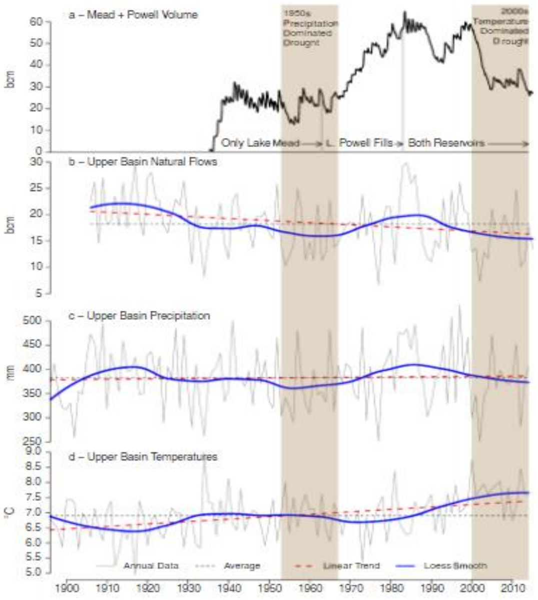
Lukas Gudmundsson[1*], Julien Boulange[2], Hong X. Do[3,4,5], Simon N. Gosling[6], Manolis G. Grillakis[7], Aristeidis G. Koutroulis[8], Michael Leonard[3], Junguo Liu[9], Hannes Müller Schmied[10,11], Lamprini Papadimitriou[12,13], Yadu Pokhrel[14], Sonia I. Seneviratne[1], Yusuke Satoh[2,15], Wim Thiery[1,16], Seth Westra[3], Xuebin Zhang[17], Fang Zhao[18,19]

AGU PUBLICATIONS
Water Resources Research

RESEARCH ARTICLE
10.1002/2016WR019638

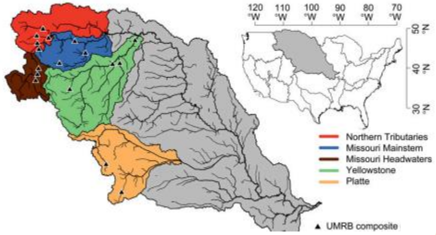
The twenty-first century Colorado River hot drought and implications for the future

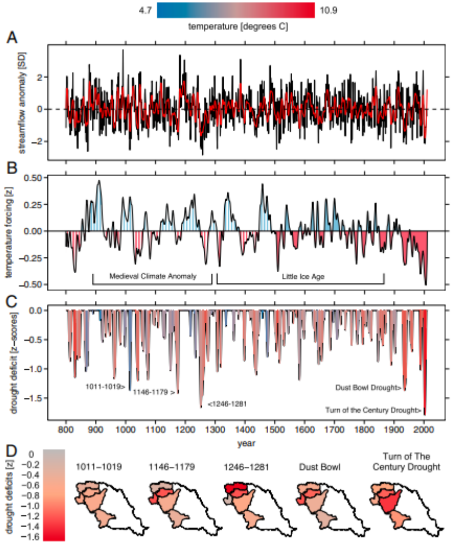
Bradley Udall[1,2] and Jonathan Overpeck[2,3]



Increased drought severity tracks warming in the United States' largest river basin

Justin T. Martin[a,1], Gregory T. Pederson[a], Connie A. Woodhouse[b,c], Edward R. Cook[d], Gregory J. McCabe[e], Kevin J. Anchukaitis[b,c], Erika K. Wise[f], Patrick J. Erger[g], Larry Dolan[h,2], Marketa McGuire[i], Subhrendu Gangopadhyay[i], Katherine J. Chase[j], Jeremy S. Littell[k], Stephen T. Gray[k], Scott St. George[l], Jonathan M. Friedman[m], David J. Sauchyn[n], Jeannine-Marie St-Jacques[o], and John King[p]

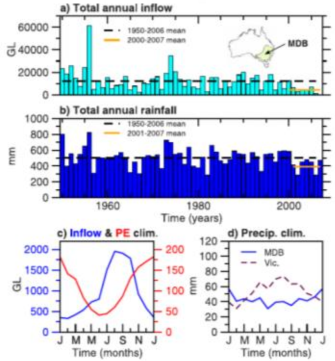




GEOPHYSICAL RESEARCH LETTERS, VOL. 35, L07701, doi:10.1029/2008GL033390, 2008

Evidence of impacts from rising temperature on inflows to the Murray-Darling Basin

Wenju Cai[1] and Tim Cowan[1]



EVOLUTION OF IRRIGATED SURFACE IN BRAZIL AND SPAIN

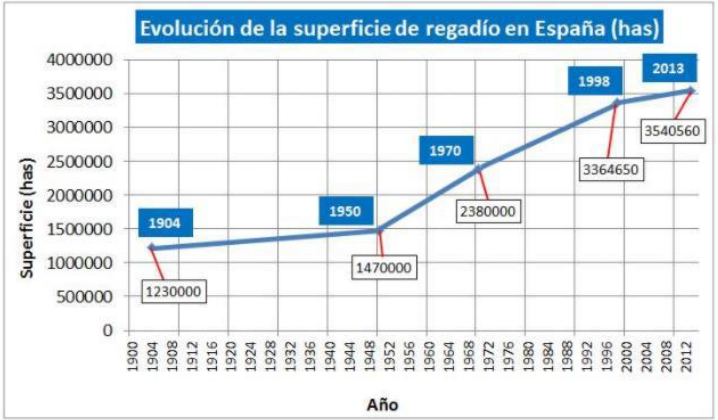
INOVAGRI International Meeting
XXVIII CONIRD
I Simpósio Latino Americano de Salinidade

EVOLUÇÃO DA AGRICULTURA IRRIGADA NA REGIÃO NORDESTE DO BRASIL

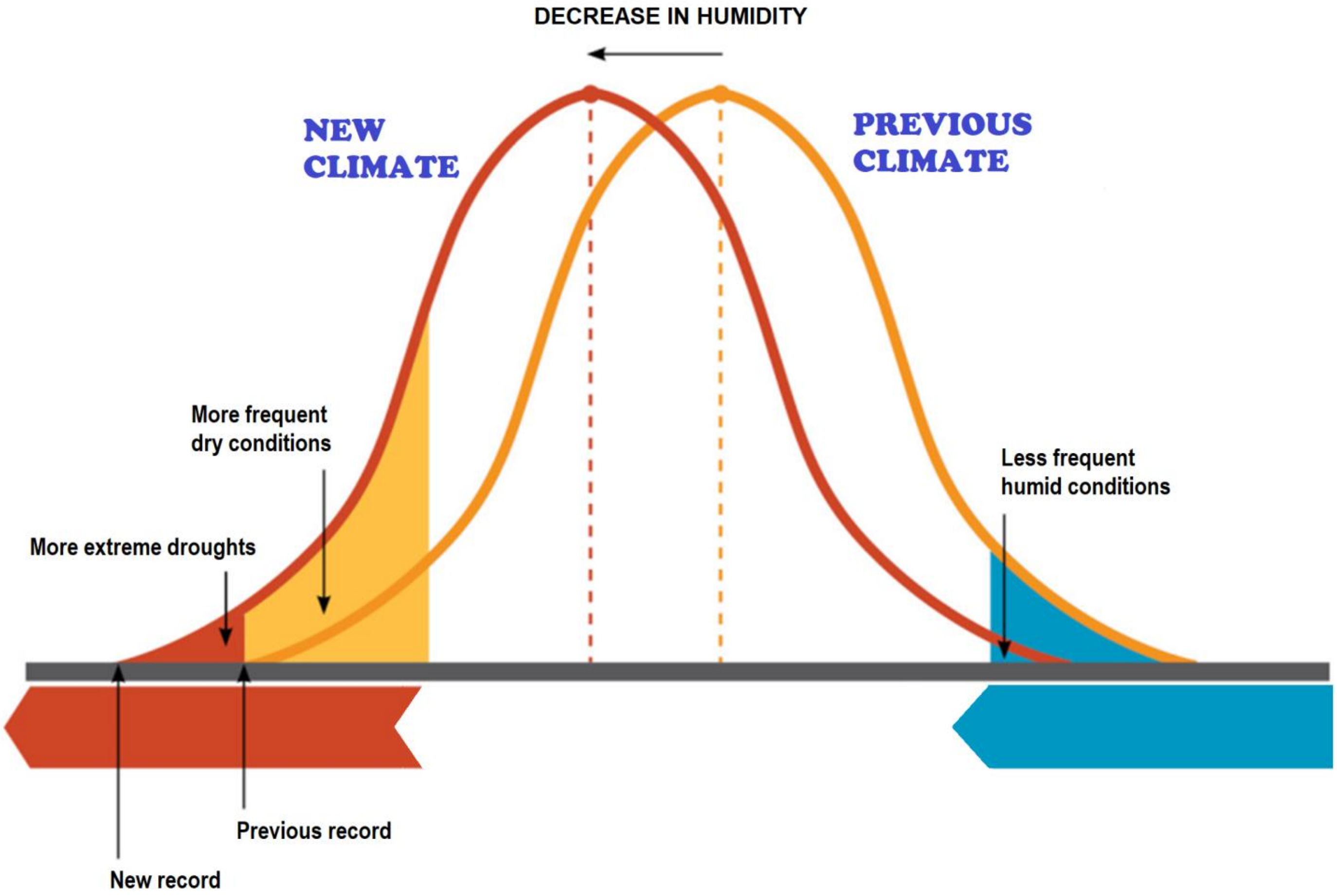
Tabela 2. Evolução das áreas dos estabelecimentos agropecuários com uso de irrigação no Brasil, nas Grandes Regiões brasileiras e nos estados nordestinos: anos de 1996, 2006 e 2017

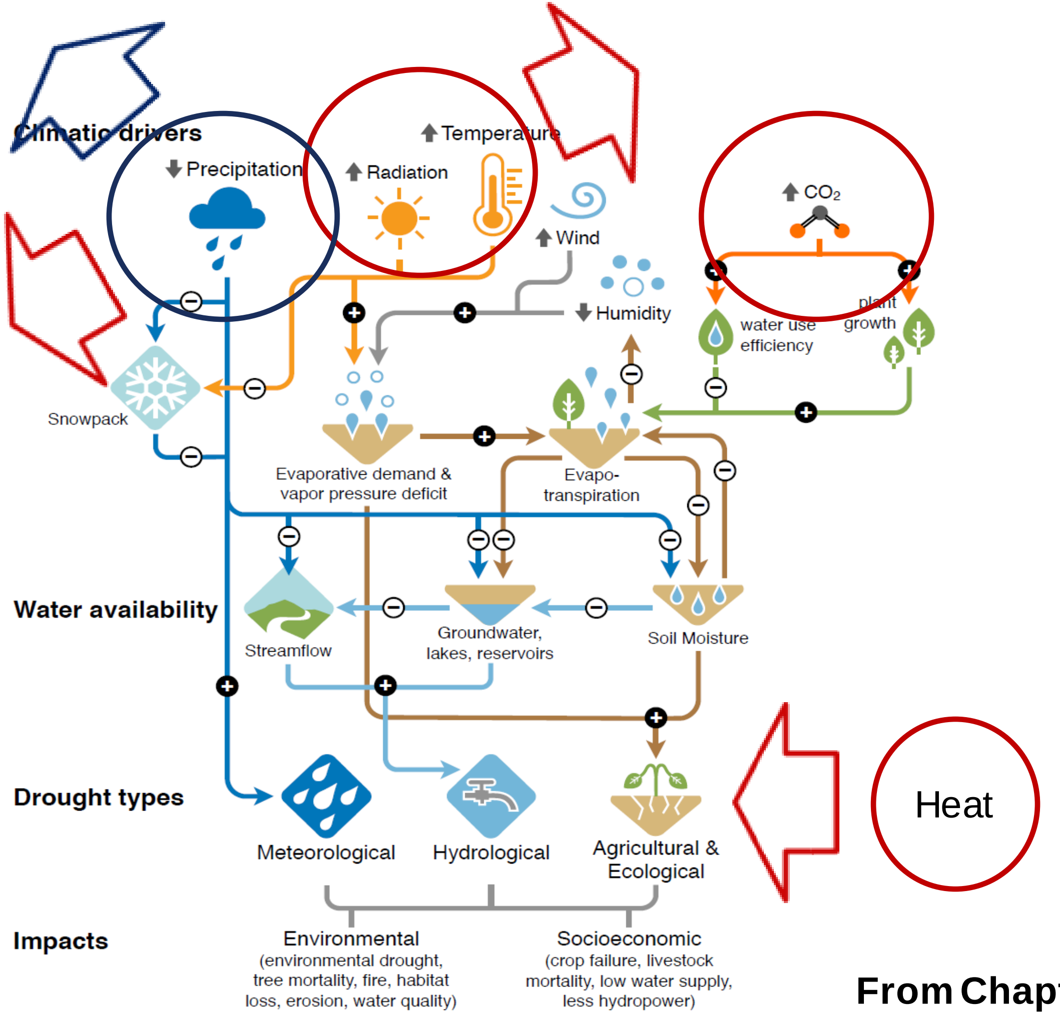
Região	Área irrigada			Diferenças			Relações		
	1996 (a)	2006 (b)	2017 (c)	(b-a)	(c-b)	(c-a)	(b/a)	(c/b)	(c/a)
	ha			ha			%		
Brasil	3121642	4545534	6902960	1423892	2357426	3781318	145,61	151,86	221,13
Norte	83022	109582	372530	26560	262948	289508	131,99	339,96	448,71
Nordeste	751886	1007657	1269136	255771	261479	517250	134,02	125,95	168,79
Sudeste	929189	1607681	2666816	678492	1059135	1737627	173,02	165,88	287,00
Sul	1096592	1238812	1731517	142220	492705	634925	112,97	139,77	157,90
Centro-Oeste	260952	581801	862961	320849	281160	602009	222,95	148,33	330,70
Maranhão	16521	64059	64473	47538	414	47952	387,74	100,65	390,25
Piauí	18254	30948	32968	12694	2020	14714	169,54	106,53	180,61
Ceará	108998	117381	222478	8383	105097	113480	107,69	189,53	204,11
Rio Grande do Norte	45778	54716	56632	8938	1916	10854	119,52	103,50	123,71
Paraíba	63548	58683	105178	-4865	46495	41630	92,34	179,23	165,51
Pernambuco	118400	152917	192806	34517	39889	74406	129,15	126,09	162,84
Alagoas	156992	195764	150382	38772	-45382	-6610	124,70	76,82	95,79
Sergipe	13691	20521	29089	6830	8568	15398	149,89	141,75	212,47
Bahia	209705	312668	415128	102963	102460	205423	149,10	132,77	197,96

Fonte: IBGE (1998); IBGE (2007); IBGE (2012); IBGE (2018)

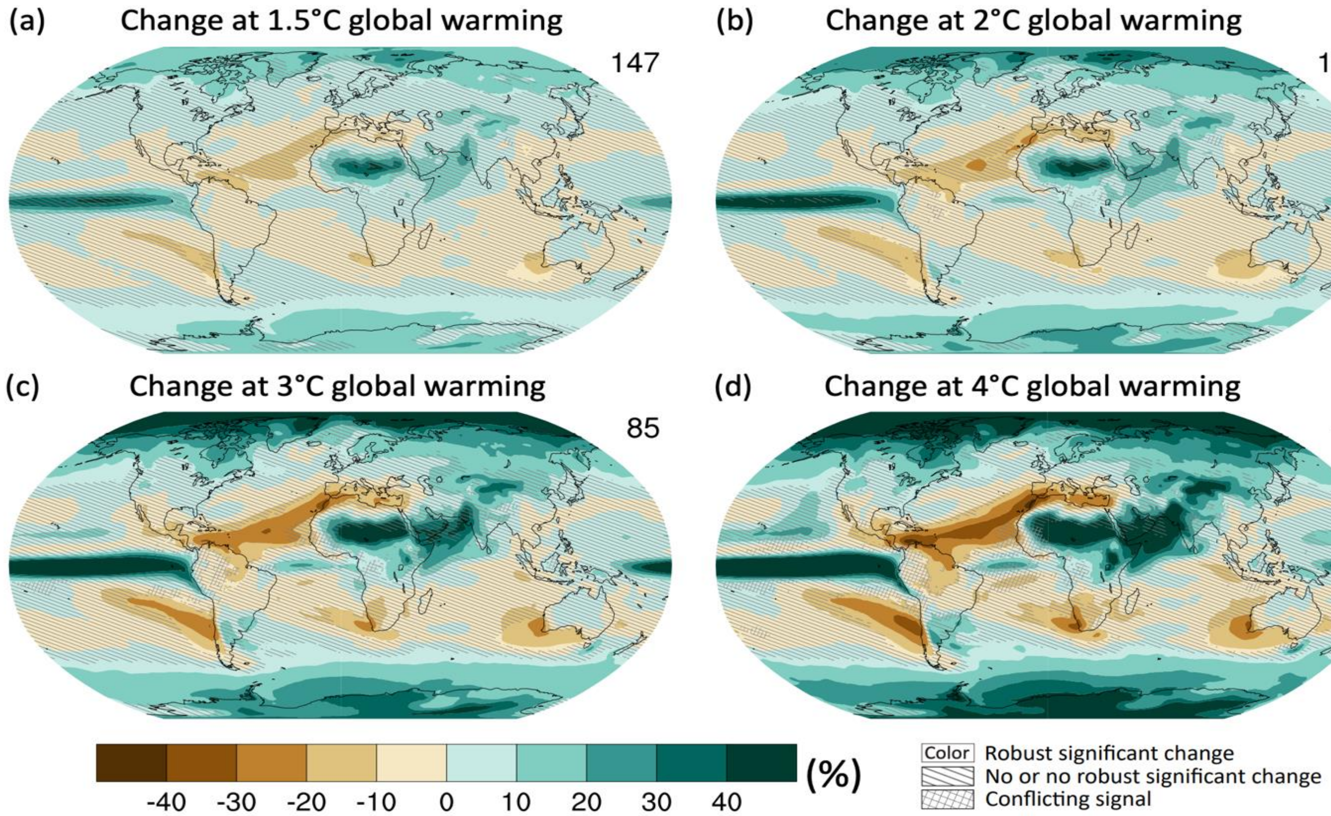


Future projections


DECREASE IN HUMIDITY
NEW CLIMATE
PREVIOUS CLIMATE
More frequent dry conditions
Less frequent humid conditions
More extreme droughts
Previous record
New record



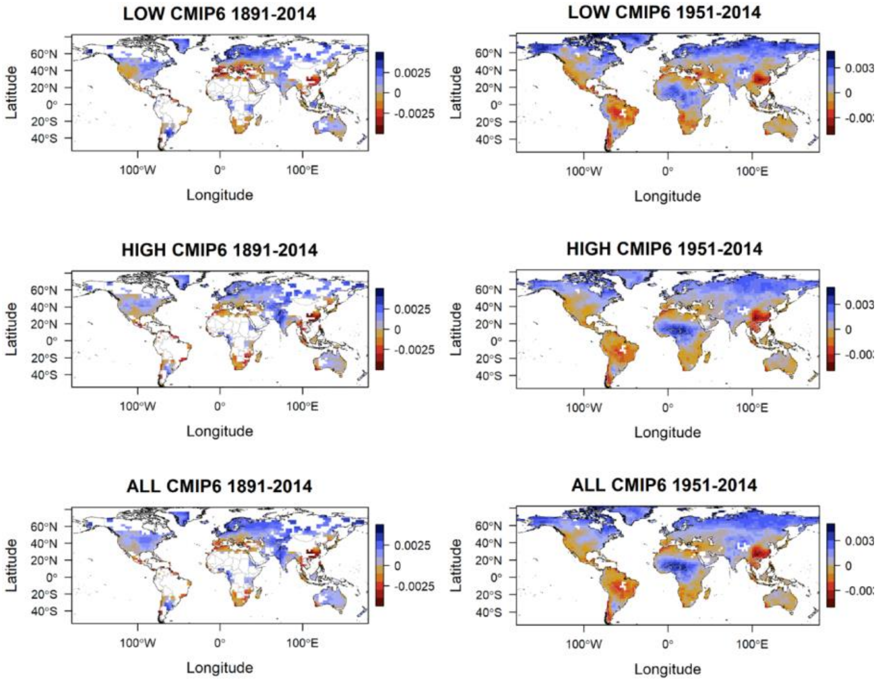
From Chapter 8. IPCC AR6, WGI


(a) Change at 1.5°C global warming
147
(b) Change at 2°C global warming
132
(c) Change at 3°C global warming
85
(d) Change at 4°C global warming
47
-40 -30 -20 -10 0 10 20 30 40
(%)
Color Robust significant change
No or no robust significant change
Conflicting signal

Climate Dynamics (2022) 58:2825–2842
https://doi.org/10.1007/s00382-021-06034-x

Do CMIP models capture long-term observed annual precipitation trends?

S. M. Vicente-Serrano[1] · R. García-Herrera[2,3] · D. Peña-Angulo[1] · M. Tomas-Burguera[4] · F. Domínguez-Castro[5,6] · I. Noguera[1] · N. Calvo[2] · C. Murphy[7] · R. Nieto[8,9] · L. Gimeno[8,9] · J. M. Gutierrez[10] · C. Azorin-Molina[11] · A. El Kenawy[12,13]



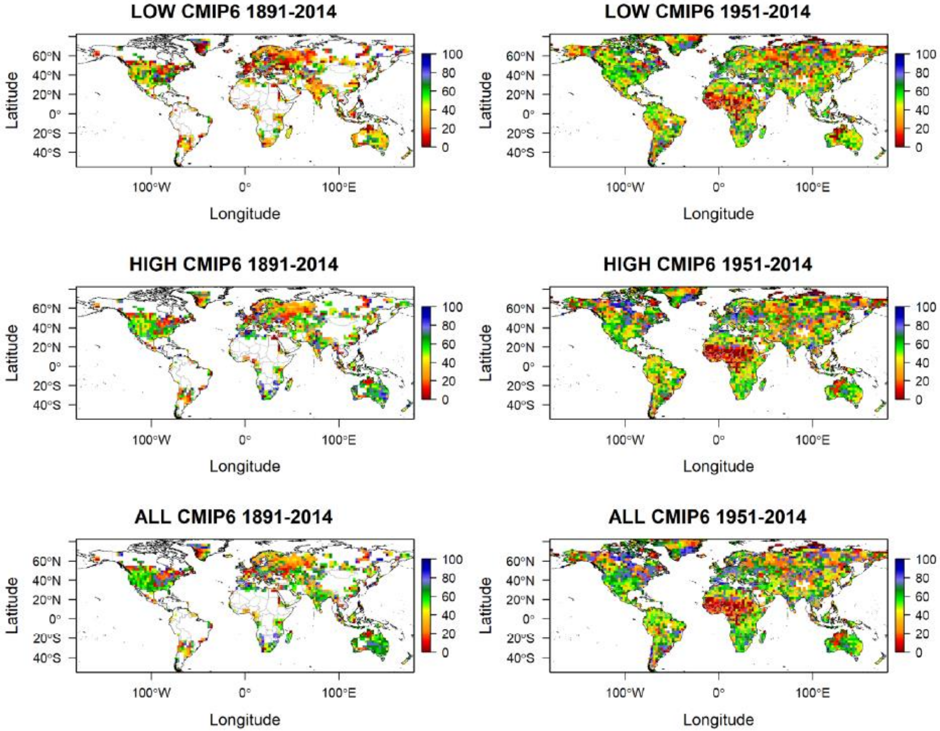
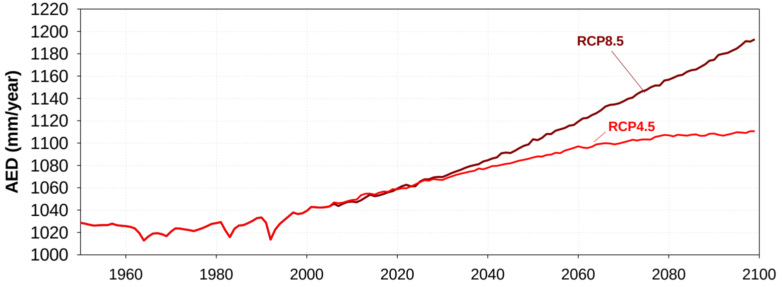
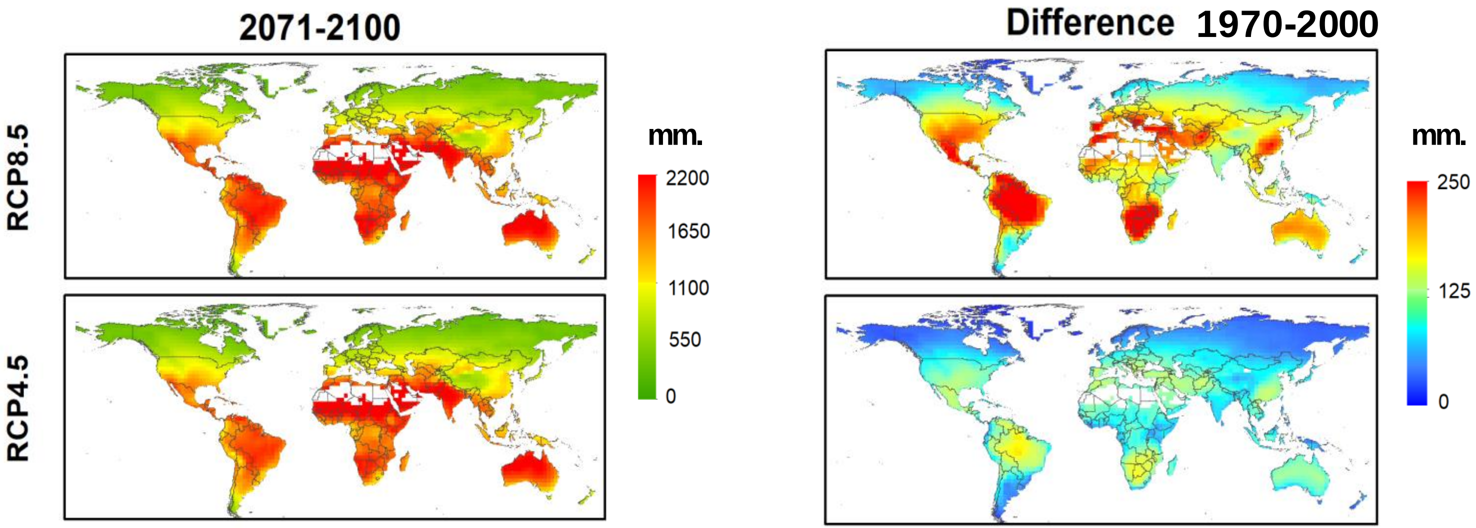


Fig. 8 Percentage of models in each CMIP6 group showing the same sign and significance of the observed annual precipitation trends


AED (mm/year)
1000
1020
1040
1060
1080
1100
1120
1140
1160
1180
1200
1220
1960
1980
2000
2020
2040
2060
2080
2100
RCP8.5
RCP4.5

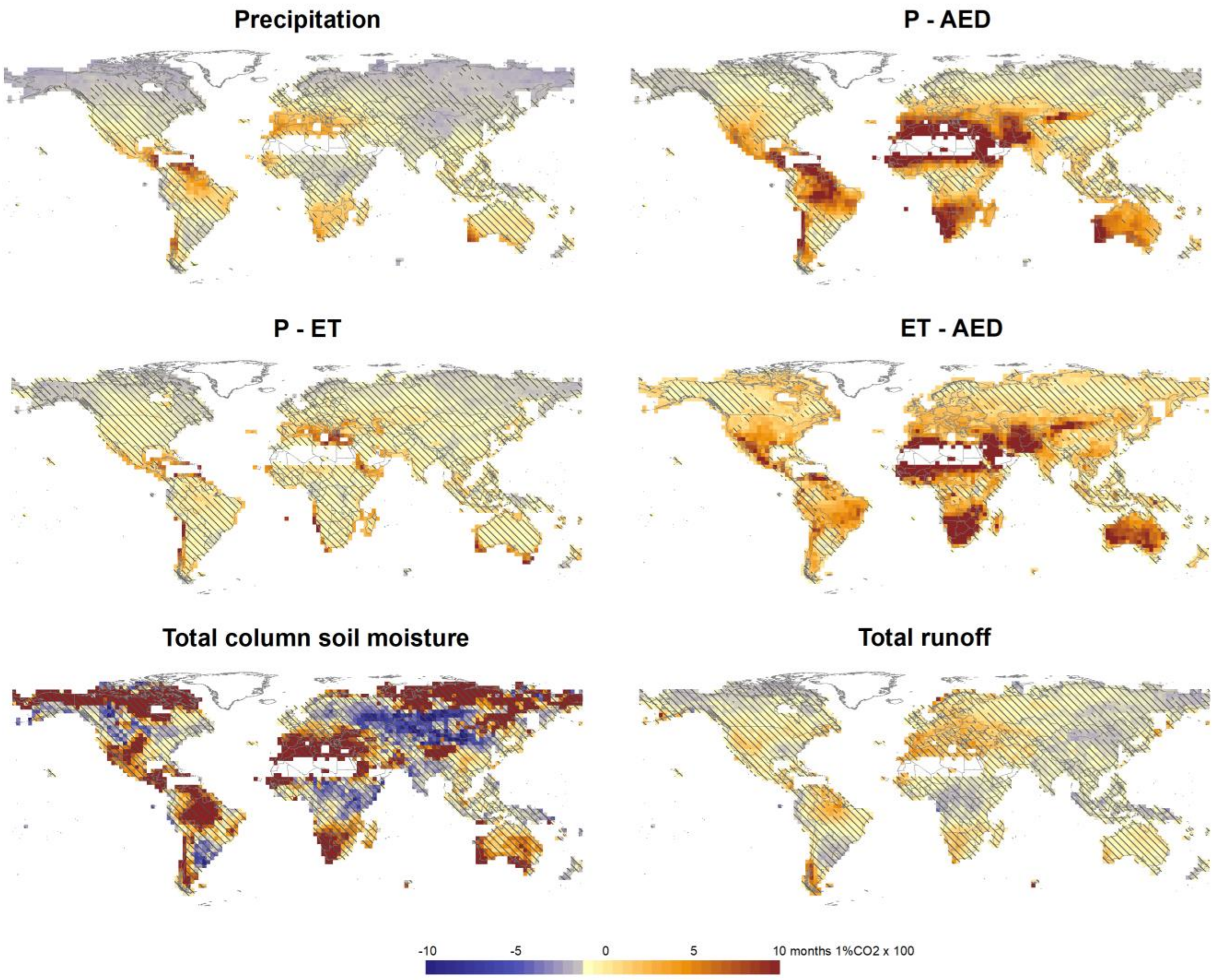

2071-2100
Difference 1970-2000
RCP8.5
RCP4.5
mm.
2200
1650
1100
550
0
mm.
250
125
0

Change in drought duration (in months) per % of CO2 increase.

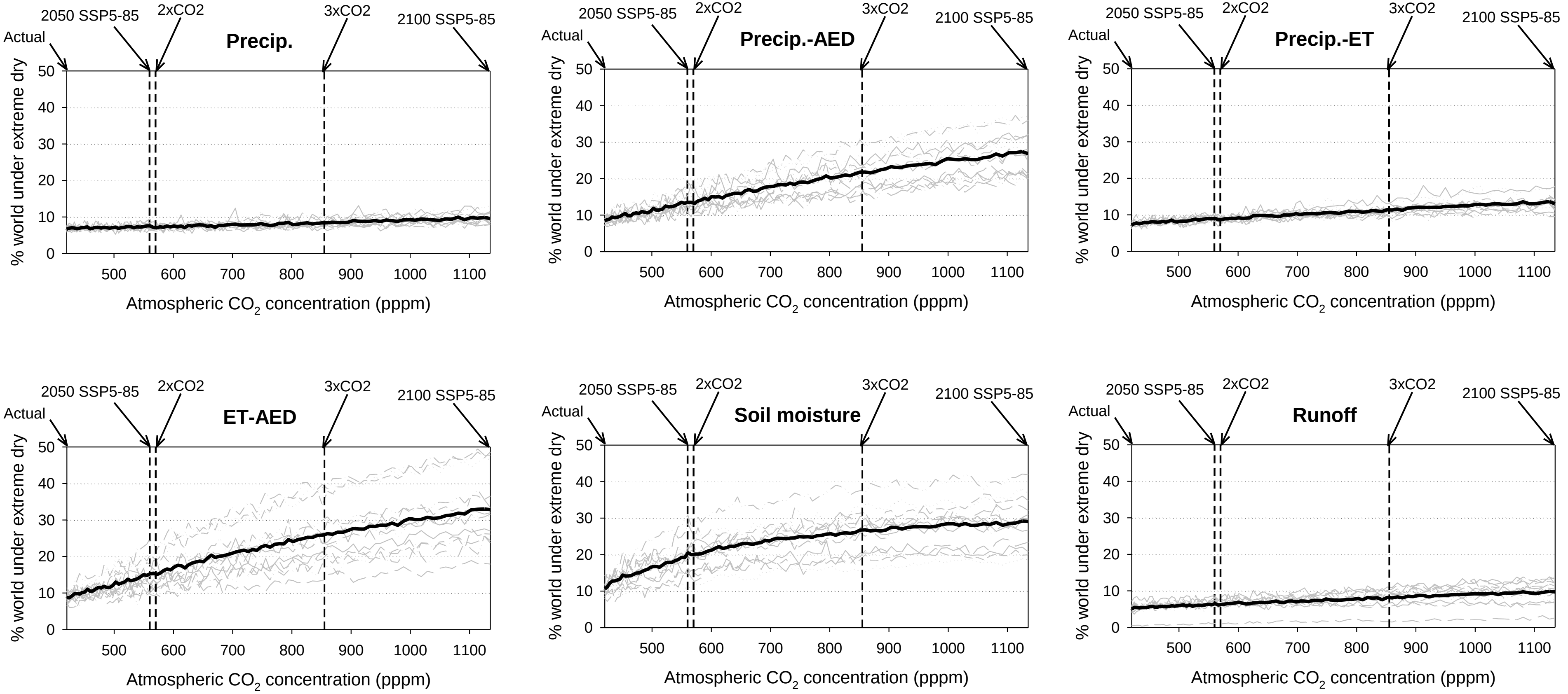
Median of the change in the 13 models

Sttipling represent less than 70% of models with significant trends of the same sign of change that the median.

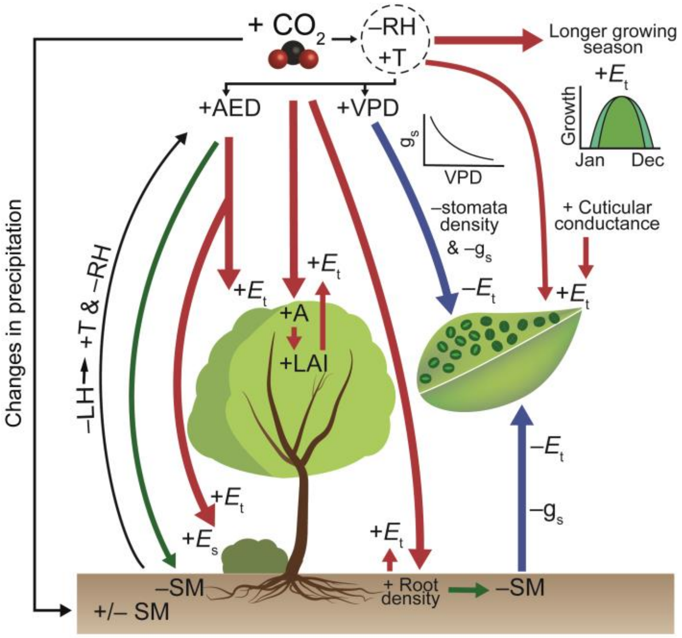
Drought events identified at a threshold of 0 (similar results for tresholds of 1 in 5 years and 1 in 20 years)

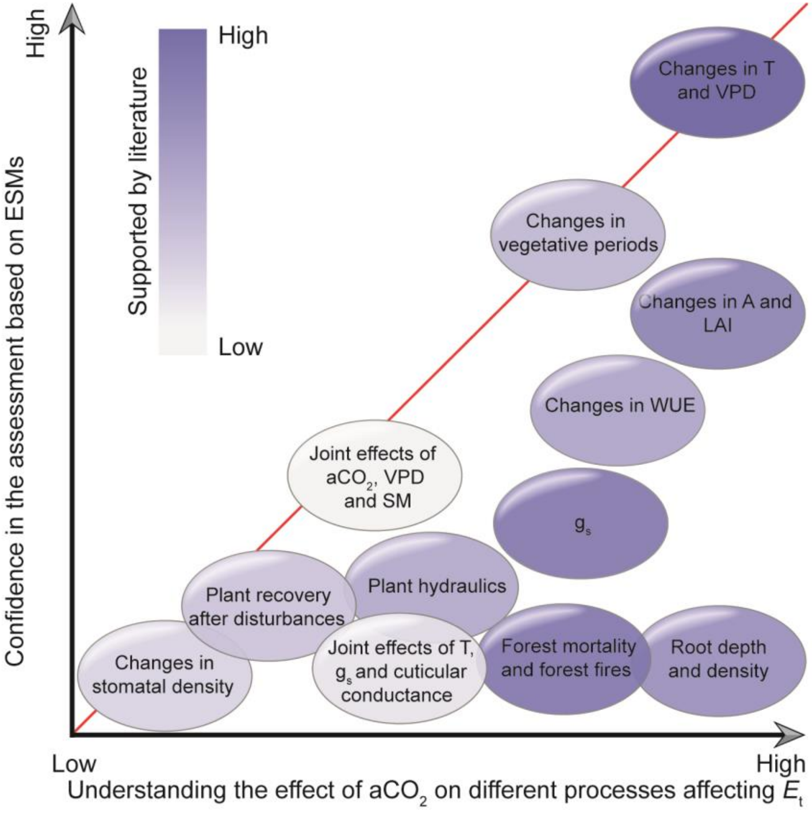


% of world with values below 5th PERCENTILE determined from preindustrial to actual as reference for the future



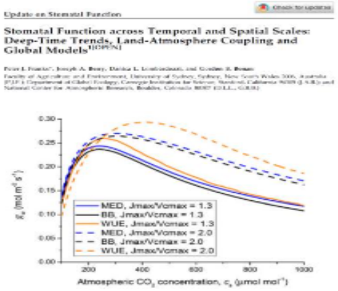
Mechanisms driving the effects of CO_2 on E_t



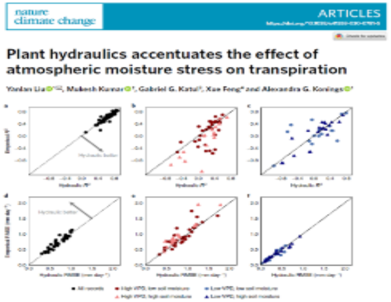


Still important uncertainties.

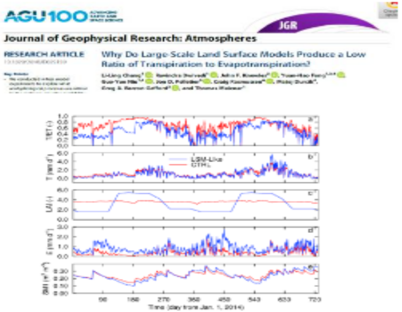
Uncertainties in the estimation of g_s by the models



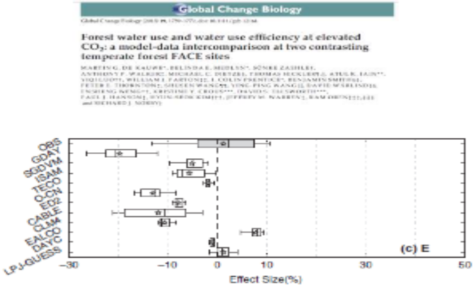
Limitations to reproduce plant hydraulics



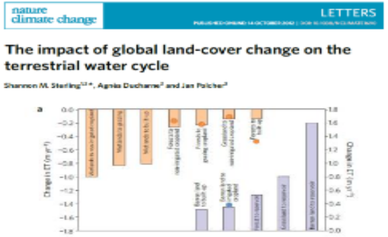
Underestimation of the ratio between T and ET



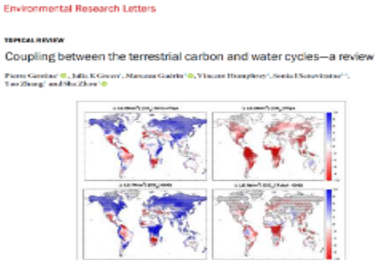
Divergence between models to reproduce ET



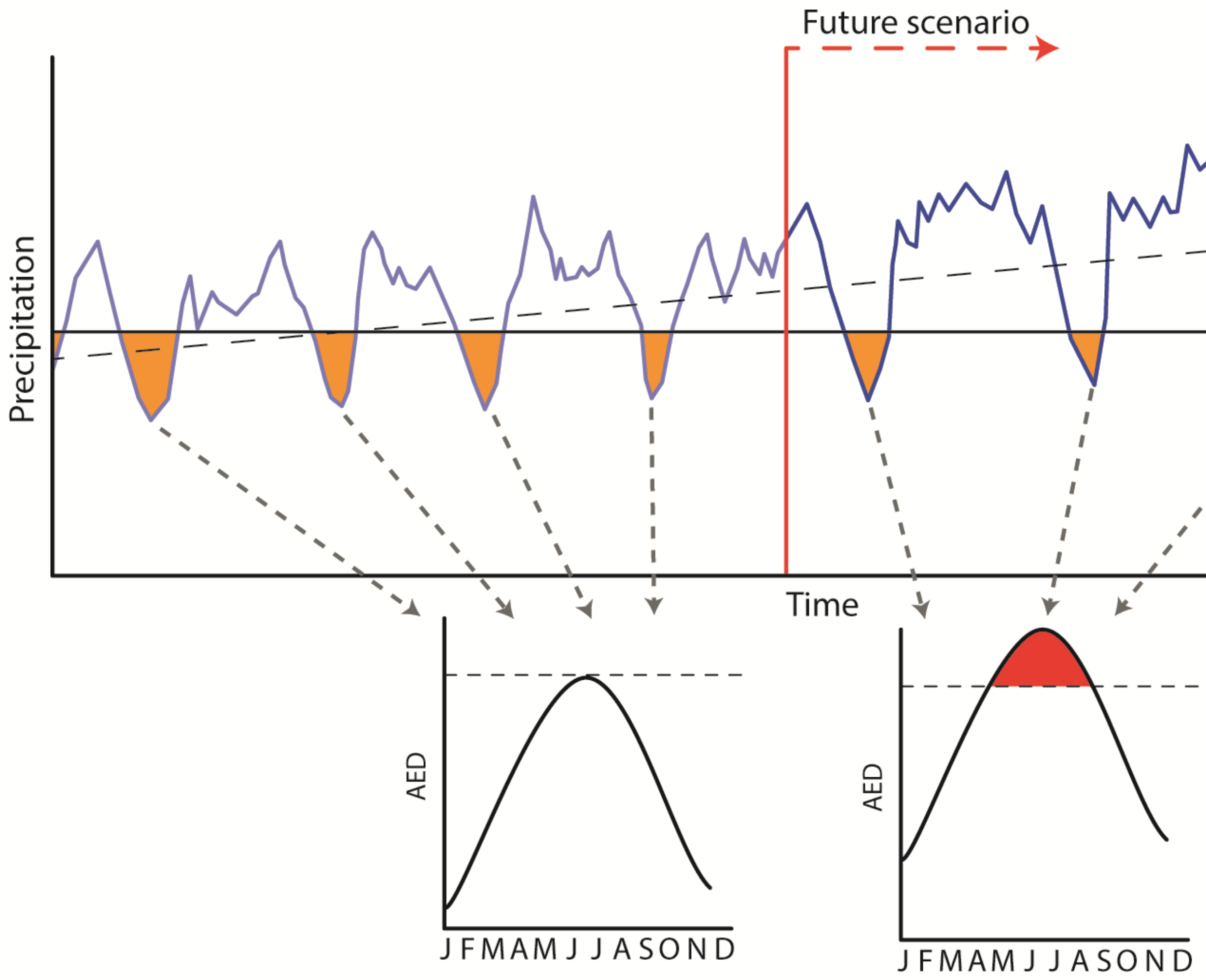
Dynamical vegetation models and land management practices are not included

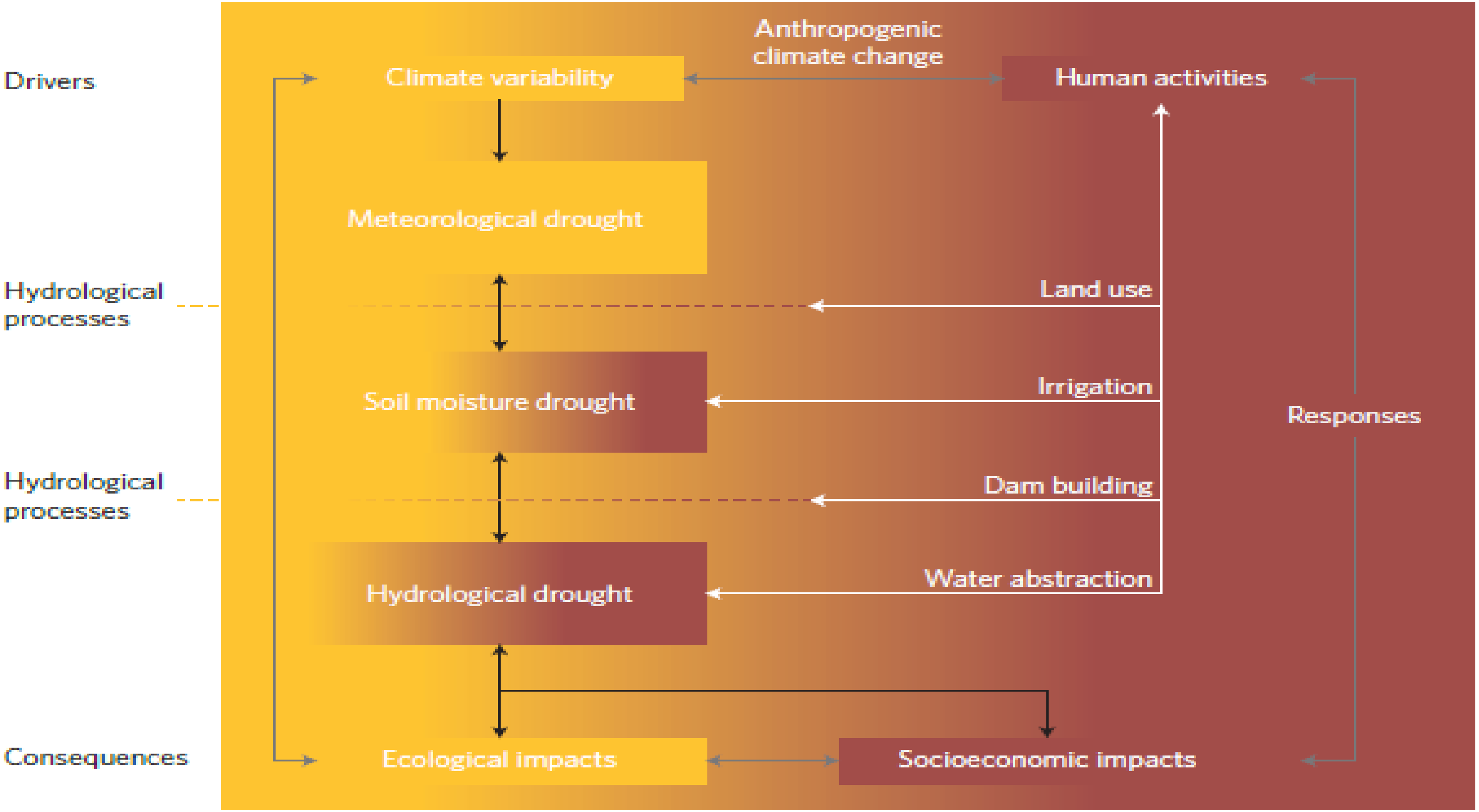


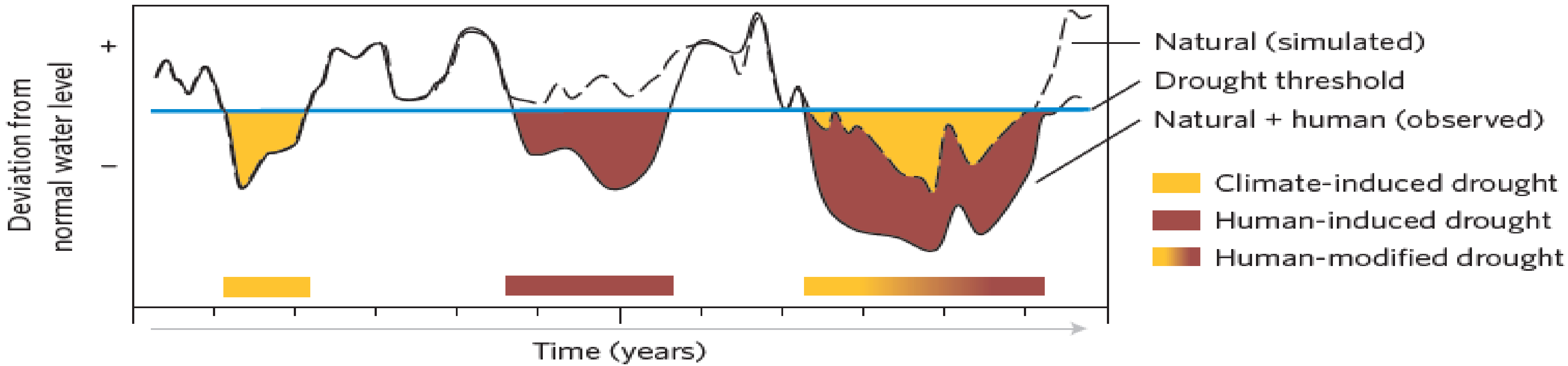
Physiological effects diverge among models



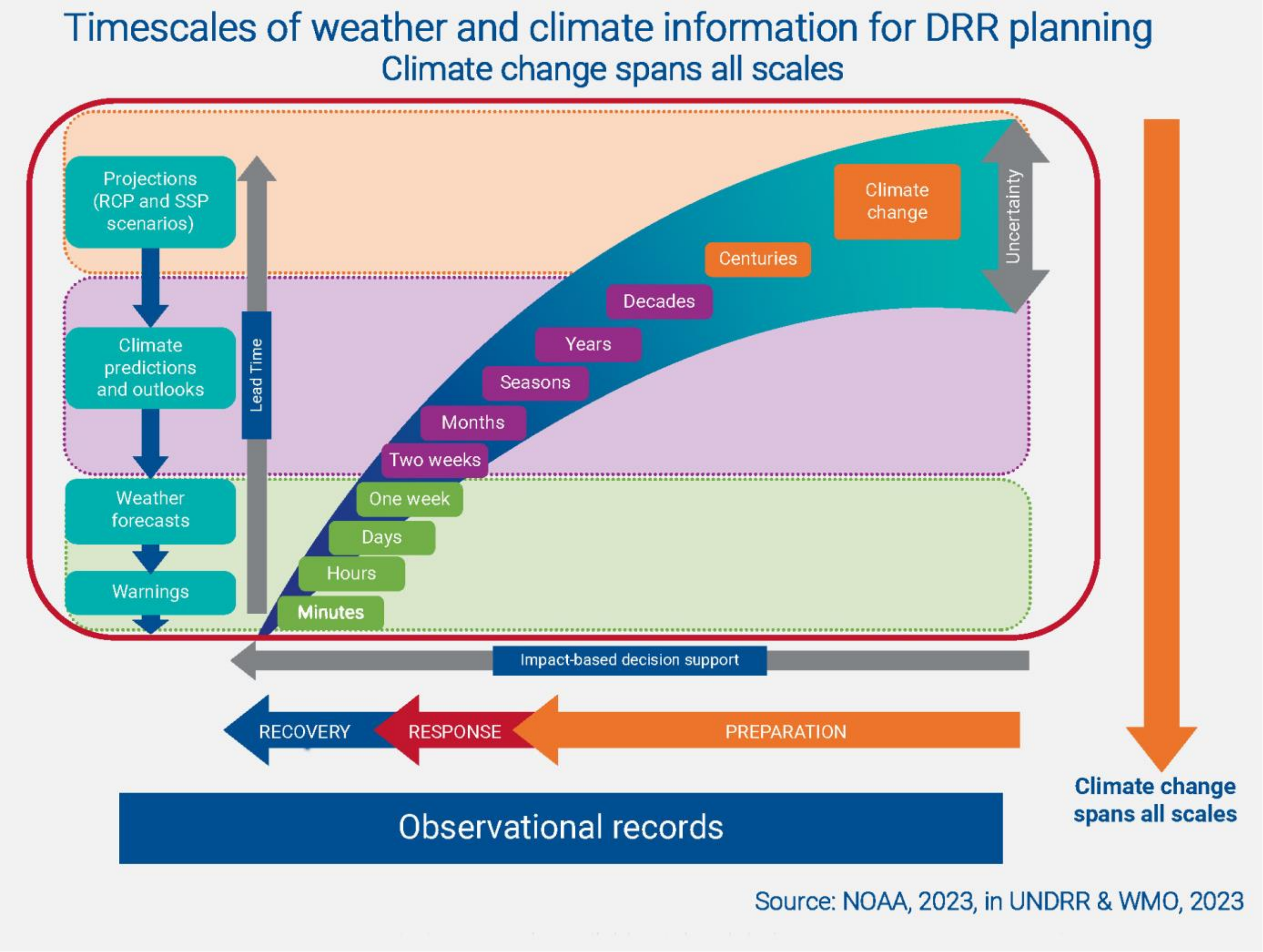




Future scenario
Precipitation
Time
AED
J F M A M J J A S O N D
AED
J F M A M J J A S O N D

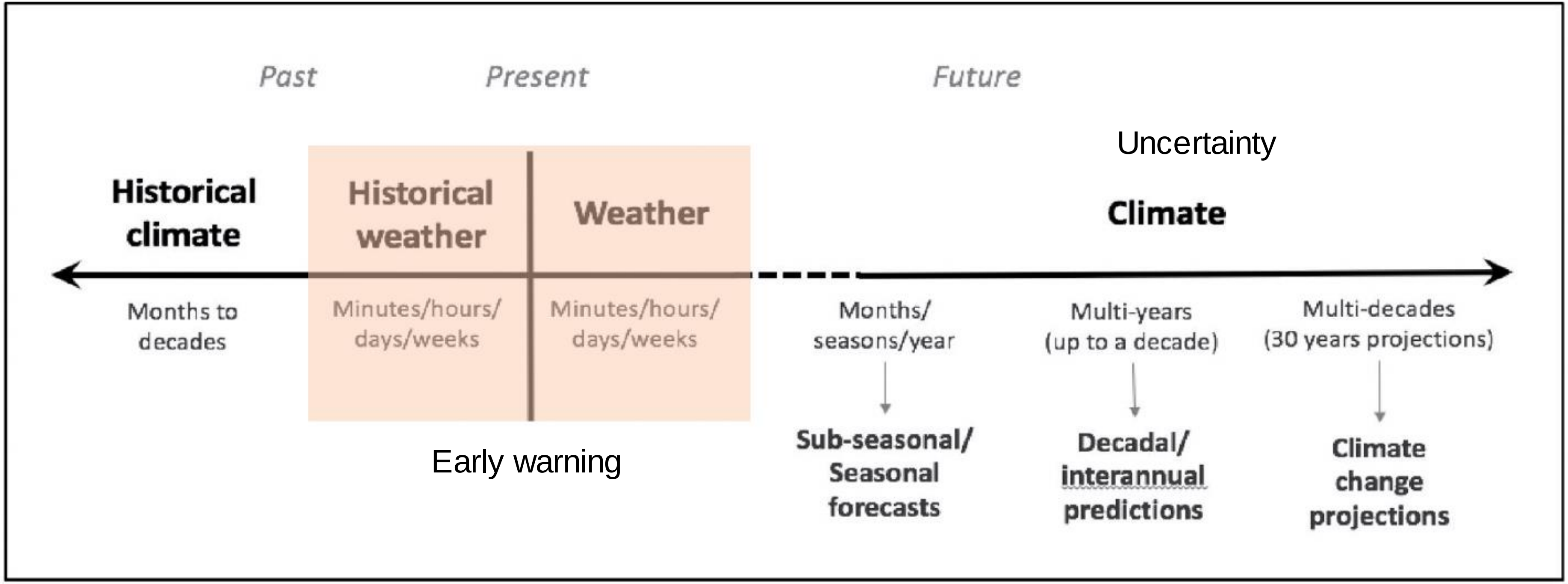

Drivers
Hydrological processes
Hydrological processes
Consequences
Climate variability
Anthropogenic climate change
Human activities
Meteorological drought
Land use
Soil moisture drought
Irrigation
Responses
Dam building
Hydrological drought
Water abstraction
Ecological impacts
Socioeconomic impacts


Deviation from normal water level
+
–
Time (years)
Natural (simulated)
Drought threshold
Natural + human (observed)
Climate-induced drought
Human-induced drought
Human-modified drought

Drought climate services



Timescales of weather and climate information for DRR planning
Climate change spans all scales
Projections (RCP and SSP scenarios)
Climate predictions and outlooks
Weather forecasts
Warnings
Lead Time
Climate change
Uncertainty
Centuries
Decades
Years
Seasons
Months
Two weeks
One week
Days
Hours
Minutes
Impact-based decision support
RECOVERY
RESPONSE
PREPARATION
Observational records
Climate change spans all scales
Source: NOAA, 2023, in UNDRR & WMO, 2023

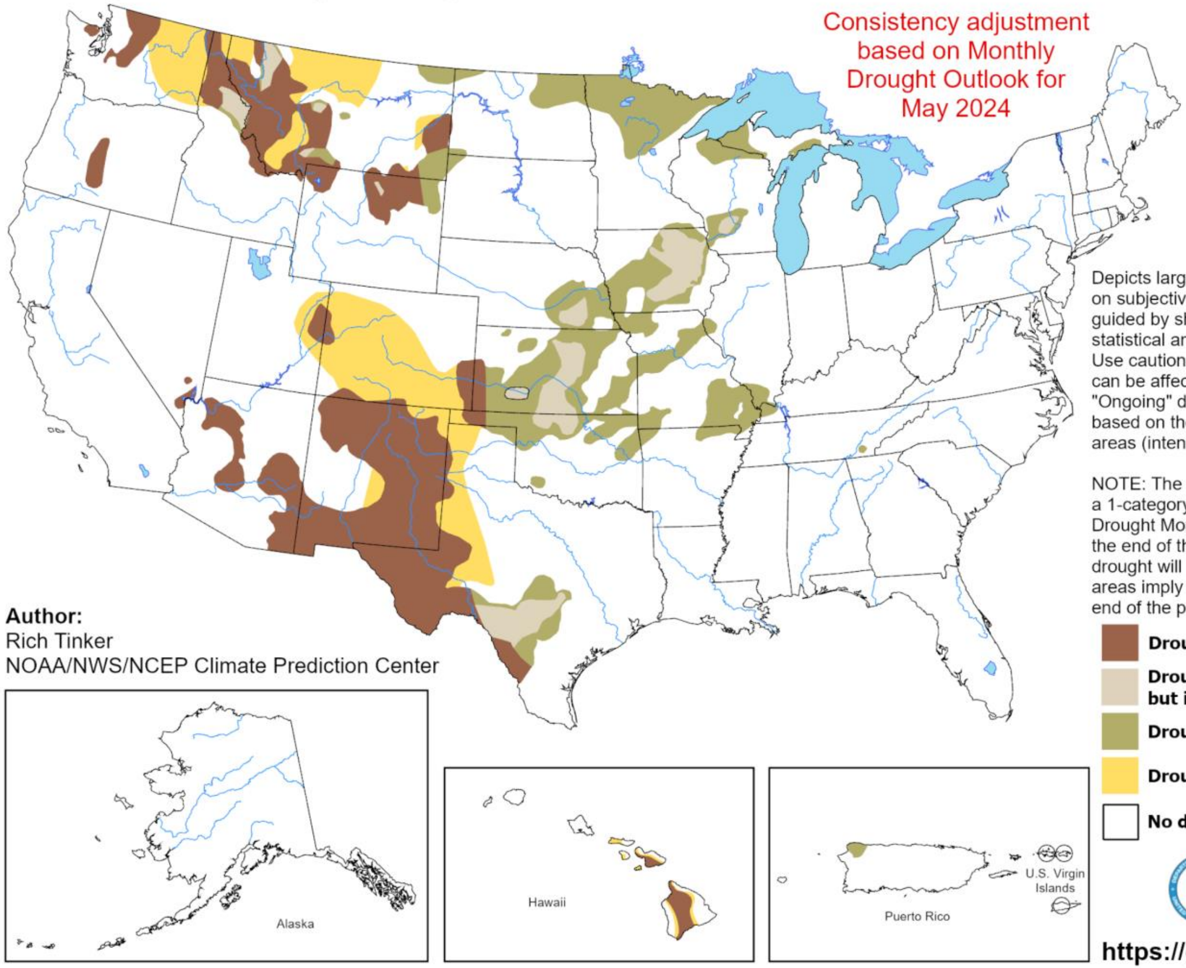


https://doi.org/10.1016/j.cliser.2017.06.001

U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for May 1 - July 31, 2024
Released April 30, 2024



Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

- **Drought persists**
- **Drought remains, but improves**
- **Drought removal likely**
- **Drought development likely**
- **No drought**

Author:
Rich Tinker
NOAA/NWS/NCEP Climate Prediction Center

https://go.usa.gov/3eZ73

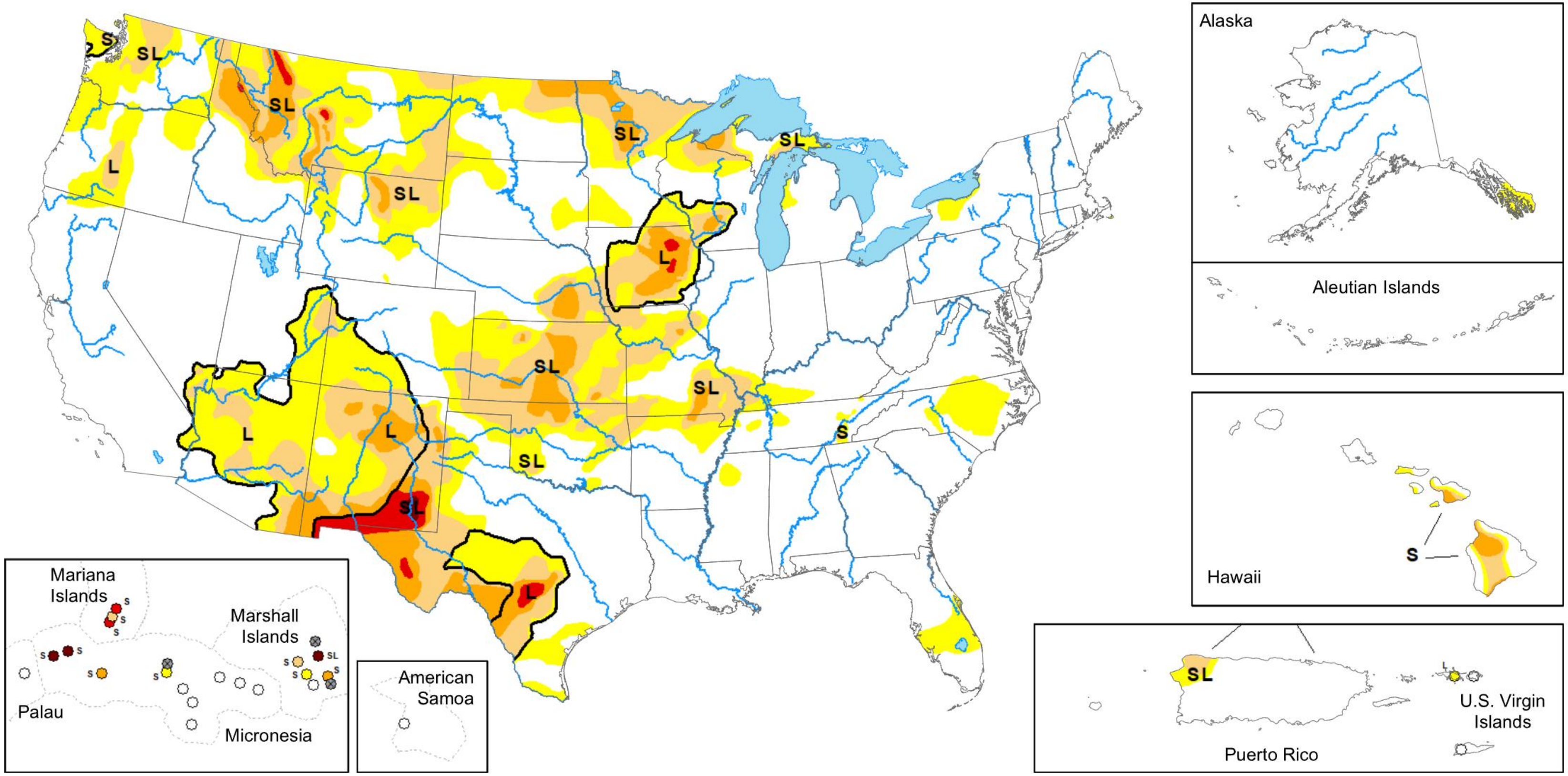
What can be expected from an efficient drought monitoring system?

- Comprehensible.
- Frequent updates, i.e. real-time.
- Spatially comparable.
- Useful to monitor different drought types.
- Low-resources requirement.

Map released: April 25, 2024

Data valid: April 23, 2024

View grayscale version of the map



THE U.S. DROUGHT MONITOR NETWORK

IMPROVING DROUGHT EARLY WARNING

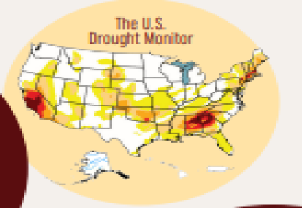
Based on a survey of the network by the National Drought Mitigation Center, with funding by the National Integrated Drought Information System.

NDMC NATIONAL DROUGHT MITIGATION CENTER UNIVERSITY OF NEBRASKA

NIDIS

Q WHAT IS THE U.S. DROUGHT MONITOR NETWORK?

a A group of 425+ observers from across the country who supply input about local conditions or impacts to the authors of the U.S. Drought Monitor map.



Q WHAT BENEFITS?

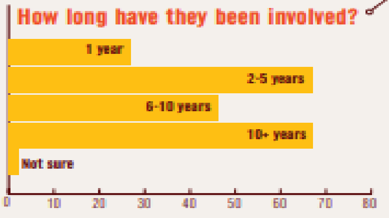
a
- The science of drought
- Awareness
- Communication
- Decision-making
- Credibility
- Validity
- Local characterization of drought
- Network member organization

89% say the USDM process has improved the ability to provide early drought warnings in the United States.

Q WHO ARE THE OBSERVERS?

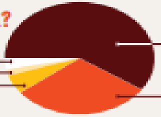
a
- Climatologists
- Meteorologists
- Hydrologists
- Remote sensing specialists
- Ag scientists
- Biologists
- Natural resource scientists
- Social scientists

How long have they been involved?



*209 participated in this survey question

Where do they work?



Benefits to the nation

Benefits to science

* Each graphic reflects 100 percent of responses; not every participant answered every question.

What to use for drought monitoring?

Sources of water resources:
reservoir storages, streamflow and groundwater

Water available for plants vs demand:
Soil moisture, evapotranspiration, atmospheric evaporative demand, vegetation metrics: satellites…

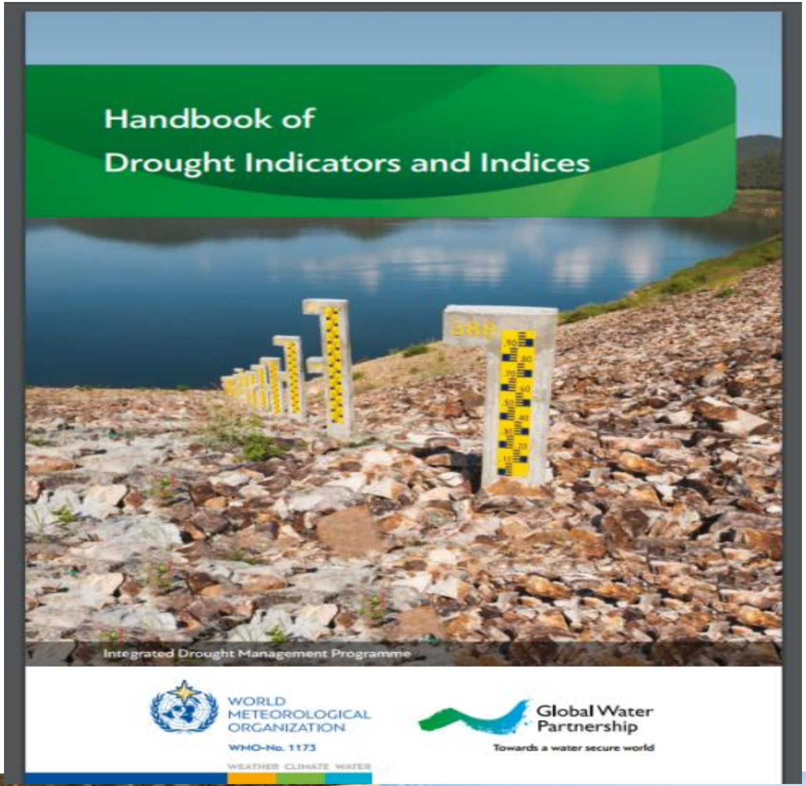
Is this information available? On real-time? Uncertainty?

Usually the origin and severity of drought events is strongly determined by climate anomalies: precipitation deficits and high atmospheric evaporative demand.

This information is available on real-time in the national meteorological services with the actual network of automatic meteorological stations.

This information can be used to generate drought indices that are useful to monitor drought: they are highly correlated with drought impacts.

DROUGHT INDICES



Agricultural Drought Index	Rainfall	Temp.	Estimated soil moisture	Vegetation index	Stream flow	Potential evapo-transpiration	Crop coefficient	Soil type
Palmer Drought Severity Index	X	X						
Deciles	X							
Prescott Ratio Index								
Hutchinson Index	X							
Plant Growth Index								
Soil Moisture Anomaly	X	X	X?					
Enhanced Vegetation Index								
TCI								
NDVI								
Aridity Anomaly Index	X		X			X		
Two reservoir water balance model	X					X		
Soil Water Index	X			X		X		X
scPDSI	X	X						
Drought Severity Index	X							
Warm-spell duration Index		X						
Cold-spell duration Index		X						
Simple Daily Intensity Index	X							
Relative Soil Moisture	X	X	X			X		
Relative Water Deficit	X	X	X			X		
Accumulated Water Deficiency	X	X	X			X		
Accumulated Drought Index	X	X				X		
Crop Moisture Index (CMI)	X					X		
Days without rainfall	X							
Soil Moisture						X		
SPEI	X	X						
CMI-Palmer based	X	X						
Crop Specific ET	X	X						
Drought Monitor	X	X	X	X	X	X		
Standardized Precipitation Index (SPI)	X							
Percent Normal	X							
Relative Soil Moisture	X	X	X					
Soil Moisture Anomaly	X	X						
Cumulative rainfall	X							

Sivakumar et al. (2010): Agricultural Drought Indices, WMO

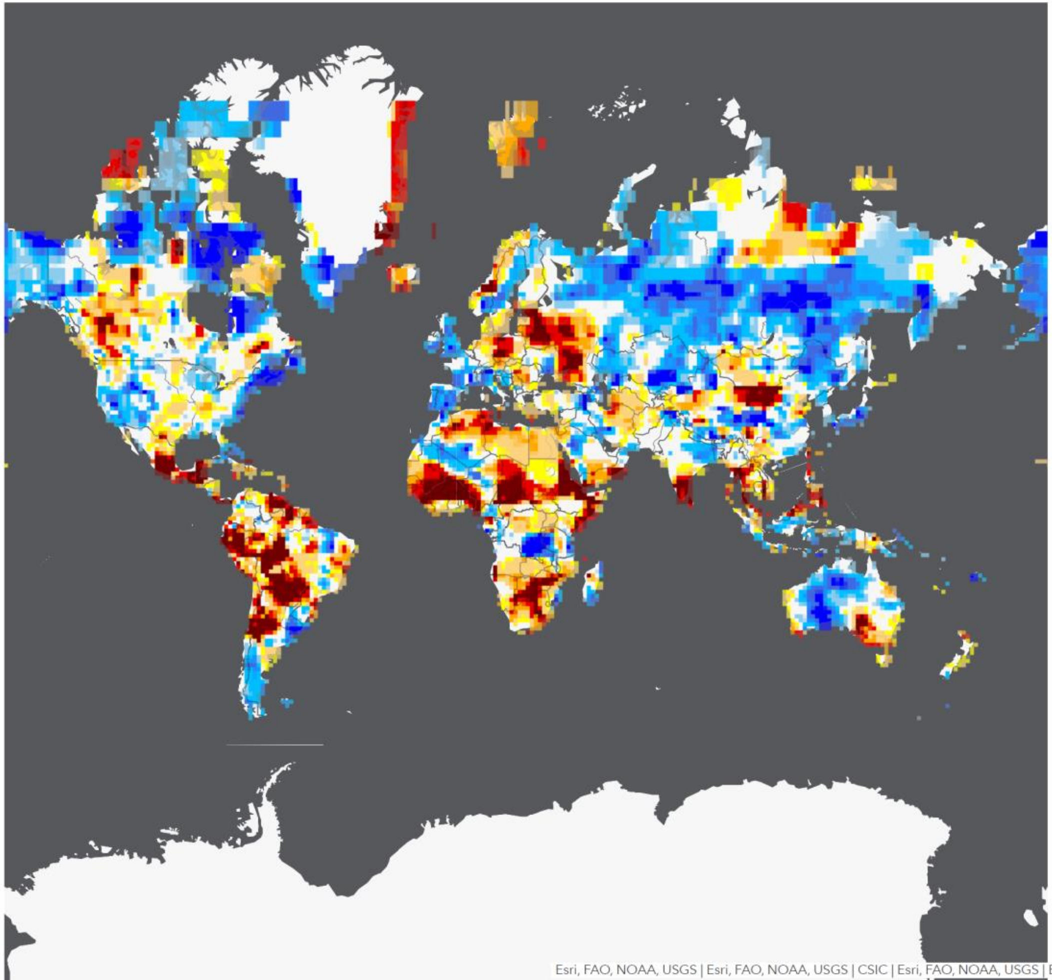


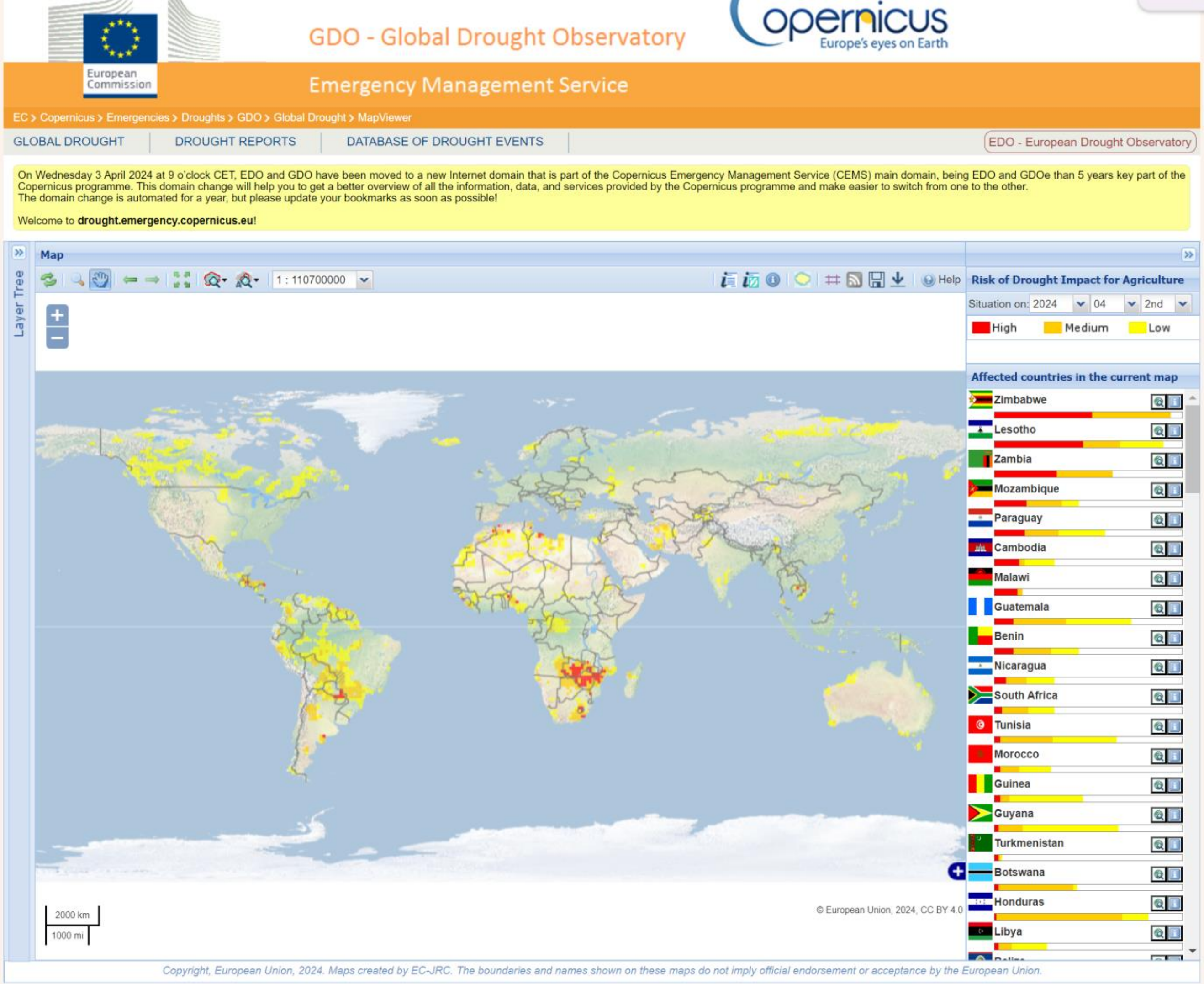

Global Drought Data Global Drought Information System

Capas

- [ ] World Countries (Generalized) - Light Borders
- [ ] World Countries (Generalized) - Dark Borders
- [ ] North American Drought Monitor (NADM) [NDMC]
- [ ] European Combined Drought Indicator (CDI) [EDO]
- [ ] GPCC Global Drought Index (DI) [DWD] - 1 month
- [ ] GPCC Global Drought Index (DI) [DWD] - 3 month
- [ ] GPCC Global Drought Index (DI) [DWD] - 6 month
- [ ] GPCC Global Drought Index (DI) [DWD] - 9 month
- [ ] GPCC Global Drought Index (DI) [DWD] - 12 month
- [ ] GPCC Global Drought Index (DI) [DWD] - 24 month
- [ ] GPCC Global Drought Index (DI) [DWD] - 48 month
- [x] GPCC Standardized Precipitation Evapotranspiration Index (SPEI) [CSIC] - 1 month
- [ ] GPCC Standardized Precipitation Evapotranspiration Index (SPEI) [CSIC] - 2 month
- [ ] GPCC Standardized Precipitation Evapotranspiration Index (SPEI) [CSIC] - 3 month
- [ ] GPCC Standardized Precipitation Evapotranspiration Index (SPEI) [CSIC] - 6 month
- [ ] GPCC Standardized Precipitation Evapotranspiration Index (SPEI) [CSIC] - 9 month
- [ ] GPCC Standardized Precipitation Evapotranspiration Index (SPEI) [CSIC] - 12 month
- [ ] GPCC Standardized Precipitation Evapotranspiration Index (SPEI) [CSIC] - 24 month
- [ ] GPCC Standardized Precipitation Evapotranspiration Index (SPEI) [CSIC] - 36 month
- [ ] GPCC Standardized Precipitation Evapotranspiration Index (SPEI) [CSIC] - 48 month
- [ ] MERRA2 Evaporative Demand Drought Index (EDDI) [NOAA ESRL] - 1 month
- [ ] MERRA2 Evaporative Demand Drought Index (EDDI) [NOAA ESRL] - 2 month
- [ ] MERRA2 Evaporative Demand Drought Index (EDDI) [NOAA ESRL] - 3 month
- [ ] MERRA2 Evaporative Demand Drought Index (EDDI) [NOAA ESRL] - 6 month

cargando...




GDO - Global Drought Observatory
opernicus
Europe's eyes on Earth
European Commission
Emergency Management Service
EC > Copernicus > Emergencies > Droughts > GDO > Global Drought > MapViewer
GLOBAL DROUGHT
DROUGHT REPORTS
DATABASE OF DROUGHT EVENTS
EDO - European Drought Observatory
On Wednesday 3 April 2024 at 9 o'clock CET, EDO and GDO have been moved to a new Internet domain that is part of the Copernicus Emergency Management Service (CEMS) main domain, being EDO and GDOe than 5 years key part of the Copernicus programme. This domain change will help you to get a better overview of all the information, data, and services provided by the Copernicus programme and make easier to switch from one to the other.
The domain change is automated for a year, but please update your bookmarks as soon as possible!
Welcome to drought.emergency.copernicus.eu!
Map
Layer Tree
1 : 110700000
Help
Risk of Drought Impact for Agriculture
Situation on: 2024 04 2nd
High
Medium
Low
Affected countries in the current map
Zimbabwe
Lesotho
Zambia
Mozambique
Paraguay
Cambodia
Malawi
Guatemala
Benin
Nicaragua
South Africa
Tunisia
Morocco
Guinea
Guyana
Turkmenistan
Botswana
Honduras
Libya
2000 km
1000 mi
© European Union, 2024, CC BY 4.0
Copyright, European Union, 2024. Maps created by EC-JRC. The boundaries and names shown on these maps do not imply official endorsement or acceptance by the European Union.

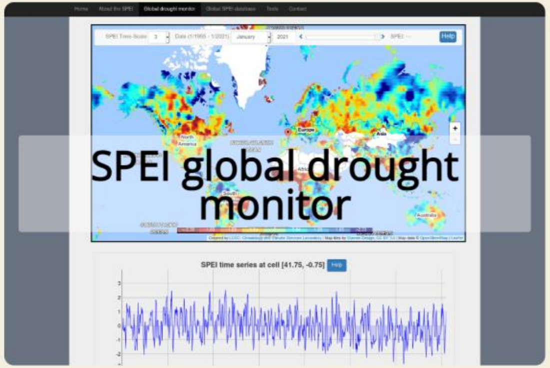
Climatology and Climate Services Laboratory

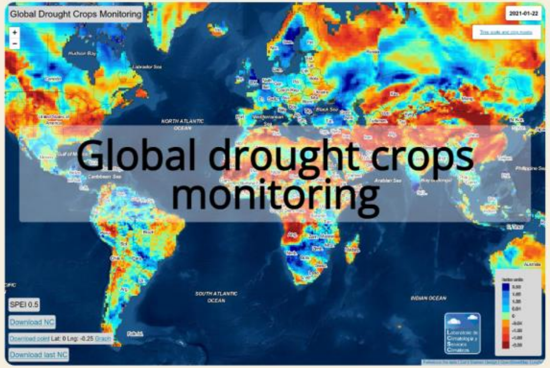
Laboratory of
Climate
Services and
Climatology

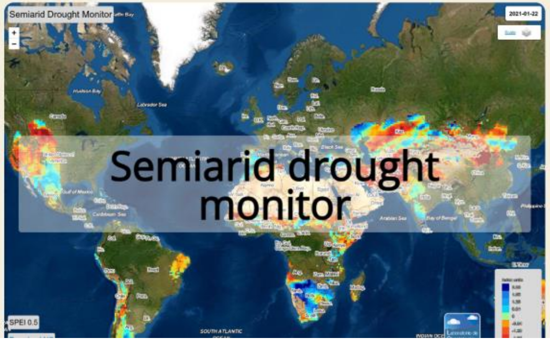
https://lcsc.csic.es

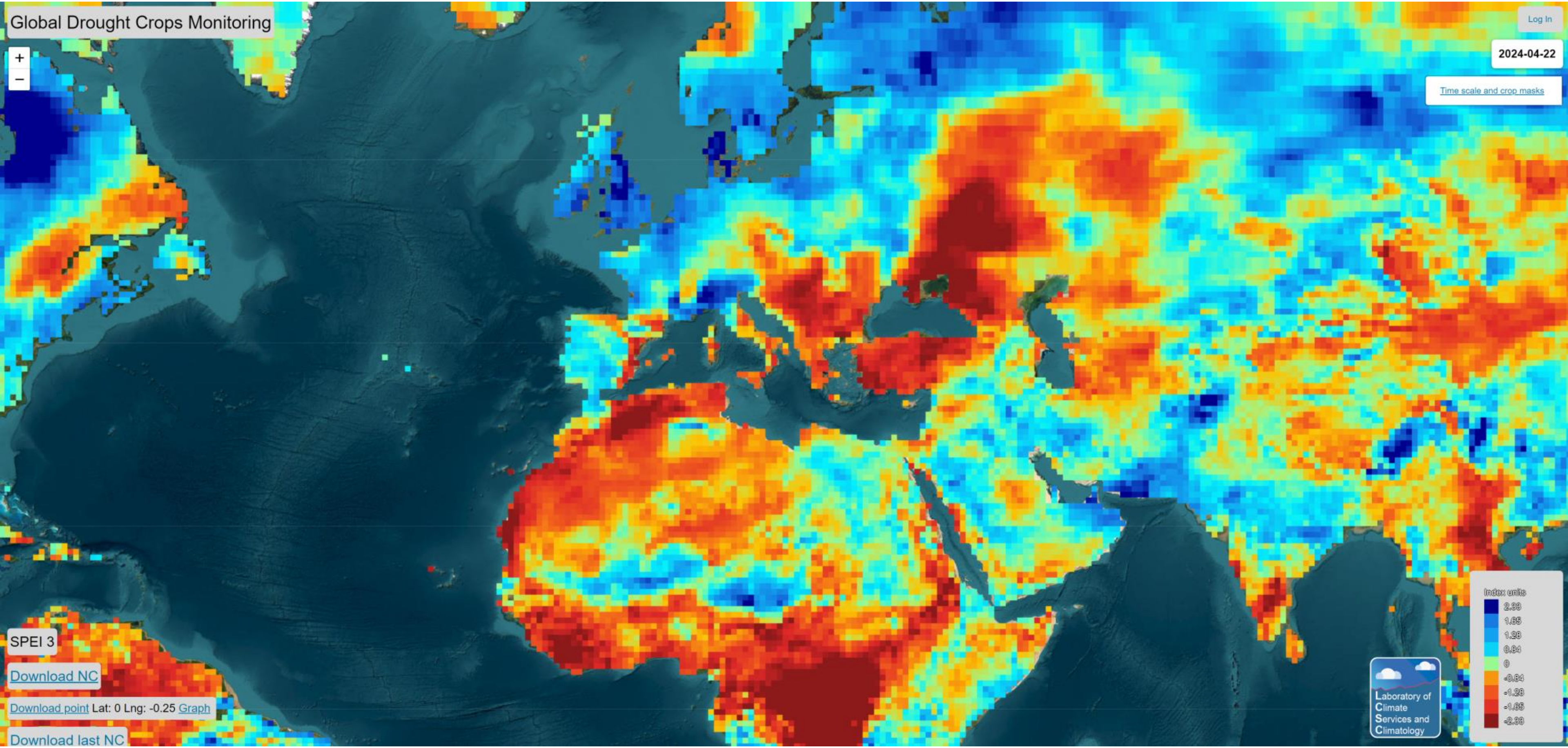
Real time

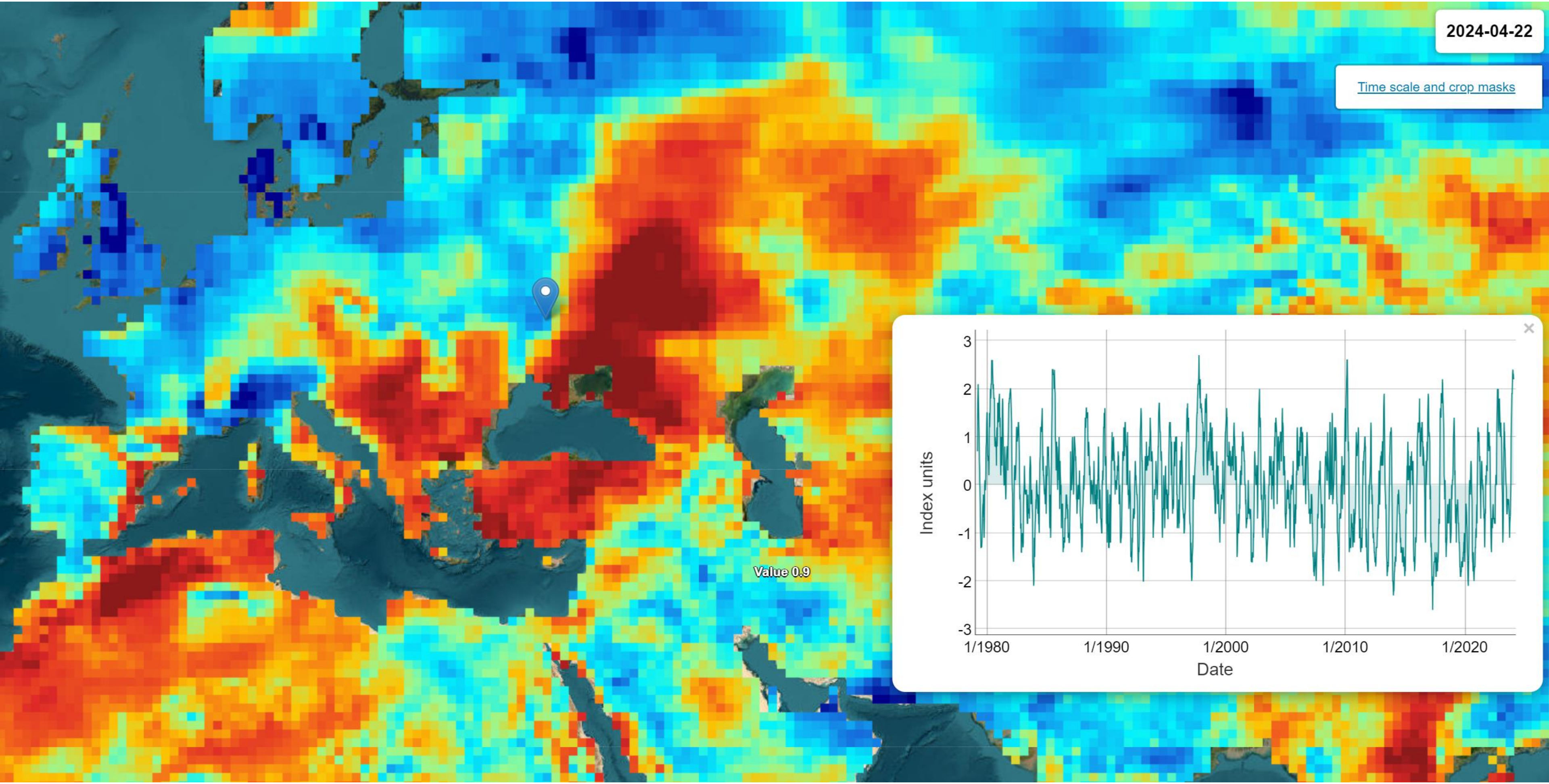
Global scale








Global Drought Crops Monitoring
+
−
Log In
2024-04-22
Time scale and crop masks
SPEI 3
Download NC
Download point Lat: 0 Lng: -0.25 Graph
Download last NC
Laboratory of Climate Services and Climatology
Index units
2.33
1.65
1.28
0.84
0
-0.84
-1.28
-1.65
-2.33


2024-04-22
Time scale and crop masks
Value 0.9
Index units
Date
1/1980
1/1990
1/2000
1/2010
1/2020
3
2
1
0
-1
-2
-3

Received: 30 August 2021 | Revised: 29 July 2022 | Accepted: 24 August 2022

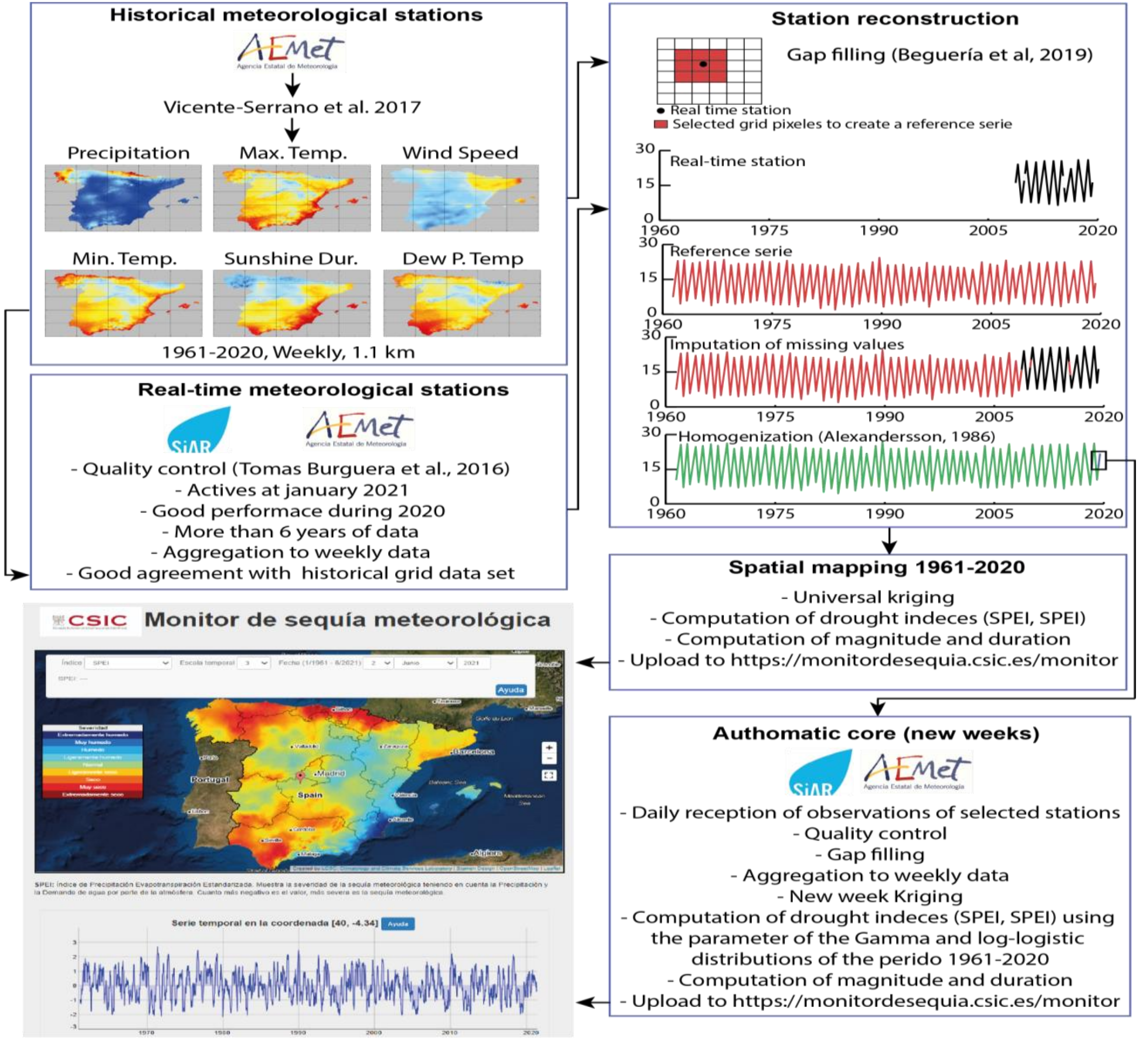
DOI: 10.1002/gdj3.178

DATA SERVICES ARTICLE

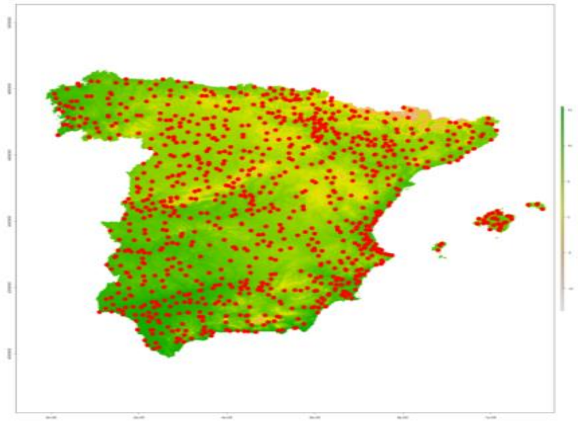
Geoscience Data Journal RMetS WILEY

A global drought monitoring system and dataset based on ERA5 reanalysis: A focus on crop-growing regions

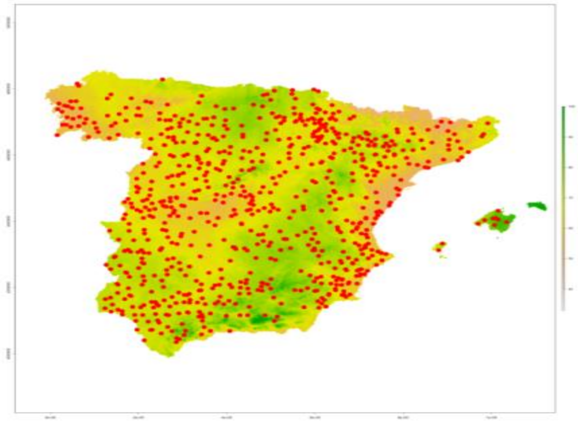
Sergio M. Vicente-Serrano[1] | Fernando Domínguez-Castro[2,3] | Fergus Reig[1] | Miquel Tomas-Burguera[4] | Dhais Peña-Angulo[5] | Borja Latorre[6] | Santiago Beguería[6] | Isabel Rabanaque[3] | Ivan Noguera[1] | Jorge Lorenzo-Lacruz[7] | Ahmed El Kenawy[8]


Historical meteorological stations
AEMet
Agencia Estatal de Meteorología
Vicente-Serrano et al. 2017
Precipitation
Max. Temp.
Wind Speed
Min. Temp.
Sunshine Dur.
Dew P. Temp
1961-2020, Weekly, 1.1 km
Real-time meteorological stations
SiAR
AEMet
- Quality control (Tomas Burguera et al., 2016)
- Actives at january 2021
- Good performace during 2020
- More than 6 years of data
- Aggregation to weekly data
- Good agreement with historical grid data set
Station reconstruction
Gap filling (Beguería et al, 2019)
Real time station
Selected grid pixeles to create a reference serie
Real-time station
Reference serie
Imputation of missing values
Homogenization (Alexandersson, 1986)
30
15
0
1960
1975
1990
2005
2020
Spatial mapping 1961-2020
- Universal kriging
- Computation of drought indeces (SPEI, SPEI)
- Computation of magnitude and duration
- Upload to https://monitordesequia.csic.es/monitor
Authomatic core (new weeks)
SiAR
AEMet
- Daily reception of observations of selected stations
- Quality control
- Gap filling
- Aggregation to weekly data
- New week Kriging
- Computation of drought indeces (SPEI, SPEI) using the parameter of the Gamma and log-logistic distributions of the perido 1961-2020
- Computation of magnitude and duration
- Upload to https://monitordesequia.csic.es/monitor
CSIC
Monitor de sequía meteorológica
Ayuda
Portugal
Spain
Madrid
Barcelona
Serie temporal en la coordenada [40, -4.34]

Temperature



Air humidity



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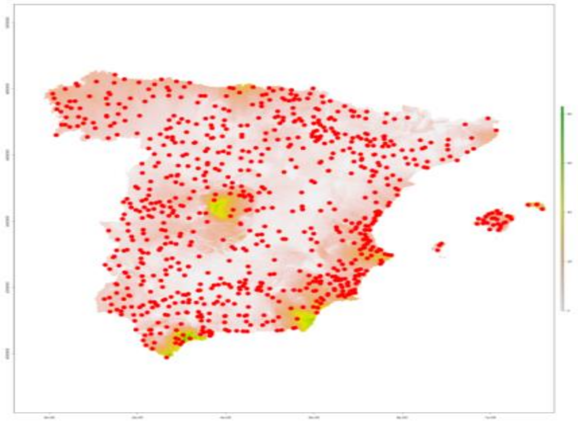

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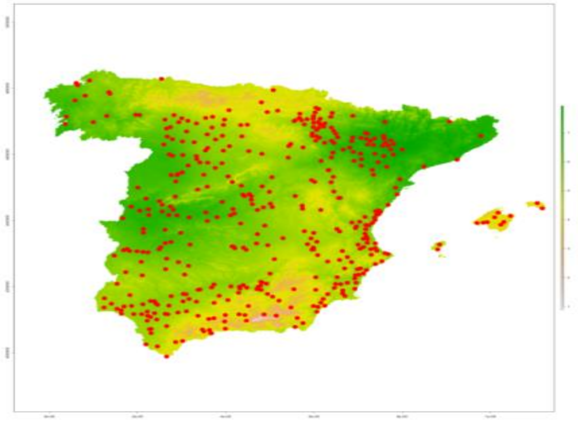
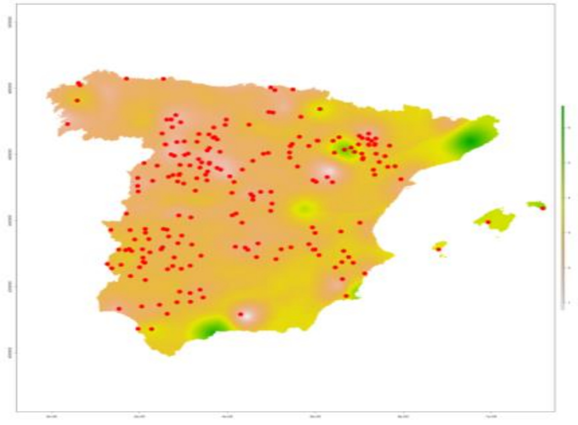
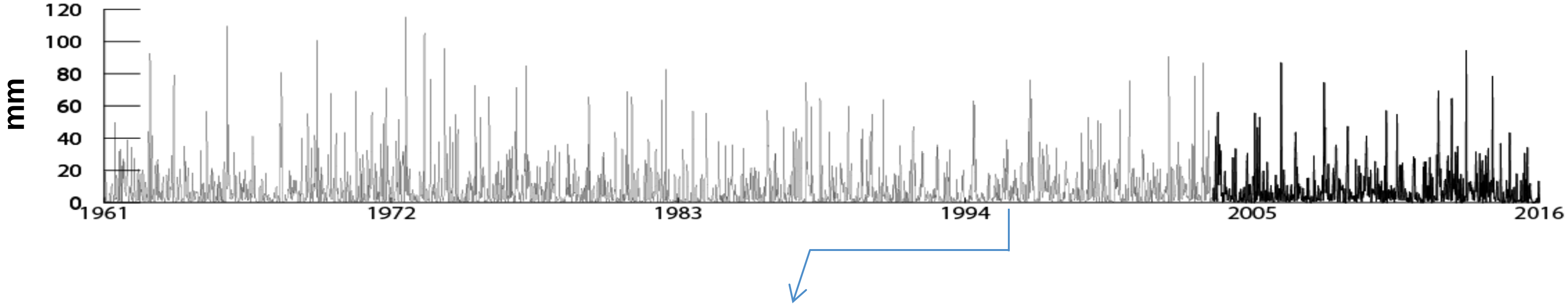


Wind speed

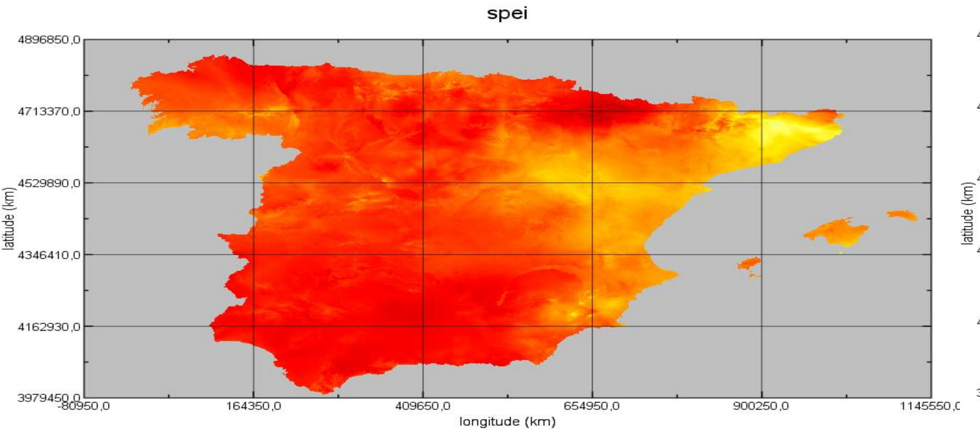


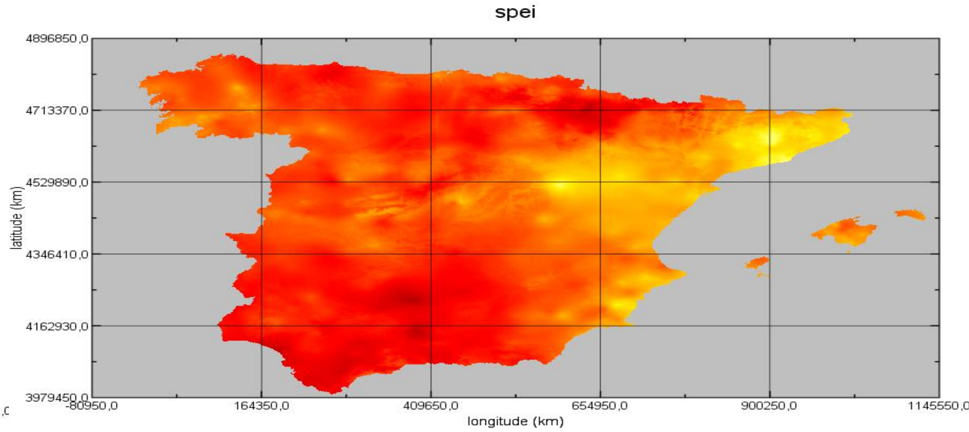


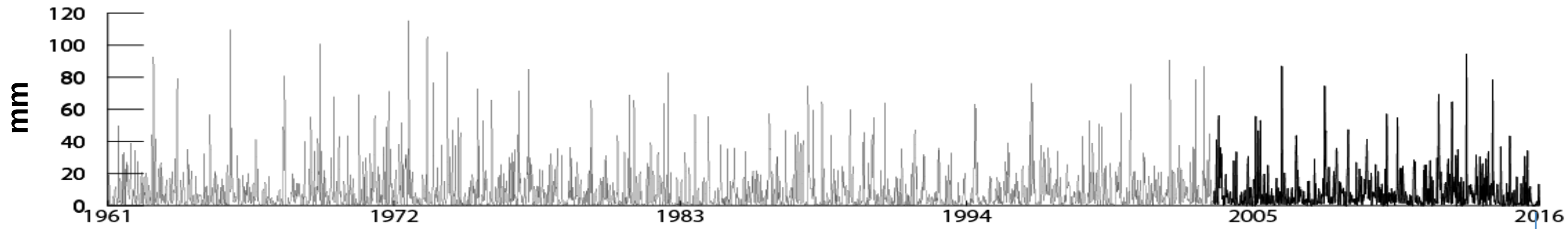
June 1995

Historical database

Automatic stations

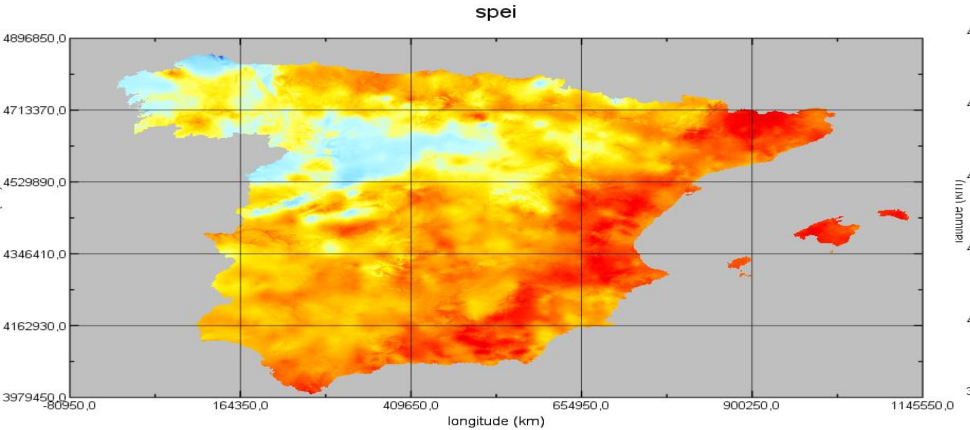




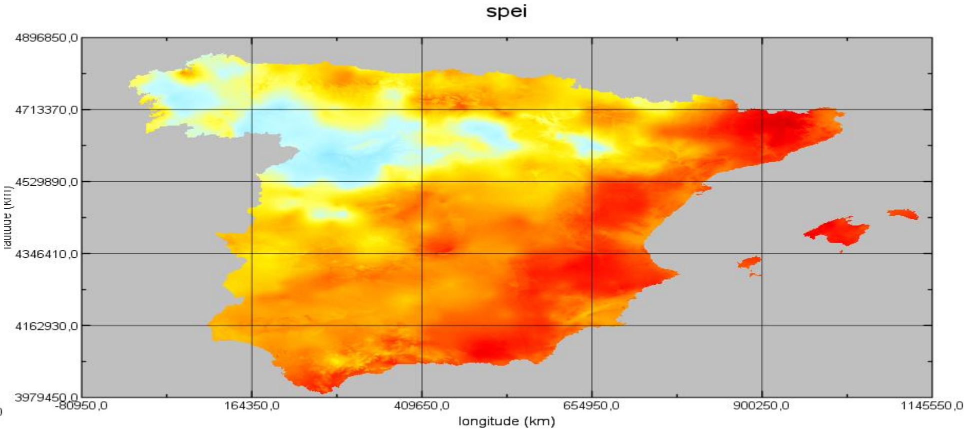


February 2016

Historical database



Automatic stations



Monitor de la sequía meteorológica

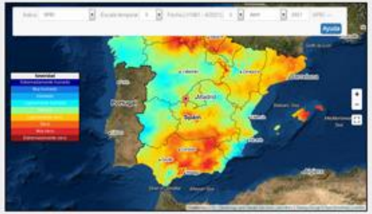
El sistema de monitorización de sequías meteorológicas está diseñado para el seguimiento, alerta temprana y evaluación de la sequía meteorológica, para lo que utiliza en tiempo real la información climática y satelital disponible que muestra el desarrollo de las condiciones de sequía meteorológica y la posible evolución de la misma.

El sistema incorpora el desarrollo de productos tecnológicos operativos con implicaciones directas para la gestión de los recursos hídricos, las áreas naturales y para la gestión del riesgo de sequía meteorológica en sectores económicos afectados.

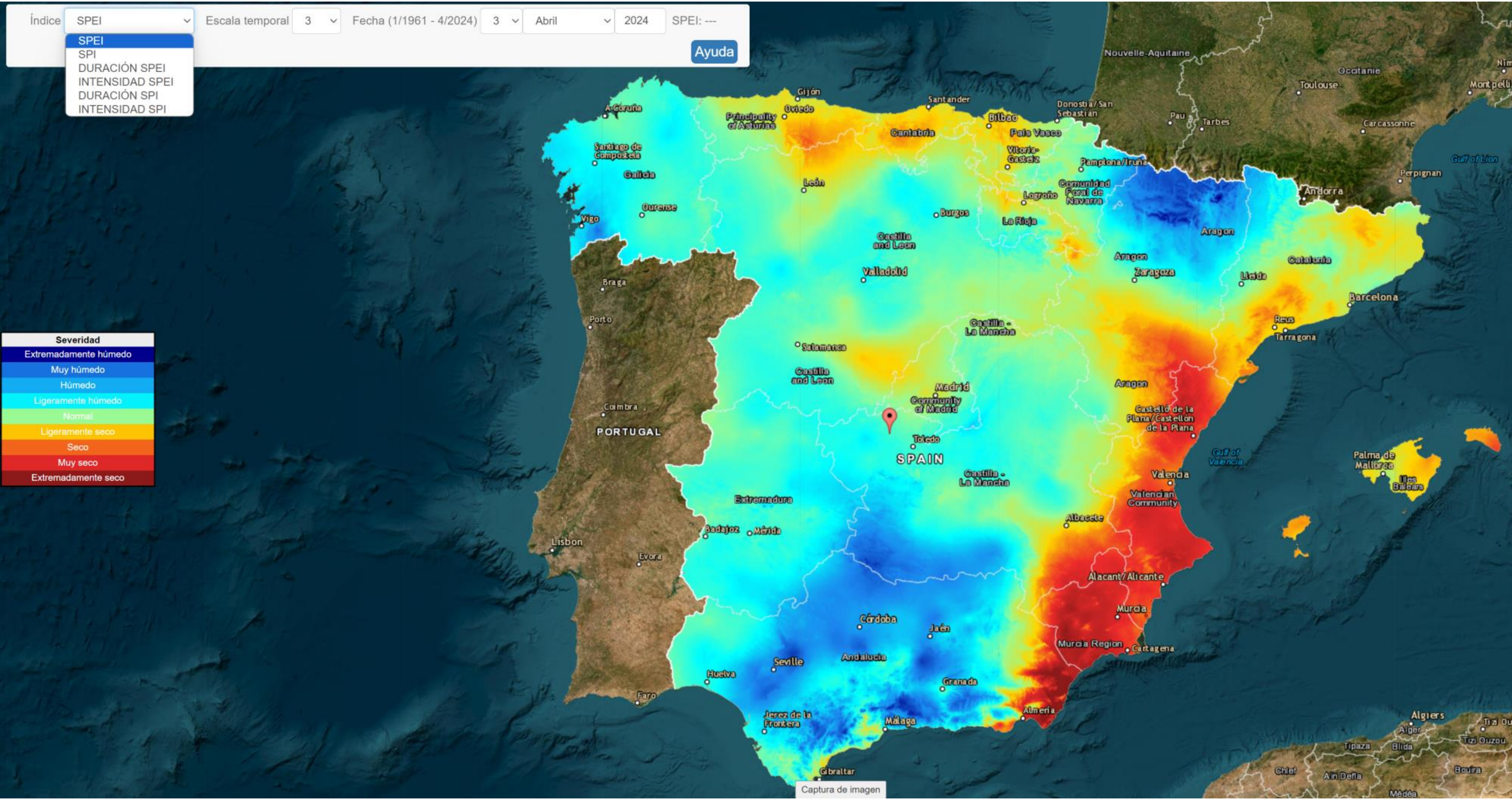
El sistema de monitorización aporta datos cuan
indicadores de sequía meteorológica sintéticos es
forma comprensible para los usuarios finales. Dic
variedad de impactos potenciales y aportan informa
la sequía meteorológica mediante un indicador, bas
de impactos esperados en diferentes sistemas y a
numérica, que permite mejor preparación y alerta
tiempo real de las condiciones de sequía meteoroló

El sistema de monitorización de sequías meteorológicas muestra las condiciones actuales de sequía meteorológica, actualizadas semanalmente, a partir de las estaciones meteorológicas automáticas disponibles de la Red de AEMET y del SIAR.

Monitor de sequía meteorológica



Acceso monitor sequía meteorológica



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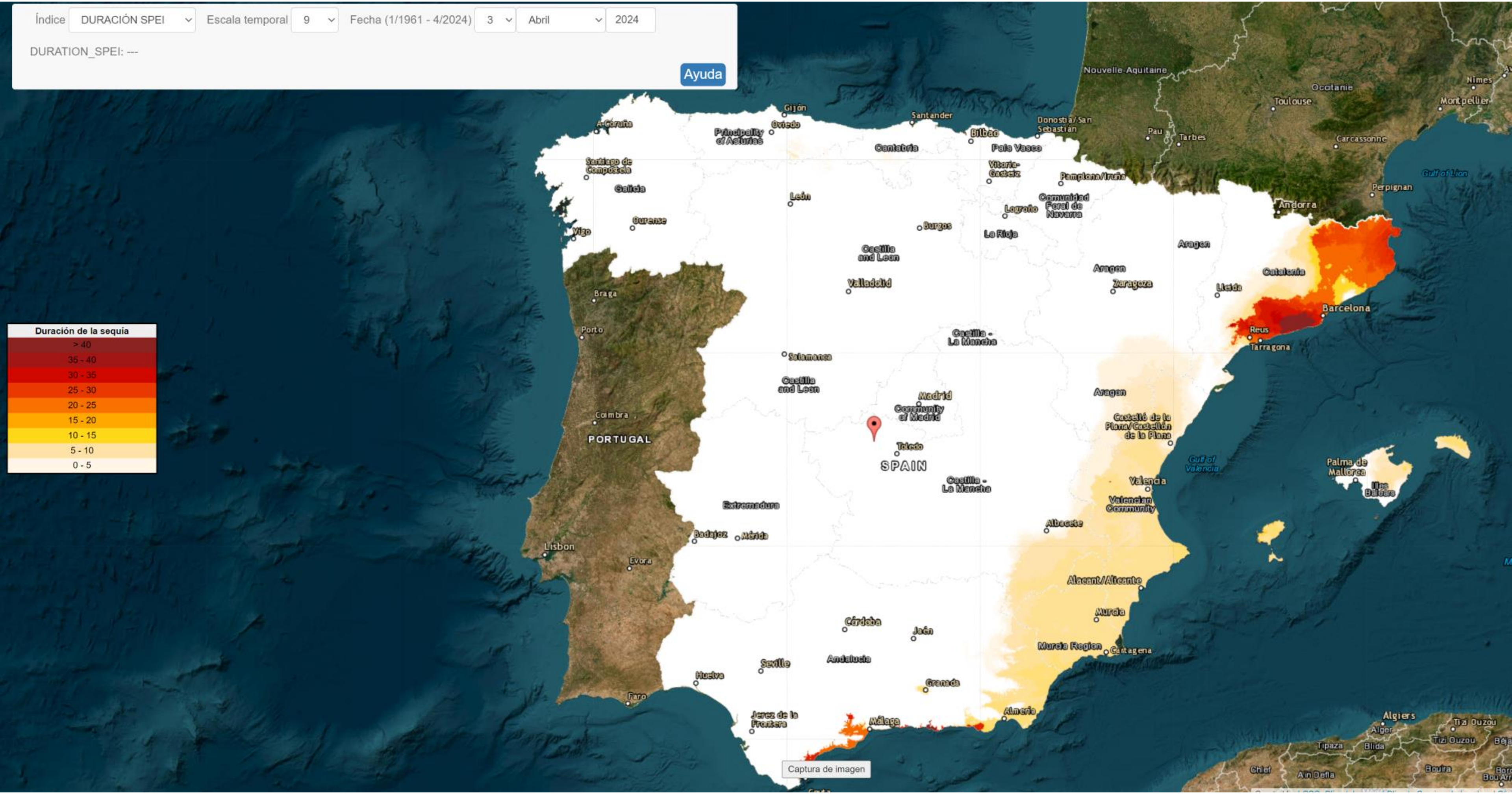
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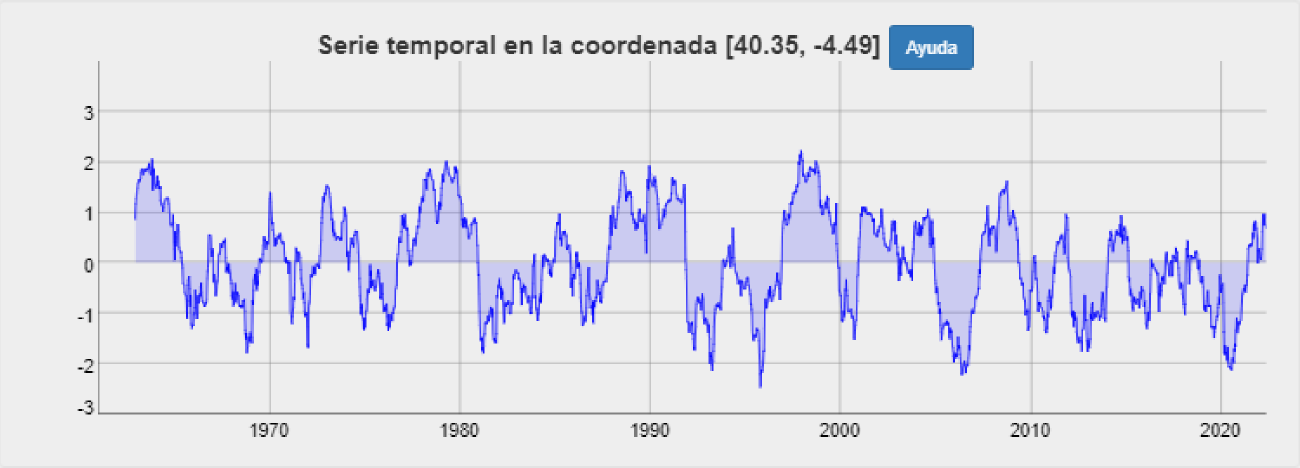

Serie temporal en la coordenada:

Coordenada: 40.35 , -4.49 Descargar

Información

El monitor de sequía meteorológica aporta información en tiempo real a partir de las estaciones meteorológicas automáticas de la Red de AEMET y del SIAR. La información se actualiza cuatro veces cada mes y se puede consultar el estado de la sequía meteorológica a partir de dos índices climáticos: El Índice de Precipitación Estandarizado (SPI) que se obtiene con datos de precipitación y el Índice de Precipitación Evapotranspiración Estandarizado (SPEI), que utiliza datos de precipitación y demanda de agua por parte de la atmósfera. Se aporta la información de los índices a diferentes escalas temporales (1, 3, 6, 9...), aspecto que permite identificar la anomalía climática considerando periodos previos más o menos largos y que informan de la posible severidad de diferentes tipos de sequía meteorológica. Además de ello, se muestra la duración la sequía meteorológica desde el inicio de la misma (considerando un umbral de condiciones secas) y su magnitud acumulada. El monitor permite la visualización del histórico desde 1961 y la selección de un punto concreto, del que se puede visualizar y descargar la serie del índice de sequía meteorológica.

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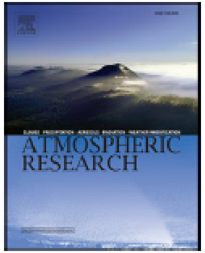


A near real-time drought monitoring system for Spain using automatic weather station network

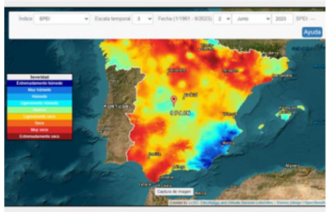
S.M. Vicente-Serrano [a,*], F. Domínguez-Castro [b,c], F. Reig [a], S. Beguería [d], M. Tomas-Burguera [e], B. Latorre [d], D. Peña-Angulo [f], I. Noguera [a], I. Rabanaque [c], Y. Luna [g], A. Morata [g], A. El Kenawy [h]

Spain contributes its drought monitoring application to the International Drought Resilience Alliance

News - 2023.6.30

The system has direct implications for the management of water resources, natural areas and meteorological drought risk management in affected economic sectors.

The index to measure the intensity of droughts, developed by Spanish scientists and members of the Interdisciplinary Thematic Platform Climate and Climate Services (PTI+ Clima) of the Spanish National Research Council (CSIC), has been incorporated into the public catalogue of Google Earth Engine, a cloud-based tool that allows users to search and discover public Earth observation datasets.



Meteorological drought monitoring system map

In Spain, the CSIC's work on the drought monitor is fully operational through the **State Agency of Meteorology (AEMET)**, attached to the Ministry of Ecological Transition and Demographic Challenge. The system incorporates the development of operational technology products with direct implications for the management of water resources, natural areas and meteorological drought risk management in affected economic sectors.

The **meteorological drought monitoring system** shows the current weather drought conditions, with weekly updates, using information provided by the available

MANY THANKS!!!