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GlobeDrought

A global-scale tool for characterizing droughts and quantifying their impact on water resources, crop productivity, trade in food products, and the need for international food aid

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DROUGHT



FAO LAND & WATER

(FAO, 2013)

- Since 1900 more than 11 million people have died as a consequence of drought and more than 2 billion have been affected by drought
- Investigating drought risk means studying water resources in critical periods

Overall objectives:

- To develop a **web-based drought (hazard and risk) information system** (global & regional)

**Contribution to
national agendas**

**Contribution
to the SDGs**
(SDG 2, SDG 6)



**Contribution to understanding
& managing drought risk**
(Sendai Framework, etc.)

Project partners



GlobeDrought - project partners

University of Göttingen

University of Bonn

Goethe University Frankfurt am Main

United Nations University (EHS)

Remote Sensing Solutions

Welthungerhilfe



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and Human Security

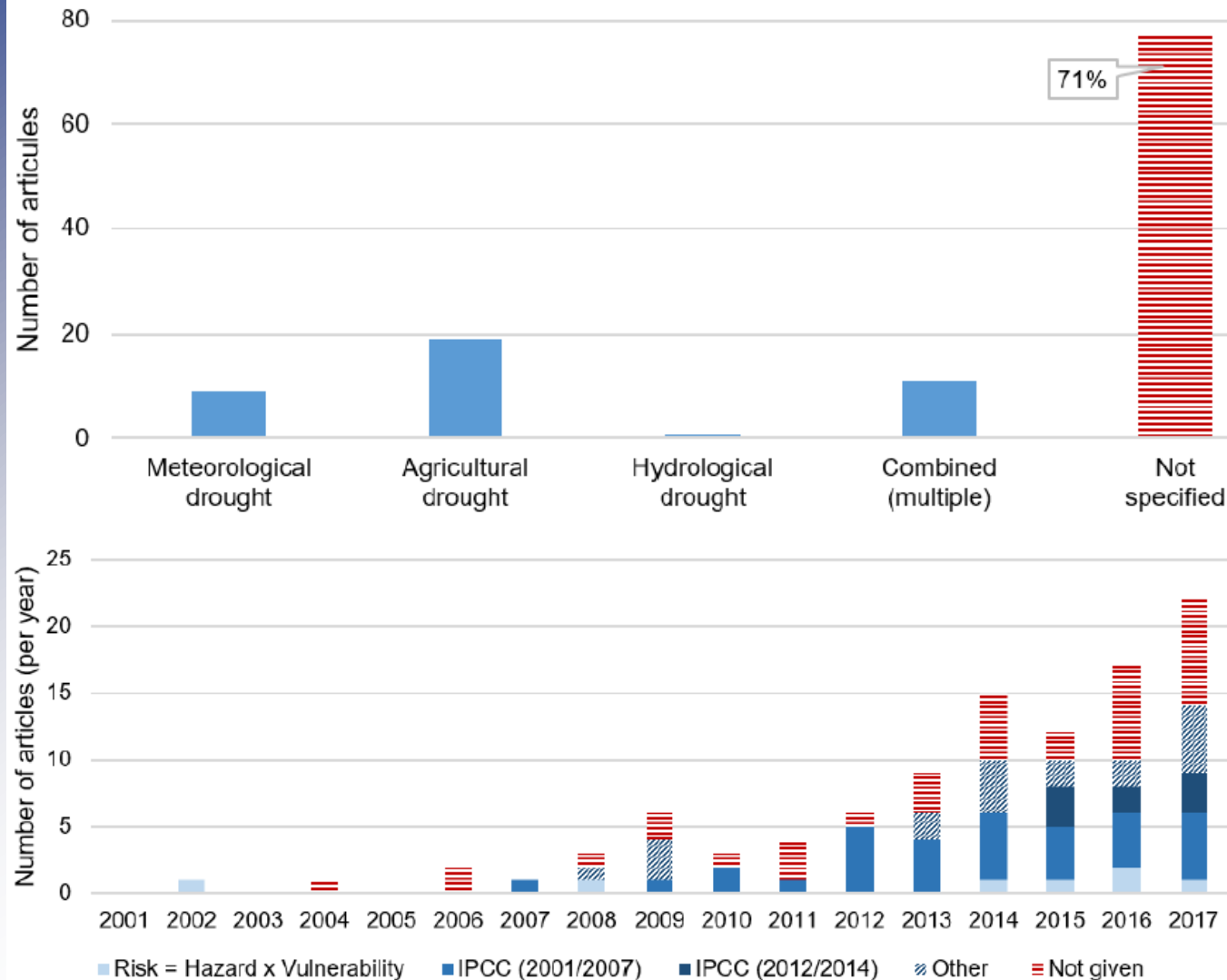


For a world without hunger

Regional partners - stakeholders

- University of Zimbabwe (IES)
- University of the Free State, RSA (DiMTEC)
- Indian Institute of Technology Bombay (CSRE)
- National Institute of Hydrology, Roorkee, India
- National Drought Mitigation Centre (NDMC), University of Nebraska, Lincoln, USA
- Fundação Cearense de Meteorologia e Recursos Hídricos – FUNCEME, Fortaleza, Brazil
- Joint Research Center of the EU, Ispra, Italy

Main results of a comprehensive literature review on drought risk assessment methodology



- No agreement in scientific literature about drought risk analysis methods
- Even type of investigated drought often not mentioned
- Indicators used to quantify drought risk differ across analyzed drought impacts

Hagenlocher et al., under review

A new drought risk analysis framework, which will integrate hazard, vulnerability and exposition is developed for the GlobeDrought project – test phase has started



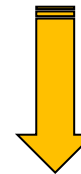
Identification of relevant drought impacts



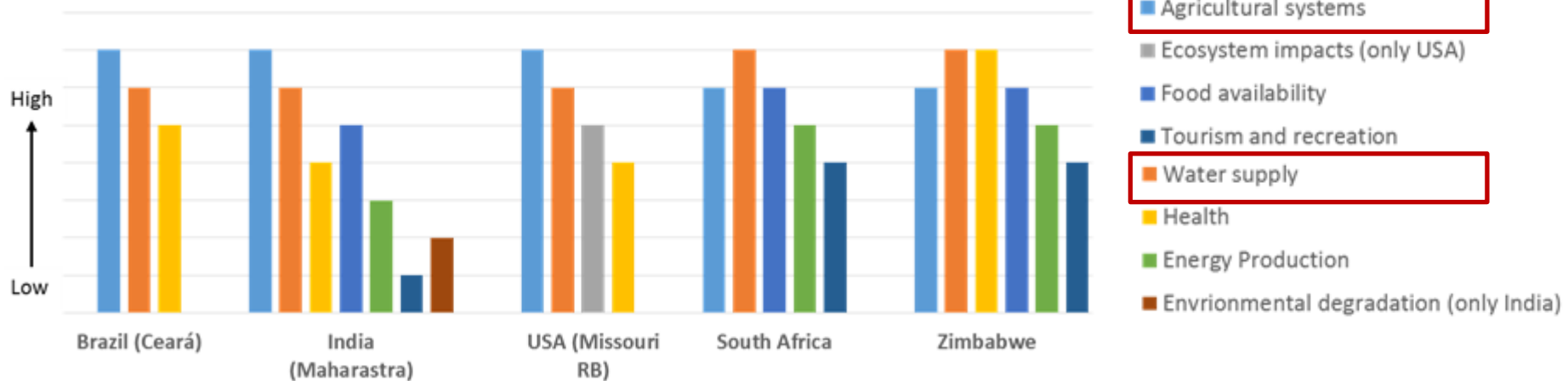
GlobeDrought 1st Stakeholder/Expert Workshop



May 3-4, 2018
UN Campus, Bonn



Regional Drought Impact Importance



Impact-specific indicator sets **can be selected by the users** of the Drought Information System

DROUGHT IMPACT ON RAINFED AGRICULTURAL SYSTEMS

HAZARD

Standardized Precipitation Index

SPEI

Accumulated Soil Moisture Deficit

Standardized Irrigation Index

Standardized Streamflow Index

Accumulated Discharge Deficit

...

EXPOSURE

Extent of irrigated crops

Extent of rainfed crops

Pasture extent

Livestock affected

People affected

Infrastructure affected

...

VULNERABILITY

Literacy rate

Gender Inequality Index

Rural population total

GINI index

Average land degradation

Total dam capacity

...

Integration and weighting

INTEGRATED DROUGHT RISK

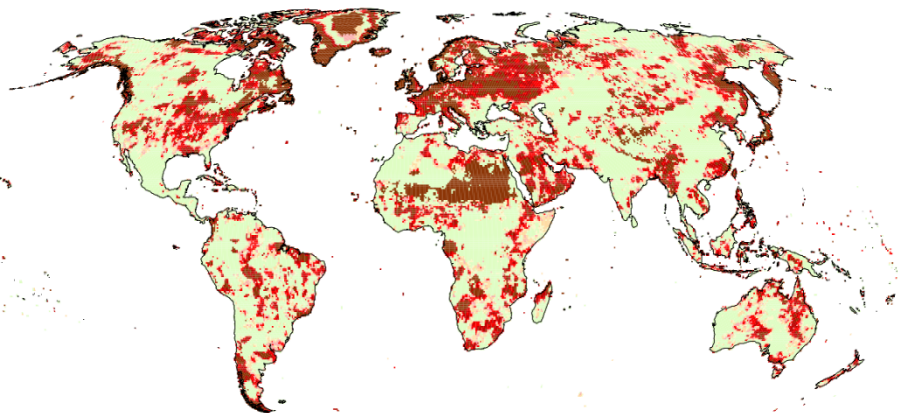
Drought risk assessment

Drought hazard – April 2015

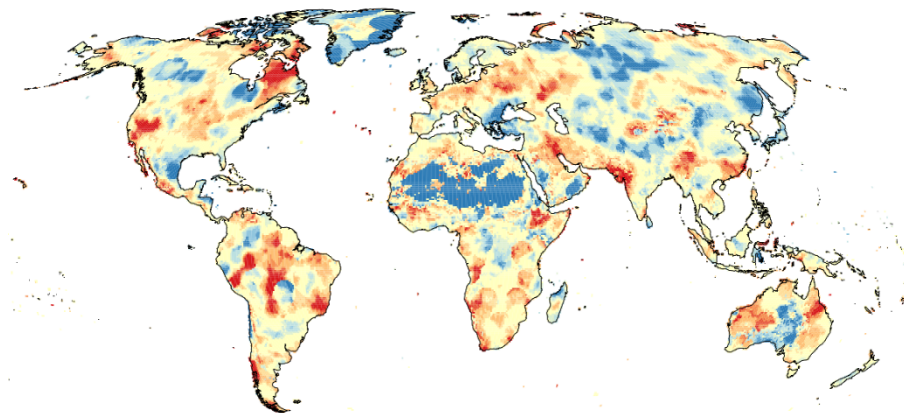


Rainfed agricultural systems

Accumulated soil moisture deficit - AMDI

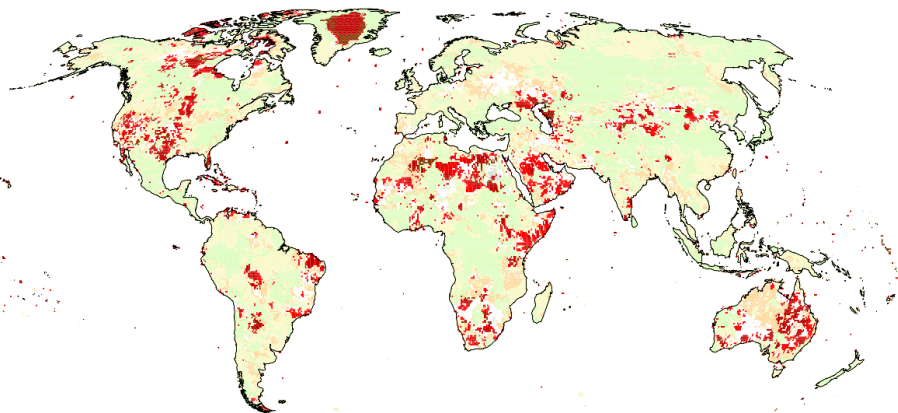


SPEI6

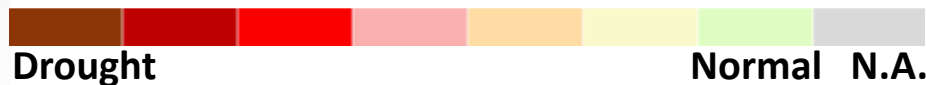
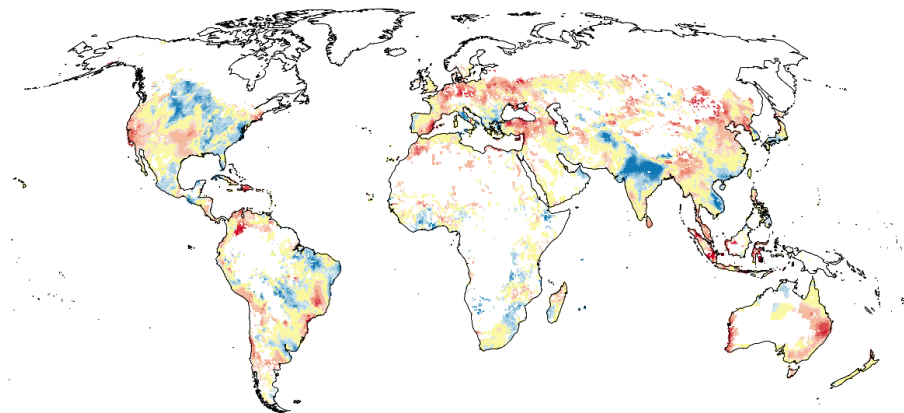


Irrigated agricultural systems

Accumulated river discharge deficit - ADQI



Standardized Irrigation Index – SII6



Drought risk assessment

+ Exposure – April 2015



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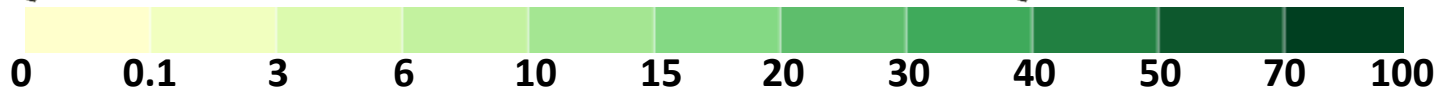
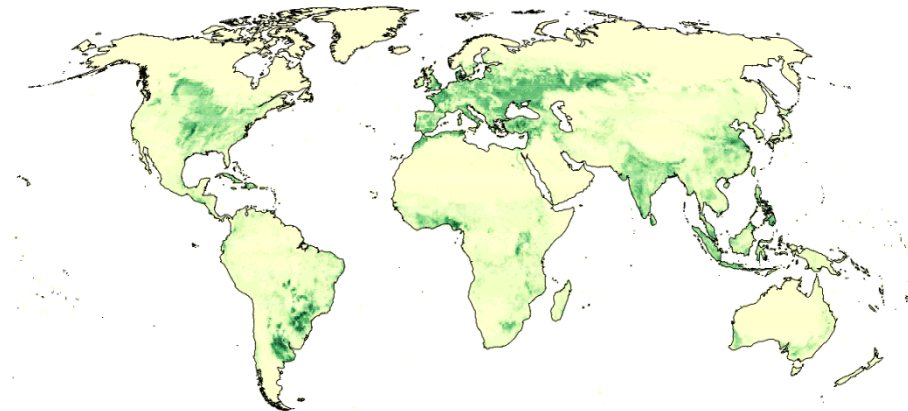
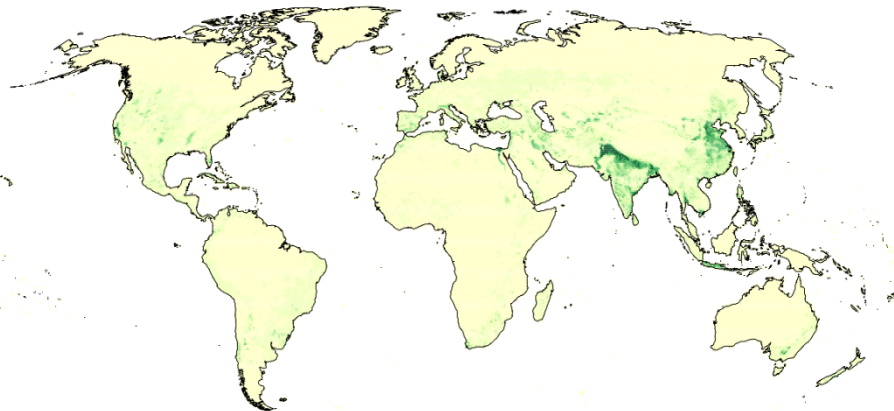


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Crop growing area (average Nov-Apr, percentage of total surface area)

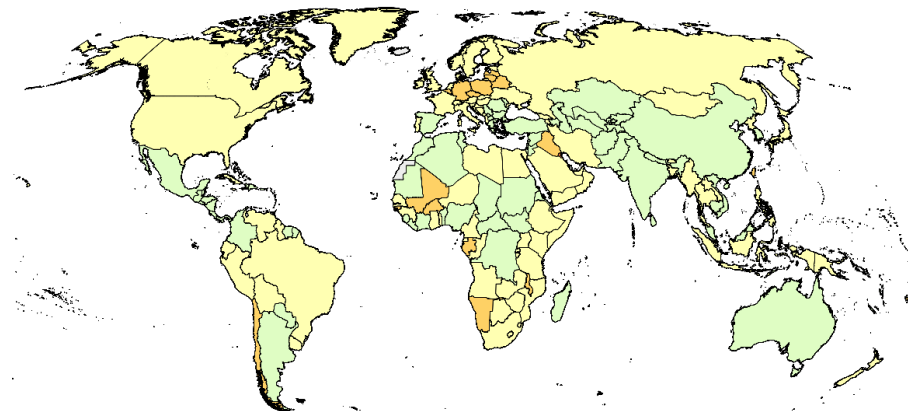
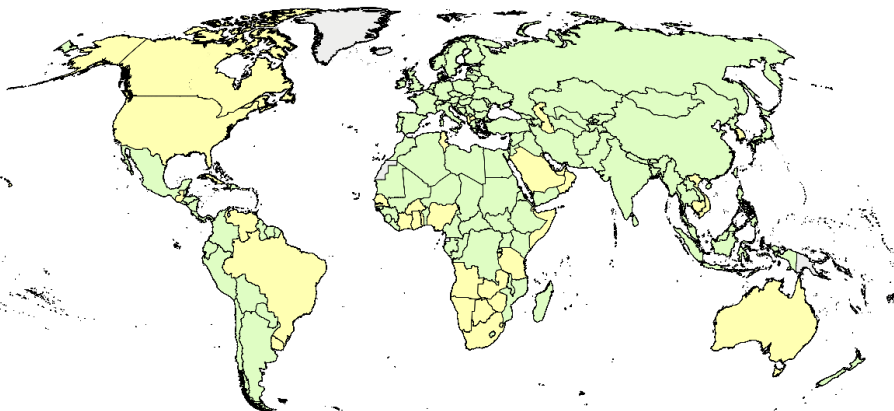
Irrigated crops

Rainfed crops



Exposure of irrigated agricultural systems

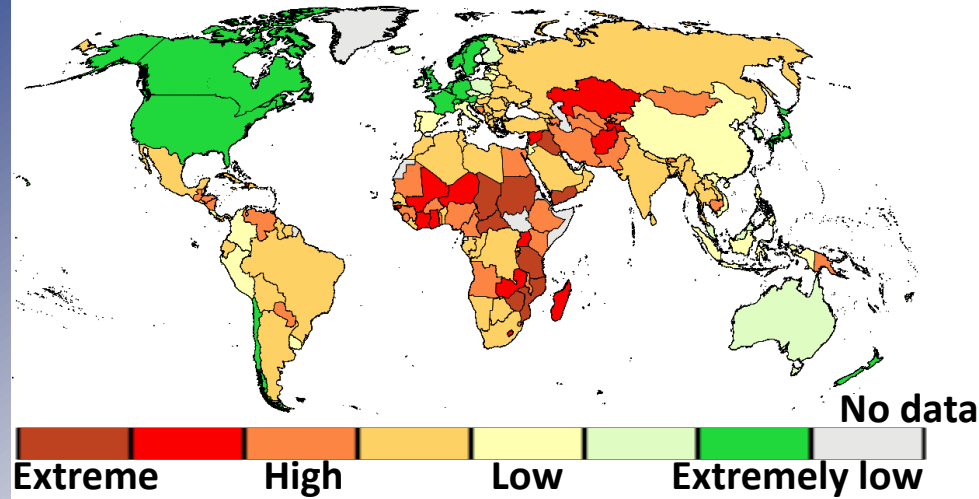
Exposure of rainfed agricultural systems



Drought risk assessment

+ Vulnerability = Drought risk 2015

Vulnerability



Vulnerability

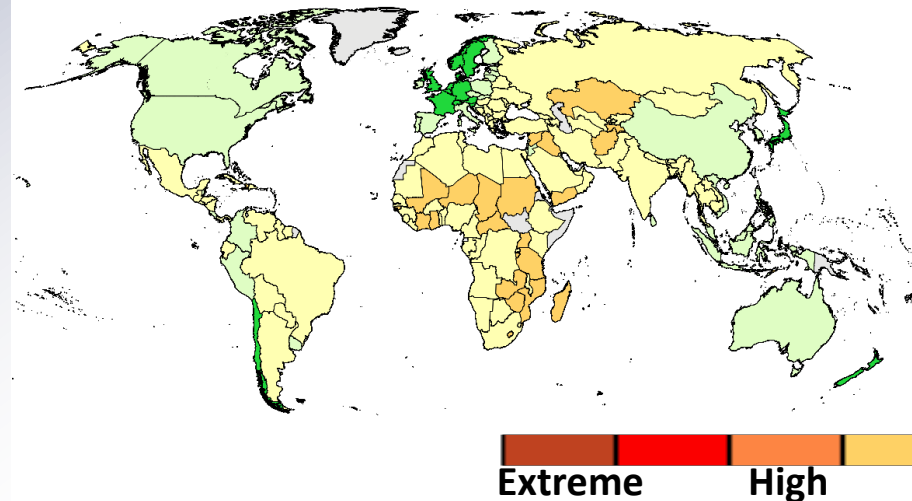
Lack of coping
capacity

Social-Environmental
Susceptibility

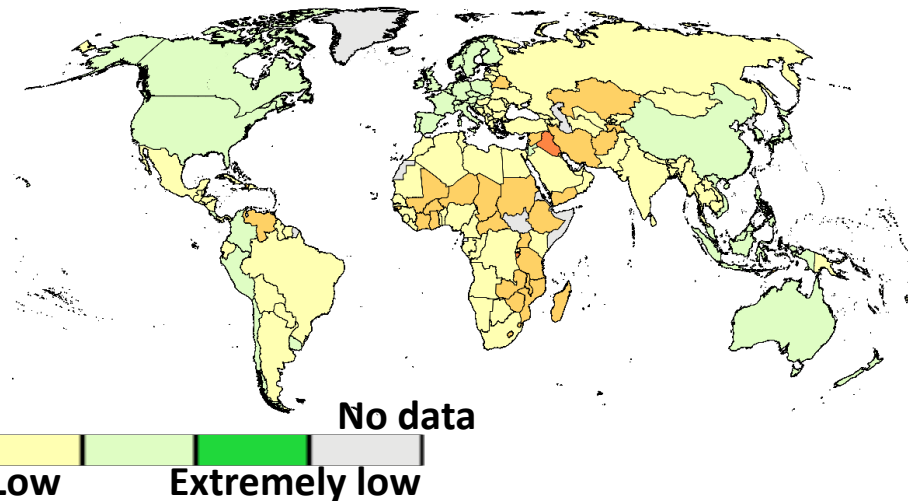
Social
susceptibility

Environmental
susceptibility

Drought risk irrigated crops



Drought risk rainfed crops

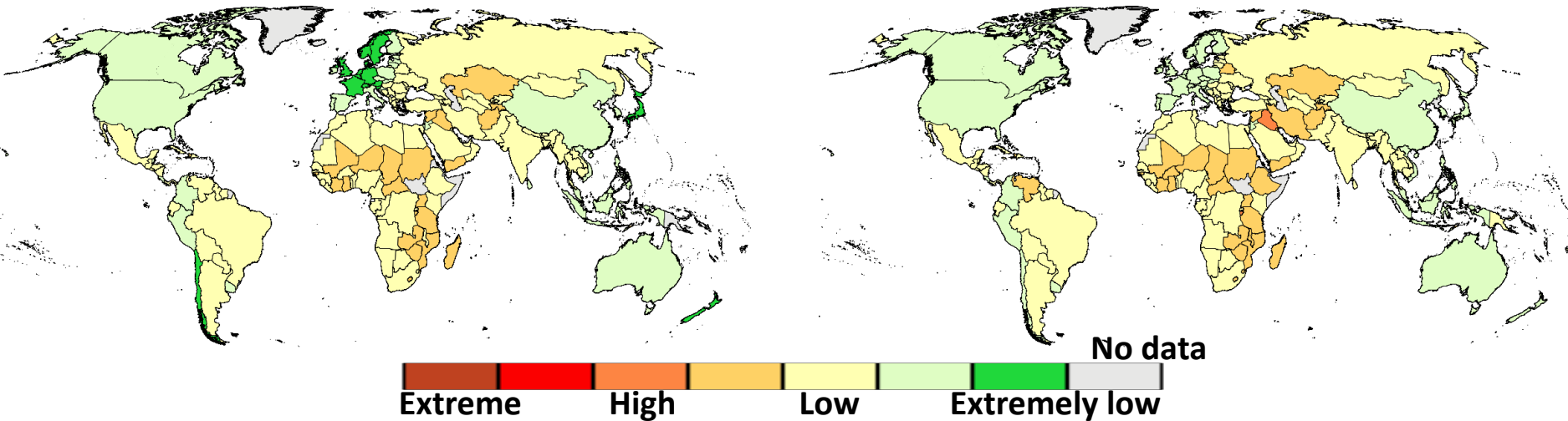


Drought risk assessment

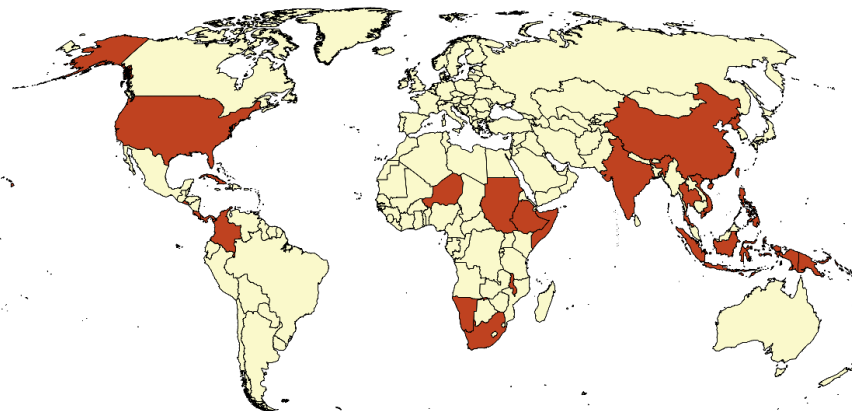
Comparison with EMDAT

Drought risk irrigated crops, 04/2015

Drought risk rainfed crops, 04/2015



Drought occurrence in 2015 according to the international disaster database EM-DAT

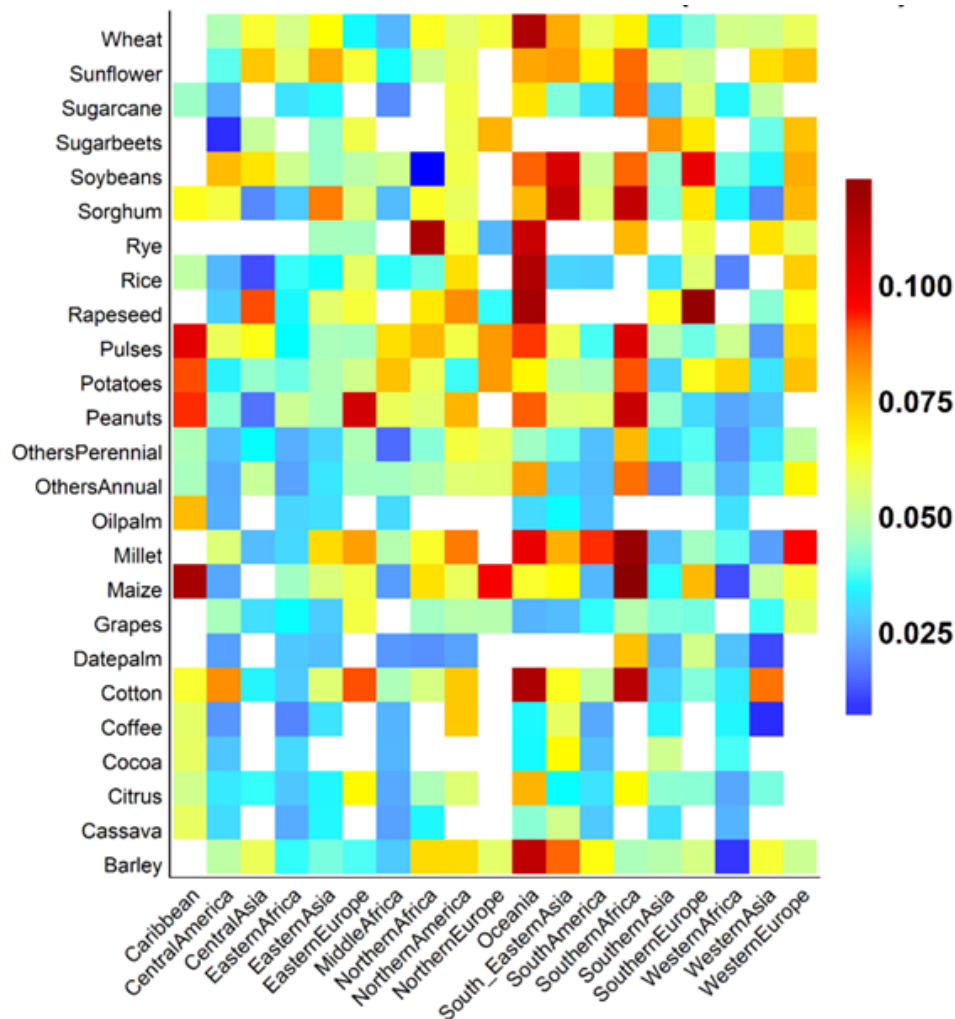


=> **Workflow** to map drought risk **established**, **implementation** in information system **ongoing**

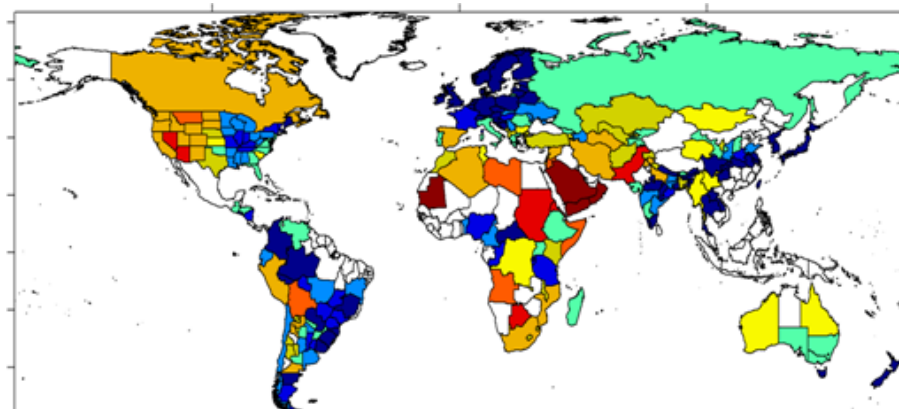
Drought risk assessment

Analysis of drought impacts

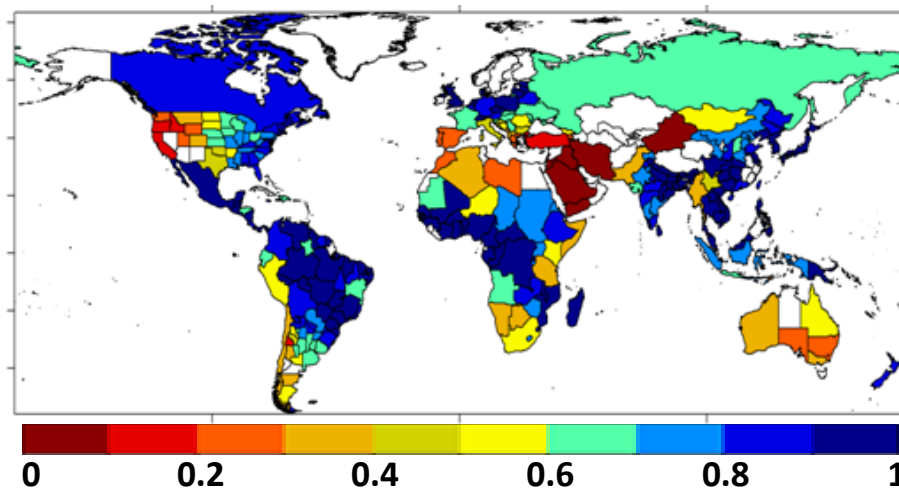
AET / PET, standard deviation, 1986-2015



AET / PET ratio – Rainfed wheat, 1985



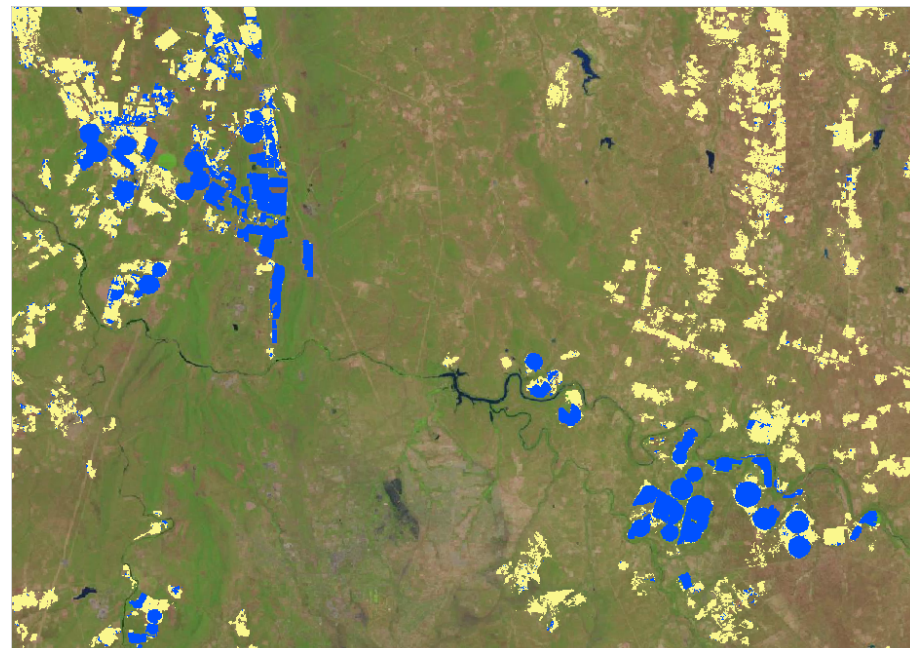
AET / PET ratio – Rainfed maize, 1985



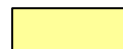
Rezaei et al., 2018; Nouri et al., under preparation

=> **Crop specific** drought impact assessments will be implemented into the Information System

Remote Sensing Solutions: Mapping of rainfed and irrigated cropland in Zimbabwe and RSA completed



Landmann et al., 2019; Landmann et al., under preparation



Rainfed crops

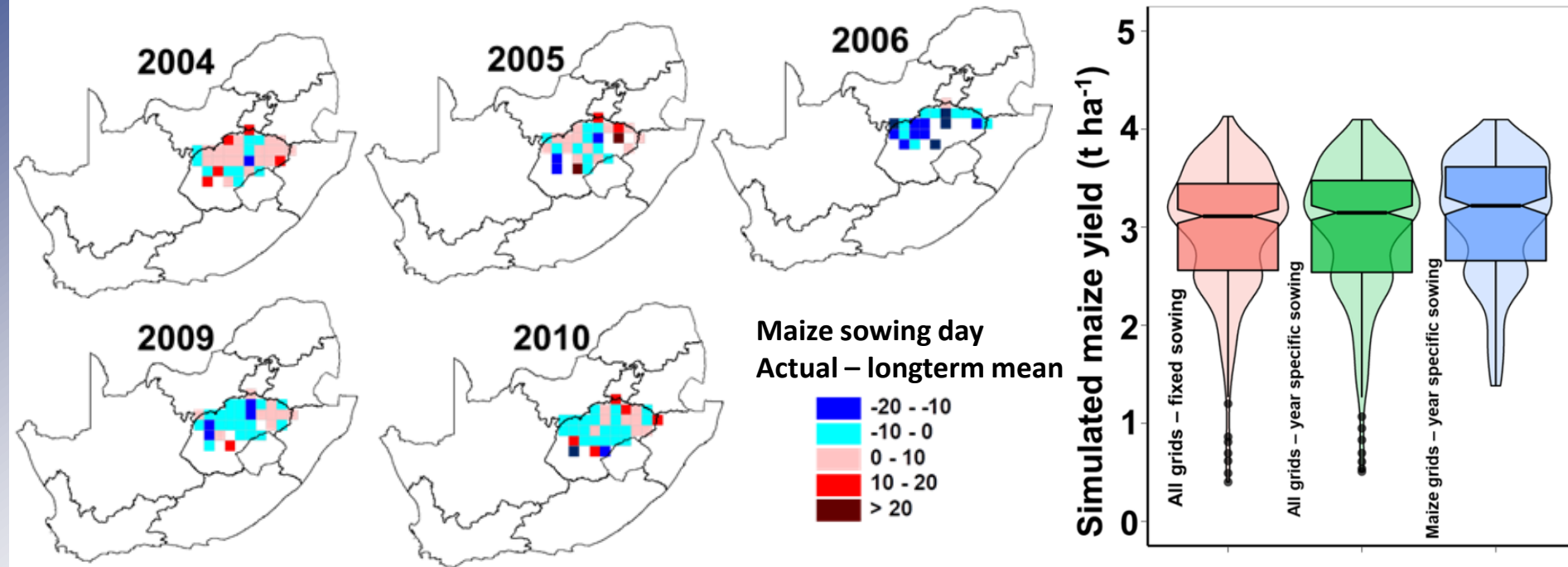


Irrigated crops

- Drought risk assessment for Southern Africa is constrained by the lack of basic information
- Global data sets are often not accurate enough for use in regional assessments
- New approach of mapping cropping systems by optimizing harmonic functions

=> **Operational separation of irrigated and rainfed agricultural systems is possible**

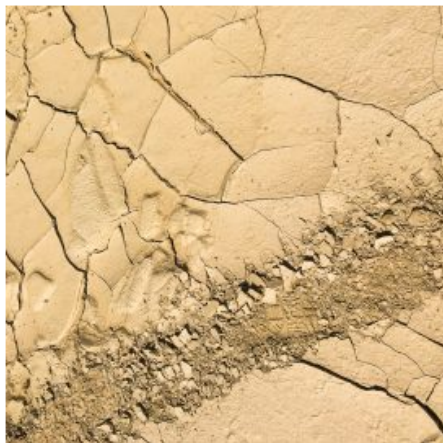
University of Bonn + University of Göttingen: Assimilation of remotely sensed sowing and harvest days into a regional crop growth model



Eyshi Rezaei et al., 2018; Eyshi Rezaei et al., under preparation

- Large interannual and spatial variability in crop sowing days
- Using correct sowing days is essential to simulate realistic crop yields
- Time series data not available, even not for developed regions such as Germany

=> **Using time series of remotely sensed sowing days removes outliers in simulated yield**



GlobeDrought – characterizing and assessing drought risk and drought impacts at the global and regional level

The first introductory webinar & lecture provide a general overview of the objectives of the BMBF GroW initiative and its GlobeDrought project.

It will discuss the relevance of understanding and assessing drought risk and its sectoral impacts in order to create more resilience societies.

The leading questions are:

What is a drought, how can it be characterized, why does it matter globally (past events & impacts, future outlook), what is drought risk, what are key components, why do we need to understand and assess drought risk?

26 FEB 2019

SIGN IN



Droughts and the post-2015 agenda

While hazards are inevitable, and the elimination of all risk is impossible, there are many technical measures, traditional practices, and public experience that can reduce the extent or severity of economic and social disasters.

In this webinar we will explore how International Organizations are dealing with Drought and how drought is managed and addressed according with the main frameworks: Sendai Framework for Disaster Risk Reduction 2015-2030; , SDGs and Paris Agreement .

18 MAY 2020

SIGN IN

<https://grow-globedrought.net/webinars/>





=> **12 learning blocks** comprising of an **online lecture** and a **webinar** scheduled for period **February 2019 to May 2020**

Way forward

Setup of the Early Warning System



Climate data processing to provide near real time drought information and forecasts



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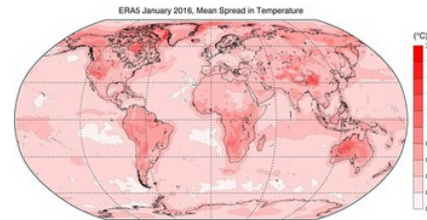
ERA5 hourly data on single levels from 1979 to present

Overview Download data Documentation

ERA5 is the fifth generation ECMWF atmospheric reanalysis of the global climate. Reanalysis combines model data with observations from across the world into a globally complete and consistent dataset using the laws of physics. This principle, called data assimilation, is based on the method used by numerical weather prediction centres, where every so many hours (12 hours at ECMWF) a previous forecast is combined with newly available observations in an optimal way to produce a new best estimate of the state of the atmosphere, called analysis, from which an updated, improved forecast is issued. Reanalysis works in the same way, but at reduced resolution to allow for the provision of a dataset spanning back several decades. Reanalysis does not have the constraint of issuing timely forecasts, so there is more time to collect observations, and when going further back in time, to allow for the ingestion of improved versions of the original observations, which all benefit the quality of the reanalysis product.

The assimilation system is able to estimate biases between observations and to sift good-quality data from poor data. The laws of physics allow for estimates at locations where data coverage is low, such as for surface temperature in the Arctic. The provision of estimates at each grid point around the globe for each regular output time, over a long period, always using the same format, makes reanalysis a very convenient and popular dataset to work with.

The observing system has changed drastically over time, and although the assimilation system can resolve data holes, the initially much sparser networks will lead to less accurate estimates. For this reason, ERA5 includes an uncertainty estimate that provides guidance on where products are expected to be more and where less accurate.



Contact

copernicus-support@ecmwf.int

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Publication Date

2018-06-14

Related data

[Essential climate variables for assessment of climate variability from 1979 to present](#)

[ERA5 hourly data on pressure levels from 1979 to present](#)

=> Selection of required variables, download, spatial + temporal aggregation of the data, formatting to fit to model requirements is ongoing, NRT information expected in 12/2019

Road map

Project start: 08/2017



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Co-design workshop

05/2018

- Selection of project regions, establishing collaboration with stakeholders
- Selection of appropriate drought risk indicators
- Design of the drought information system



Validation workshop

09/2019

- Validating the results of global and regional drought risk analyses
- Reviewing technical, institutional and functional requirements of the drought information system
- Development of the curriculum of training courses for users of the system

Capacity building workshop

04/2020

- End users, decision makers: hands on seminars how to use the information system
- Academic staff: how to integrate drought information into teaching
- NGOs, community: participative involvement of user communities, training of trainers, linking up with complementary information systems

Project end: 09/2020