

Stefan Siebert (University of Göttingen) GlobeDrought Global information system on droughts and their impact

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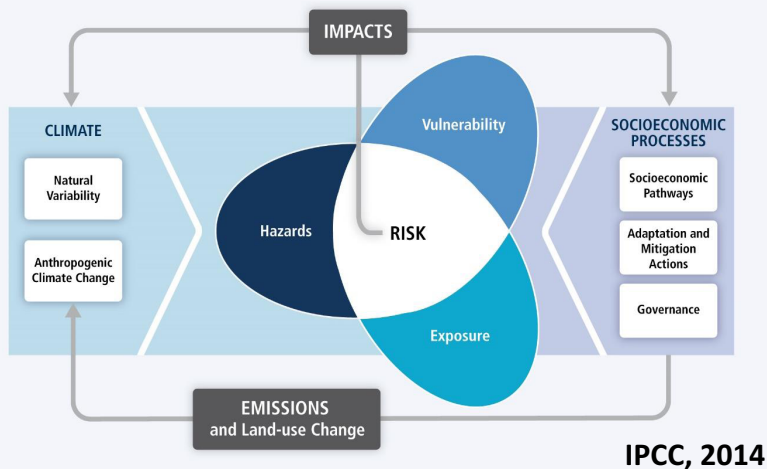
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Overall objectives:

- To analyze **drought risk** and **drought impacts** at global scale and for selected case study regions
- To develop a **web-based drought information system** (global & regional) presenting the data generated in the project
- To develop an **experimental early warning system** providing information on drought status and seasonal drought forecasts





1st stakeholder workshop



Studying drought impacts on:

Agricultural systems

Water supply

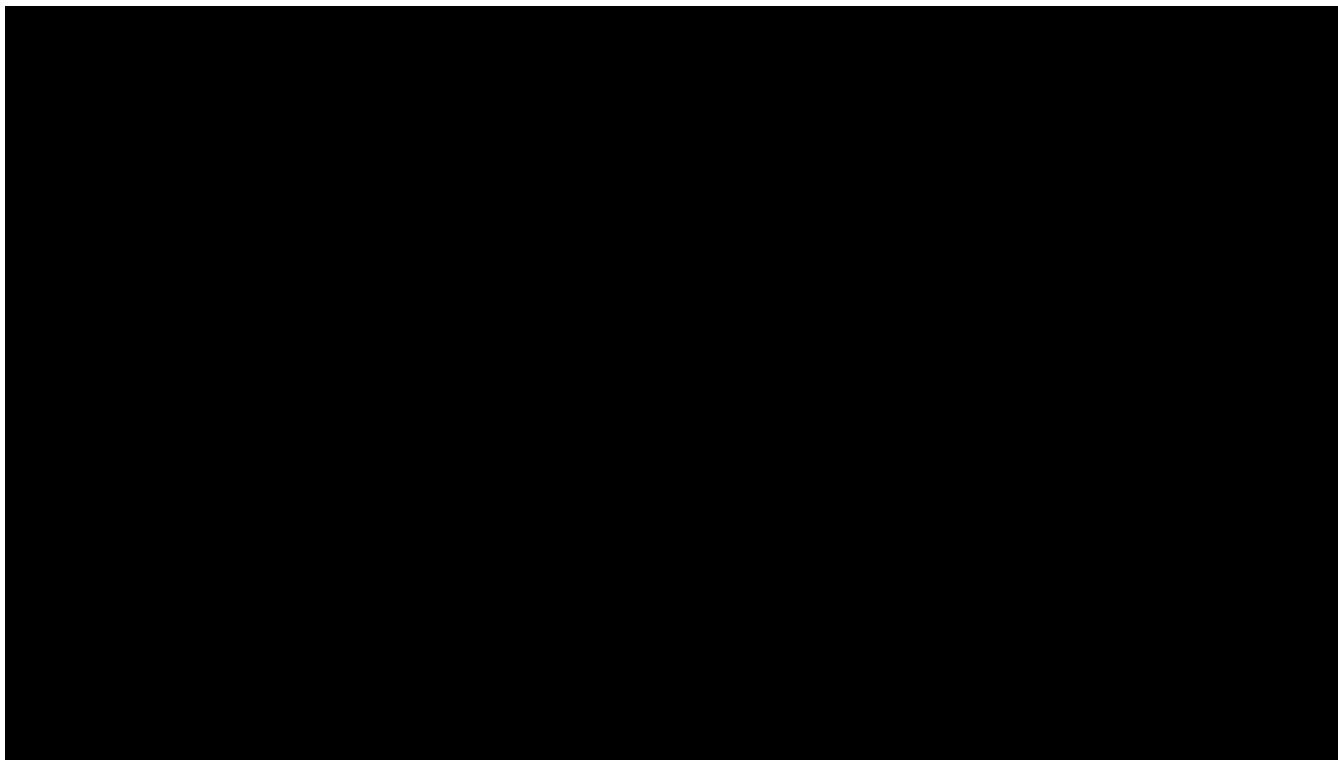
Irrigated

Rainfed

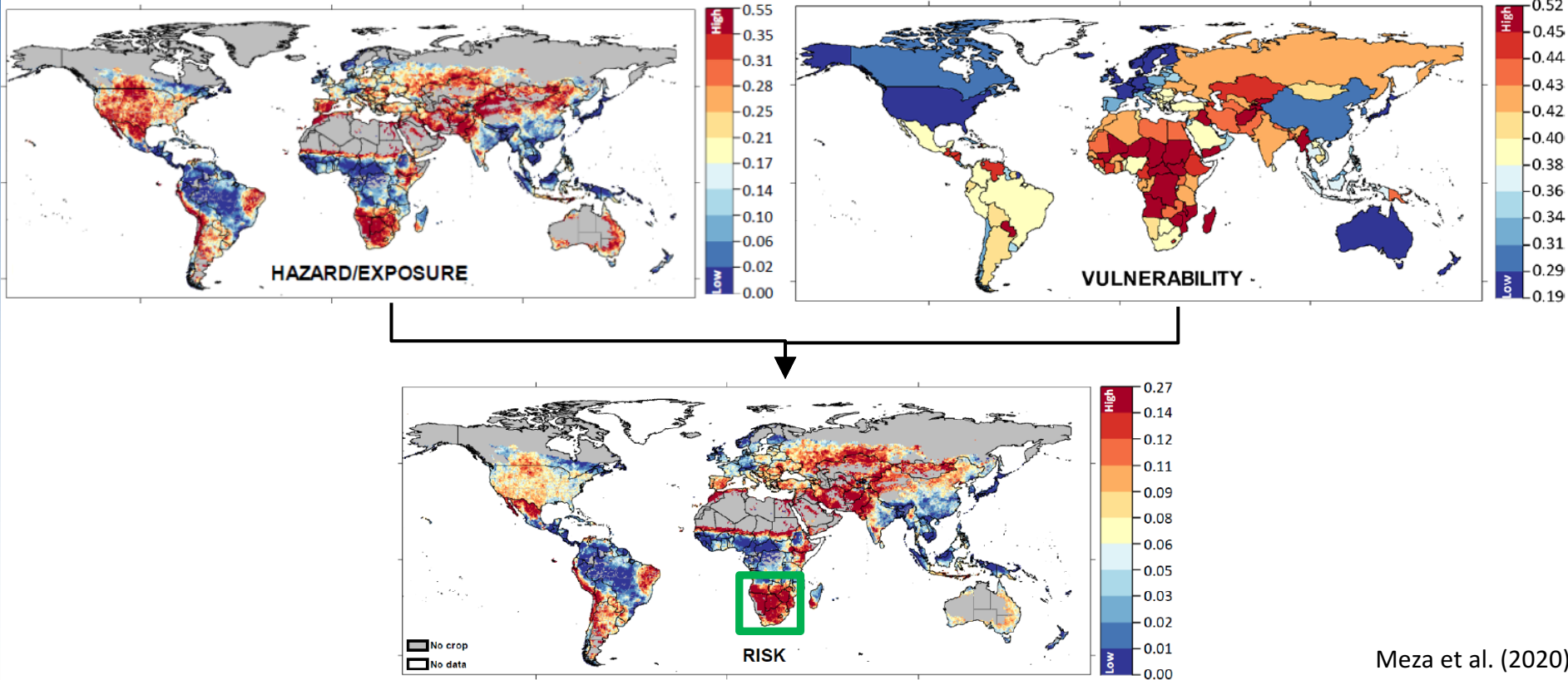
- Integrated assessment considering indicators for **hazard**, **exposure** and **vulnerability**
- Assessment at **global scale** and for selected regions such as **South Africa** and **Zimbabwe**
- Considering distinct time scales (**long-term drought risk**, current **drought status**, experimental early warning system projecting potential **future drought development**)
- Combining process based crop- and hydrological **modeling** with **remote sensing**

Global drought risk (rainfed systems) computed at high resolution for period since 1981

Drought hazard 2010-2018

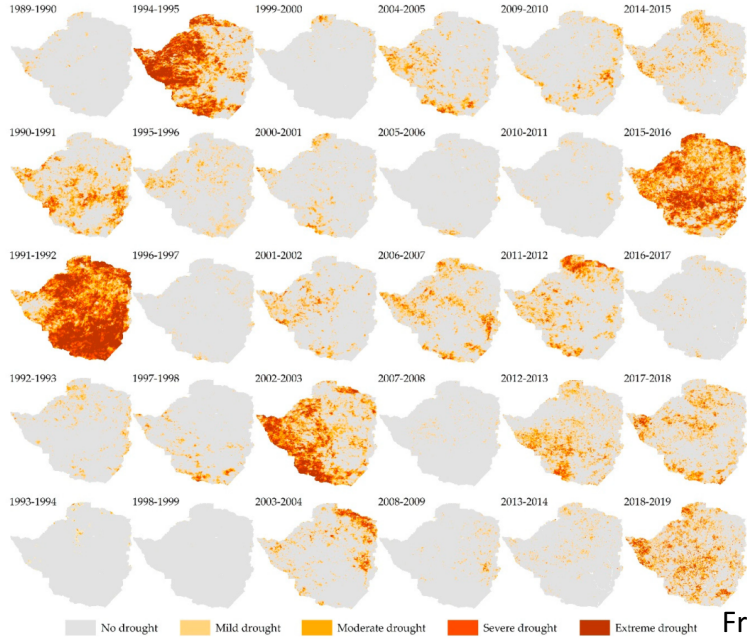


Global drought risk (rainfed systems) computed at high resolution for period since 1981

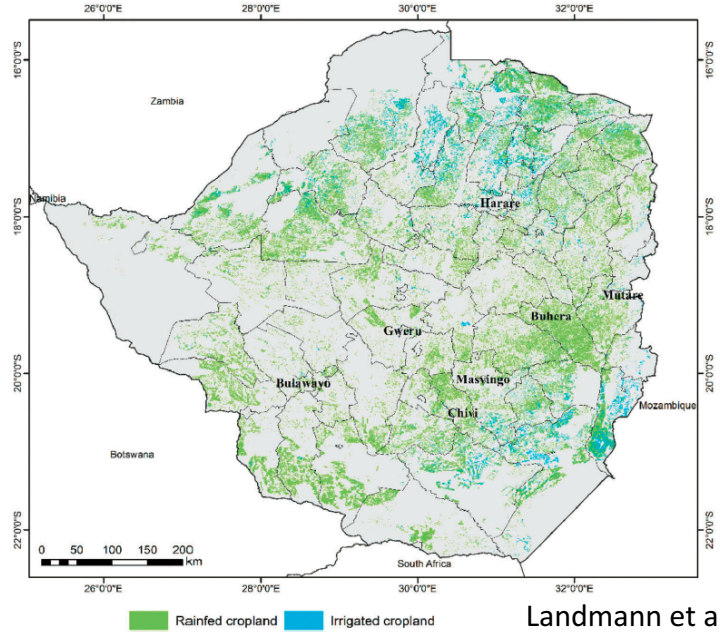


Meza et al. (2020)

Regional studies - **Zimbabwe**



Frishen et al., 2020



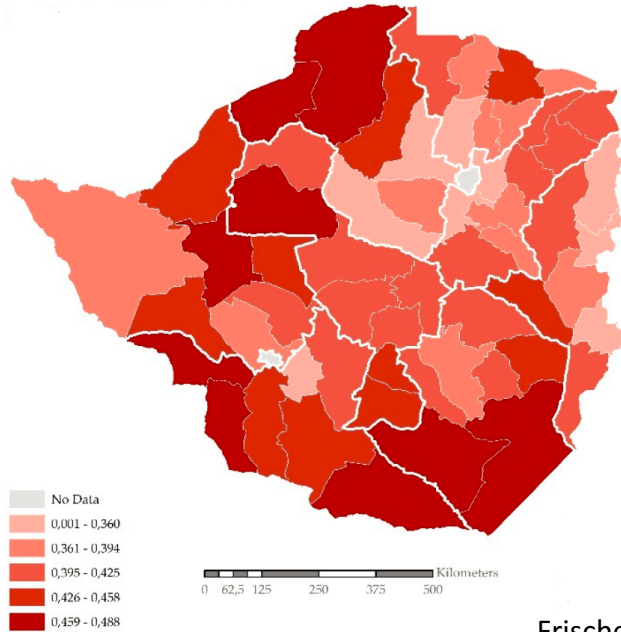
Landmann et al., 2019

Drought hazard

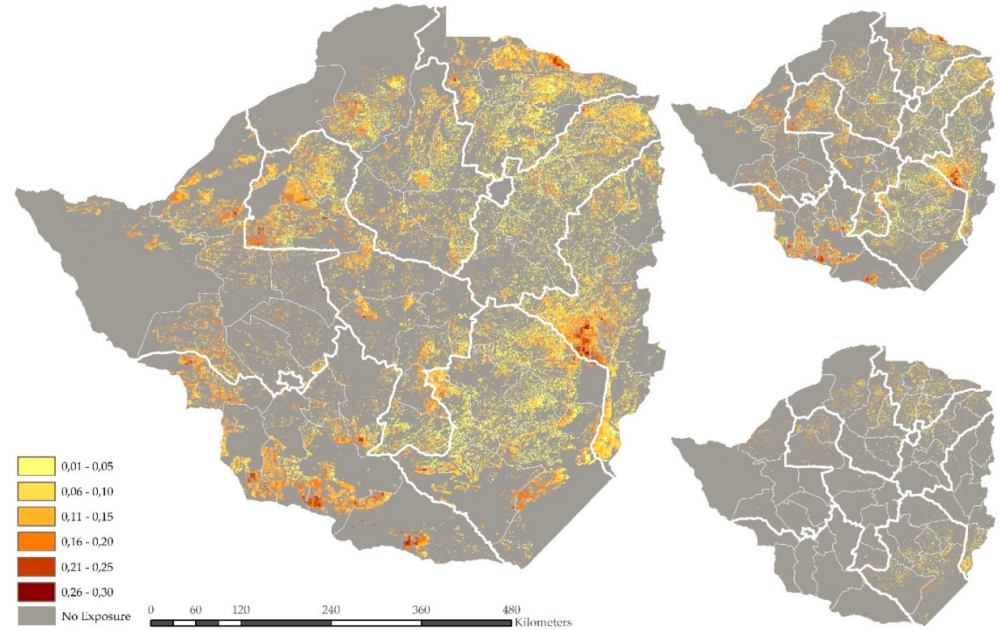
+

Exposure

Regional studies - Zimbabwe



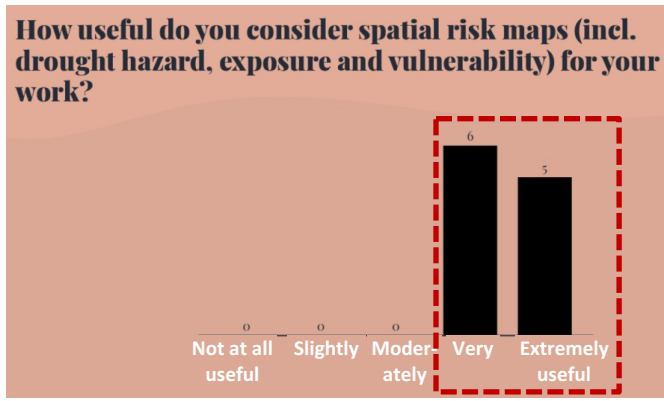
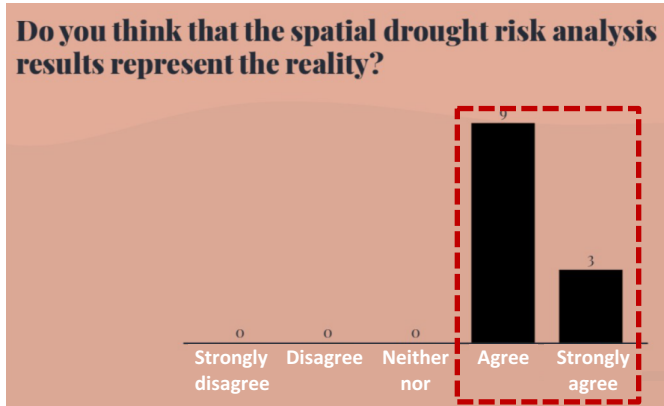
Frischen et al., 2020

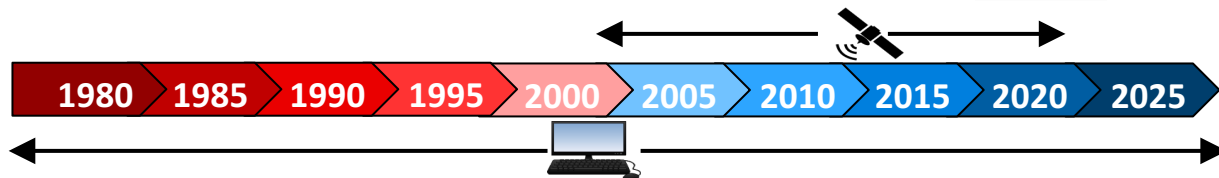


+ **Vulnerability** = **Drought risk**

Regional studies - Zimbabwe

Virtual validation workshop (09/2020) & online survey with relevant stakeholders

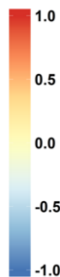
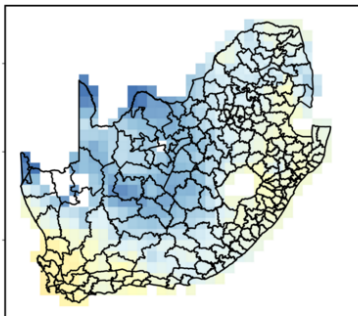
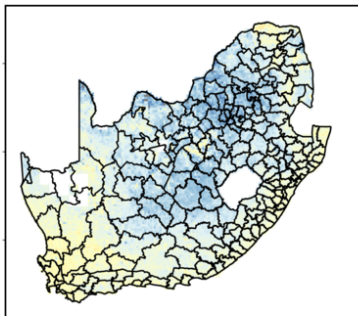




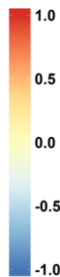
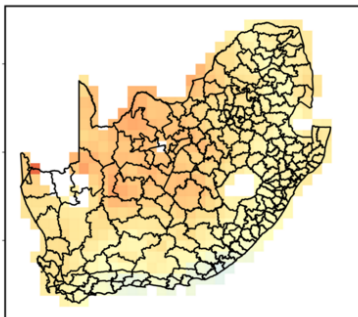
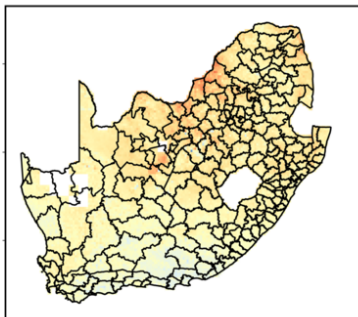
CDI -- Remote sensing

CDI -- Model

Wet year -- 2006



Dry year -- 2015



Consistent computing of the **Crop Drought Index (CDI)** for **South Africa** based on **remote sensing** and crop water **modeling**

High resolution remote sensing data only available for relative short period

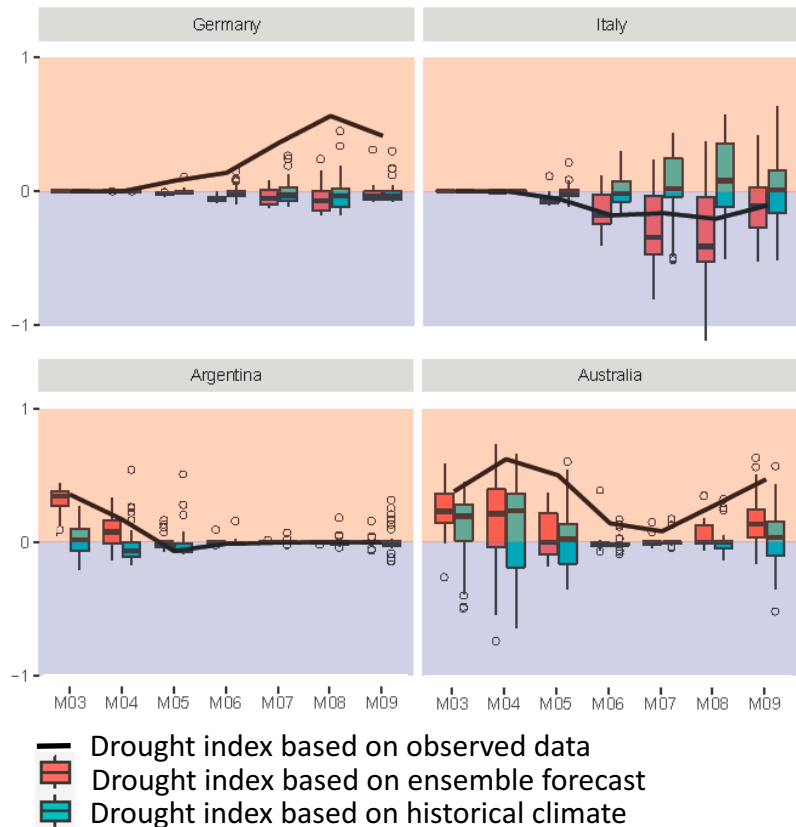
but

drought is defined as **deviation from normal conditions**



Crop model needed to define what is "normal"

Using bias-corrected global ensemble ECMWF-forecasts for drought forecasting



Case study:

Simulating the drought in year 2018 in a joint study with KIT-IMK Garmisch (**GRoW-SaWaM**)

- ERA5-input until 03/18
- Starting on 1st March 2018 using
 - a) Historical climate data
 - b) Ensemble forecasts

First results:

- Drought situation in Argentina, Australia and Italy better reproduced with ensemble forecasts
- Severe drought in Germany outside of the range predicted by historical climate or ensemble forecasts

GlobeDrought information system:

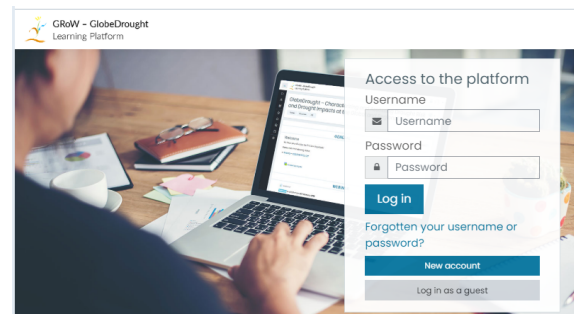
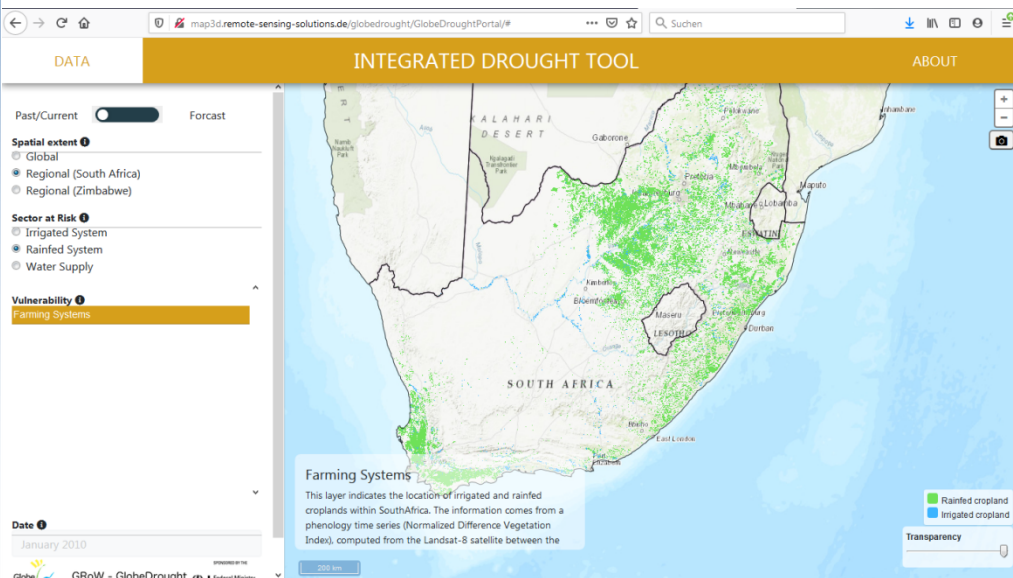
<http://map3d.remote-sensing-solutions.de/globedrought/GlobeDroughtPortal/>

=> Presentation Tobias Landmann (RSS) this afternoon at
the **stakeholder forum**

GlobeDrought eLearning platform:


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

=> **12 webinars & online lectures** available at
the project website



Available learning blocks

<p>GlobeDrought - Characterizing and Assessing Drought Risk and Drought Impacts at the Global and Regional Level</p>	<p>Drought Impacts I: Migration</p> <p>Land degradation and drought are challenges that are intimately linked to food insecurity and migration. In just 15 years, the number of...</p>	<p>Drought Impacts II: Gender/Women</p> <p>Drought can have economic, social, and environmental effects on women in developing countries. Unequal...</p>	<p>Drought Hazards I: Meteorological Droughts</p> <p>Drought is a complex phenomenon which is difficult to define and measure. Drought hazards develop slowly,</p>
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JRC TECHNICAL REPORTS

Drought vulnerability indicators for global-scale drought risk assessments

Global expert survey results report

Meza L, Hagenlocher M, Naumann G, Vogt J, V. Frischen J.

2019



EUR 29824 EN

Timing is Everything—Drought Classification for Risk Assessment

Valerie Graw¹, Gohar Charayun, Jonas Scheiner, Javier Gonzalez, Ayman Abdel Hamid, Yvonne Witz, Kerin Tschill, Joachim Post, Andries Jordaan, and Olena Dubrovskaya

Abstract. Drought is one of the most severe natural disasters with a high risk for human livelihoods. Remote sensing based drought indices can identify dry periods using, e.g., precipitation vegetation indices, soil moisture, and satellite-derived soil moisture. The timing of a drought event and duration are important variables to assess the drought impact and risk. This article introduces a drought event-based classification of drought events and reports on their impact on vegetation production during different crop growing seasons. Drought and drought severity are analyzed in Eastern Cape Province, South Africa. Here, the impact of a drought on vegetation production highly depends on the starting point and the duration of rainfall during the growing season. Weighted linear combination was applied based on vulnerable vegetation growing stages in the phenology to identify severity per season. Particularly, the extreme drought severity in 2012/2013 was used for the annual vulnerability index in 2012/2013 as a benchmark. The developed approach over one year to quantify drought impact per cropping season from local to regional scales. Satellite-based socio-economic information can further complement this hazard information to support the quantification of the actual drought risk.

Index Terms—drought indices, phenology, risk analysis, time series analysis, weighted linear combination (WLC).

1. INTRODUCTION

DROUGHT is one of the most severe disasters of the 21st century. It contributes to global food insecurity, environmental and economic problems, and ranks first with regard to the number of people affected due to natural hazards on a global scale [1], [2]. Droughts are naturally occurring but increasing in frequency, intensity and severity over the last decades, particularly in Africa, East Asia, the Mediterranean region and Southern Australia [3], [4]. The definition of drought is rather conceptual and often in lack of precision [5]. Four different types of drought are distinguished by the duration of water shortage and system affected: meteorological, hydrological, agricultural, and socio-economic [1], [6]. Effects of droughts are global, but there is still lack of quantification of the actual risk caused by drought events [7], [8].

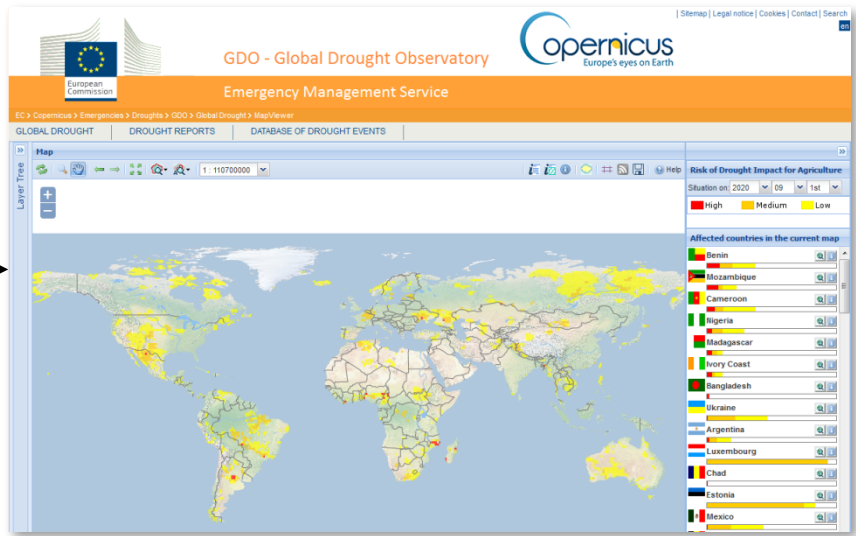
Remote sensing represents a manifold tool to monitor droughts and its characteristics. Besides precipitation information, among others, the use of the Standardized Precipitation Index [9], [10] or Standardized Precipitation Evapotranspiration Index [11], time series analysis of vegetation indices based on the Enhanced Vegetation Index (EVI) help to detect anomalies in productivity [1], [14], [15] and identify vegetation dynamics during drought and non-drought years [7]. Besides these well-established drought indices, the Modified Drought Severity Index [16] or the Flower-Plant-Dependent Drought Index [17] are some of the most recent approaches. Global drought classification schemes using, for example, the Vegetation Condition Index (VCI) [18] provide insights into the occurrence and intensity of droughts. In addition, other meteorological variables, such as temperature, play important roles with regard to crop heat stress [19].

Drought characteristics differ depending on biophysical pre-conditions and socio-economic impact [20]. The timing of a drought event is an important variable as the time of drought onset has intensive effects on the actual impact of a drought. This is, because different land cover types and various crops have different susceptibilities to rainfall, soil moisture content, and temperature. In this article, the timing of drought impacts naturally in Eastern Cape Province, South Africa, within the latest period 2007–2017. The aim of the study was to generate a more accurate annual drought severity information considering the assumed cropping cycle impacted by the timing of a drought onset and drought duration. Results were used as input data for further socio-economic analysis with regard to the objectives for the Global Framework for Disaster Risk Reduction (GSDRR) [21]. For this approach, we first, identified drought onset and end-months in the study region using remote sensing based drought information, second, detected seasonal parameters based on vegetation phenology, third, identified vulnerable

Joint publications with stakeholders:

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

=> **14 articles and reports published**, can be accessed through the project website



Emergency Management Service

Risk of Drought Impact for Agriculture

Situation on: 2020 | 09 | 1st

Legend: High (Red), Medium (Yellow), Low (Green)

Affected countries in the current map:

- Benin
- Mozambique
- Cameroon
- Nigeria
- Madagascar
- Ivory Coast
- Bangladesh
- Ukraine
- Argentina
- Luxembourg
- Chad
- Estonia
- Mexico

=> **Direct uptake and implementation** of new methods and project results into information systems maintained **by the stakeholders**

Many thanks for your attention and please visit us at:

- **Stakeholder Forum A:** Digital innovations for managing water quantity
- Our **virtual market place** available from 09AM-06PM on conference days and 03PM-06PM the other days
- Our **final project workshop** in virtual format on November 3-4, 03PM-05PM (CEST)
<https://grow-globedrought.net/final-workshop/>



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