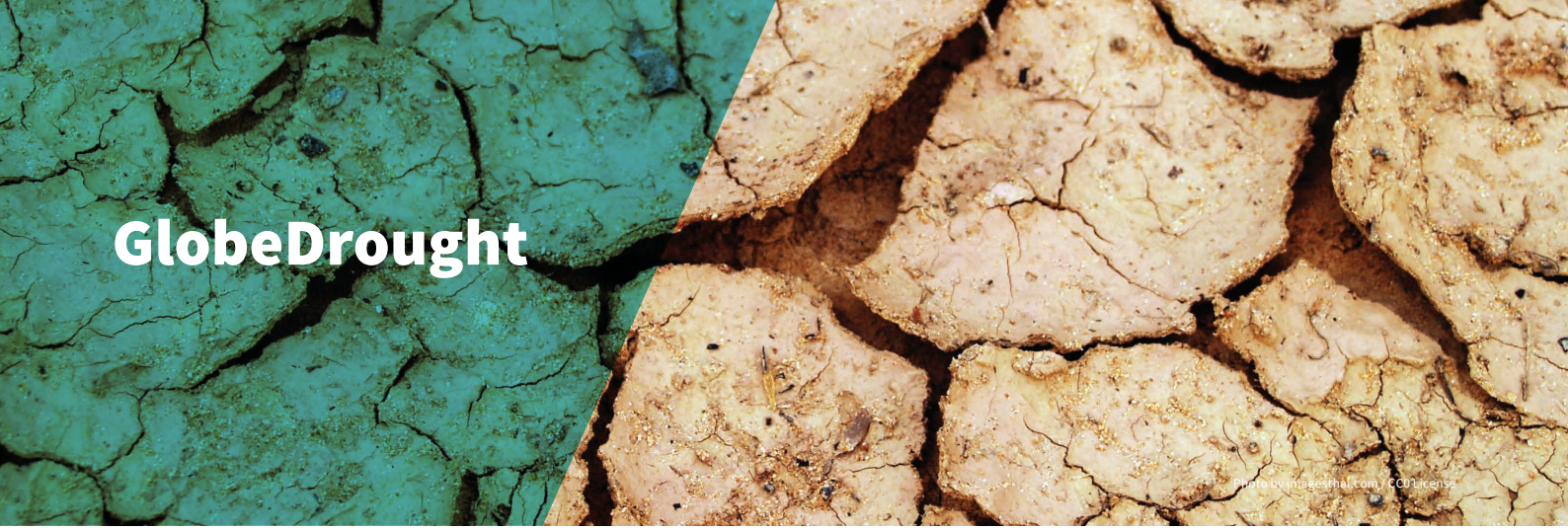
GlobeDrought

A global-scale tool for characterizing droughts and quantifying their impact on water resources

Summary

The aim of the 3-year GlobeDrought project (2017-2020) is to develop a web-based information system for comprehensively characterizing drought events. The project will produce a spatially explicit description of drought risks by considering three components: (i) drought hazard, (ii) exposure, and (iii) vulnerability. It will investigate how droughts impact water resources, crop productivity, trade in food products and the need for international food aid. In terms of methodology, the project aims to link satellite-based remote sensing of vegetation conditions and analyses of precipitation data with hydrological modeling and crop modeling. This will produce indicators for characterizing meteorological, hydrological and agricultural droughts, which will make it possible to quantify drought hazards as an important driver of risk. Analyses of socioeconomic, governance-related and environmental data will provide the basis for quantifying exposure and vulnerability of social-ecological systems. Within the framework of a co-design process, potential users and stakeholders will help to shape the content and technical design of the drought information system. The global-scale analyses planned for the project which focuses on drought impacts on agricultural systems and water supply will be supplemented by detailed analyses for regions heavily affected by droughts such as Southern Africa, Eastern Brazil, Western India, and the Missouri River Basin of the United States.



Impact

In times of drought, water resources are insufficient. These water shortages often have negative effects on agricultural productivity and on associated socioeconomic factors. They can cause reduced income, food shortages and even famines. Operational early warning systems for droughts try to address the problem. However, they are mostly only capable of characterizing the status quo, or offer limited forecasts for droughts in the near future – e.g., the next three to six months. These early warning systems generally do not sufficiently integrate variables and drought indicators. In particular, they do not adequately describe causal links in the formation and development of droughts, connections between the various types of droughts (meteorological, hydrological and agricultural), and socioeconomic factors. The project intends to fill this gap by developing an **integrated drought (risk) information system**. With its planned experimental early warning system, the project aims to reduce the time between satellite-based data collection, identification of a drought risk and the implementation of countermeasures by political decision-makers and those involved in international humanitarian aid.

Expected outcome

The **Drought Information System** will comprise of a global component and components providing more specific regional analyses. The information system will be developed and tested using historical data for climate, land use, crop yields, water use, trade and socio-economic indicators complemented with vegetation health analyses using remote sensing. The experimental early warning system will provide data, maps and tools for near real time drought monitoring. In addition, a projection of the development of droughts within the next year will be provided, based on ensembles of historical climate data as replacement of climatic data for the future. Probabilities will be calculated to quantify how likely it is that a drought becomes more severe, remains similar, becomes less severe or disappears within the projected time period.

The **regional drought assessments** will be adapted in a co-design process to the requirements of partners and stakeholders in the project regions. Therefore the regional drought information systems will be more precise, of higher spatial resolution but the indicators used and the impacts studied will vary for the specific regions. In contrast, the global information system will facilitate comparisons of drought impacts, drought risks and drought condition across the globe.

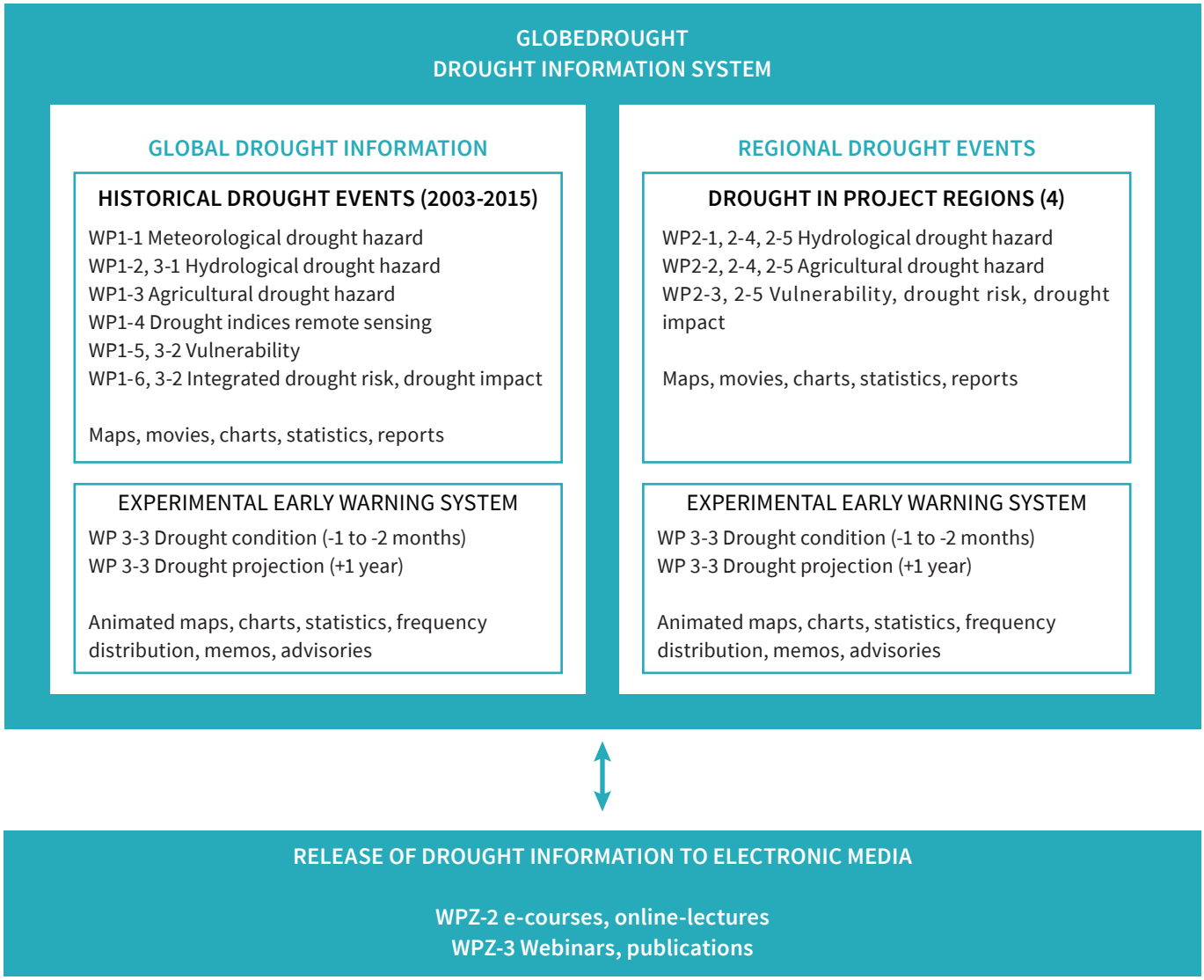


Fig. 1: Products to be developed in specific work packages contributing to the Drought Information System (source: project proposal)

GlobeDrought is one out of 12 collaborative projects funded under the "Global Resource Water (GRoW)" funding scheme in the framework program FONA (Research for Sustainability) of the German Federal Ministry for Education and Research (BMBF) which aims at contributing to the achievement of the Sustainable Development Goals (notably SDG 6).

The **GlobeDrought consortium** consists of three partners from German universities (Universities of Goettingen, Bonn and Frankfurt), the United Nations University (Institute for Environment and Human Security at Bonn, Germany), the commercial partner Remote Sensing Solutions GmbH and the Welthungerhilfe, a NGO running projects and emergency aid programs in many parts of the world.

GlobeDrought acknowledges extremely relevant support from a growing network of associated partners and regional experts collaborating in a community of practice to define information needs and the design and functionality of the drought information system. This network also helps to validate our drought information system by using regional and local data and information systems.

More information is provided **at our website at**: http://grow-globedrought.net/

Contact (project coordinator):
Prof. Dr. Stefan Siebert
Department of Crop Sciences, University of Goettingen,
Von-Siebold-Str. 8, D-37715 Goettingen
mail: stefan.siebert@uni-goettingen.de,
https://www.uni-goettingen.de/agronomy

Project partners and tools to be used

Prof. Dr. Stefan Siebert
Department of Crop Sciences
mail: stefan.siebert@uni-goettingen.de
https://www.uni-goettingen.de/
Coordination; Drought impact on crop production and agricultural water demand
Global: GCWM (Siebert and Döll, 2010)
Regional: SIMPLACE <LINTUL5, DRUNIR, CanopyT> (Zhao et al., 2015)

Prof. Dr. Jürgen Kusche
Institute of Geodesy and Geoinformation
mail: kusche@geod.uni-bonn.de
https://www.igg.uni-bonn.de/en
Drought impact on total water storage change;
Analysis of GRACE - gravity data, assimilation of total water storage changes from GRACE into WGHM (Kusche et al., 2016; Schumacher et al., 2016)

Dr. Olena Dubovyk
Center for Remote Sensing of Land Surfaces
mail: odubovyk@uni-bonn.de
https://www.zfl.uni-bonn.de/
Drought impact on vegetation health;
Remote sensing of vegetation condition, assimilation of remotely sensed crop parameters into crop models (Dubovyk et al., 2015; Parplies et al., 2016)

Prof. Dr. Petra Döll
Institute of Physical Geography
mail: p.doell@em.uni-frankfurt.de
http://www.goethe-university-frankfurt.de
Drought impact on terrestrial hydrology;
Hydrological modeling using WaterGAP and WGHM (Döll et al., 2018; Döll et al., 2012), coupling of WGHM with the crop model SIMPLACE <LINTUL5, DRUNIR, CanopyT>

Dr. Michael Hagenlocher
Institute for Environment and Human Security (UNU-EHS)
mail: hagenlocher@ehs.unu.edu
https://ehs.unu.edu/
Indicator-based approaches for spatial vulnerability assessment (agricultural systems, water supply) and integration of drought hazards, exposure and vulnerability into drought risk (Hagenlocher et al., 2018; BEH & UNU-EHS, 2016) at global level and within the case study regions.

Dr. Jonas Franke
Remote Sensing Solutions GmbH
mail: franke@rssgmbh.de
http://www.rssgmbh.de/
Development, hosting and marketing of the web-based drought information system, remote sensing-based analysis of land use and vegetation anomalies

Daniel Rupp
Welthungerhilfe
mail: daniel.rupp@welthungerhilfe.de
https://www.welthungerhilfe.de/
Vulnerability and risk assessment Zimbabwe and other regions; analysis of trade flows and emergency food aid; assessment of information from own project network

GlobeDrought is sponsored by the German Federal Ministry of Education and Research (BMBF) through it's funding measure Global Resource Water (GRoW) which is part of the Sustainable Water Management (NaWaM) funding priority within the Research for Sustainable Development (FONA) framework.