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 and associated risks. 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 agricultural systems and public water supply. 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 soil moisture 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 risk 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 (incl. South Africa and Zimbabwe), Eastern Brazil, Western India, and the Missouri River Basin of the United States.

GlobeDrought

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 soil moisture), 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** comprises of a global component and components providing more specific regional analyses for the Republic of South Africa and Zimbabwe. 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 risk assessments** are being adapted in a co-design process to the requirements of partners and stakeholders in the region. In contrast, the global information system facilitates comparisons of drought impacts, drought risks and drought conditions across the globe.

GLOBEDROUGHT
DROUGHT INFORMATION SYSTEM

GLOBAL DROUGHT INFORMATION

HISTORICAL DROUGHT EVENTS (1986-2015)

- Meteorological drought hazard
- Hydrological drought hazard
- Soil moisture drought hazard
- Drought indices remote sensing
- Vulnerability
- Integrated drought risk, drought impact
- Assimilation total water storage in hydrological model

Maps, charts, statistics, reports

EXPERIMENTAL EARLY WARNING SYSTEM

Drought condition (−1 to −2 months)
Drought projection (+1 year)

Animated maps, charts, statistics, frequency distribution, memos, advisories

REGIONAL DROUGHT INFORMATION

DROUGHT IN PROJECT REGIONS

- Hydrological drought hazard
- Soil moisture drought hazard
- Vulnerability, drought risk, drought impact
- Assimilation total water storage in hydrological model

Maps, charts, statistics, reports

EXPERIMENTAL EARLY WARNING SYSTEM

Drought condition (−1 to −2 months)
Drought projection (+1 year)

Animated maps, charts, statistics, frequency distribution, memos, advisories

RELEASE OF DROUGHT INFORMATION TO ELECTRONIC MEDIA

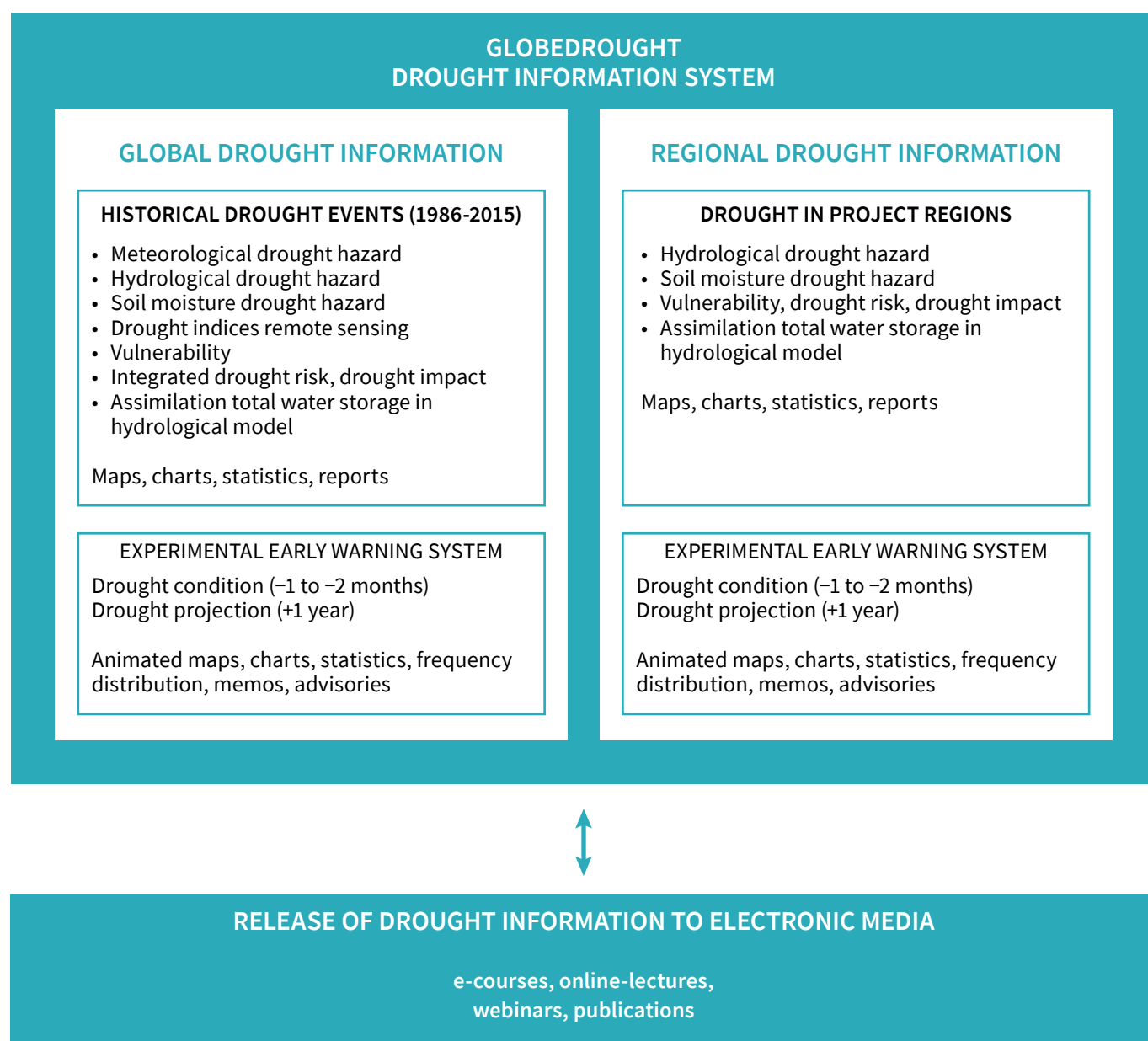**e-courses, online-lectures, webinars, publications**

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 Welthungerhilfe, an 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.

E-Learning Activities

The GlobeDrought e-Learning activities are arranged into 12 learning blocks that are delivered sequentially. Each learning block covers the learning objectives of one topic with a webinar, an online lecture, and an online forum discussion.

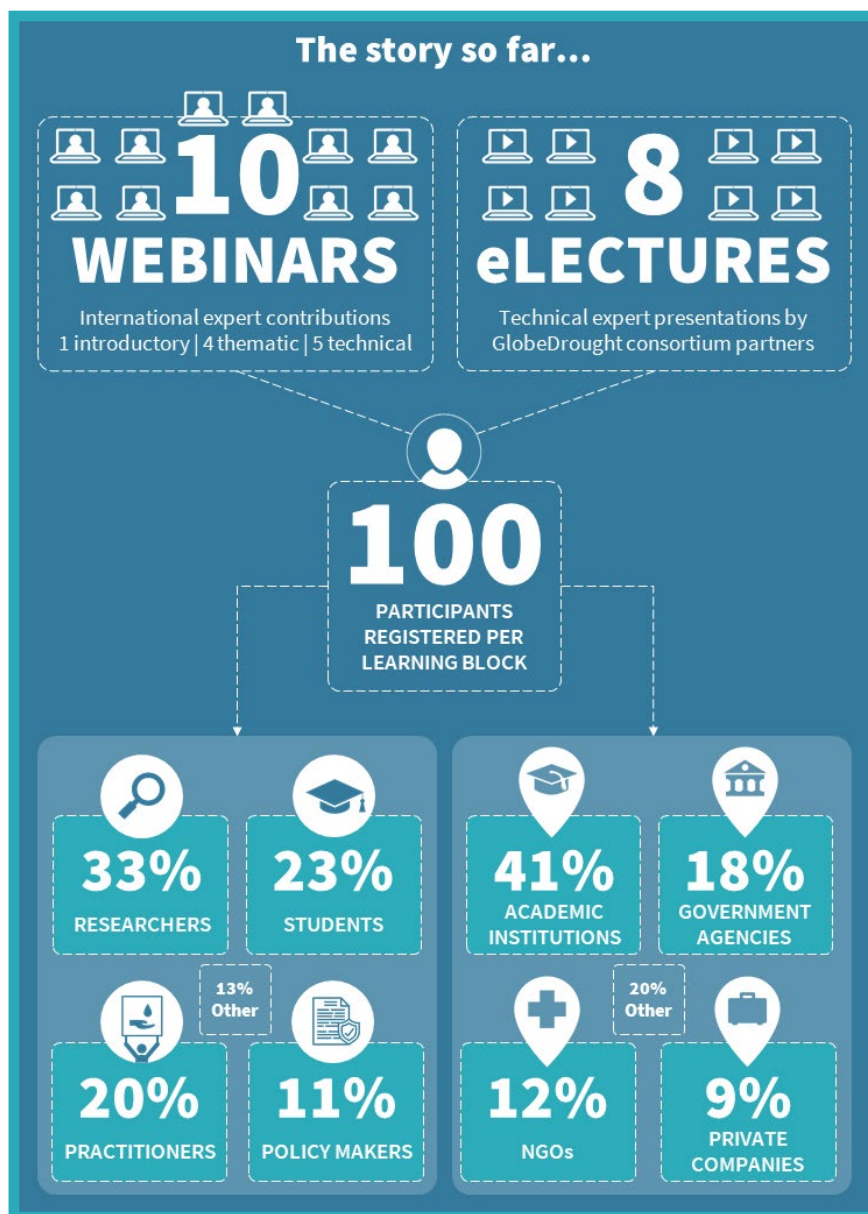The series includes two types of learning blocks:

1. **Technical**
   Covering different topics related to drought risk reduction and management, such as indicators, remote sensing, and risk assessment

2. **Thematic**
   Covering different topics related to drought impacts, such as migration, women empowerment, and food security

The webinars and lectures are targeted towards practitioners of all levels, including people involved in NGOs or international organisations working on disaster risk reduction and the the world of academia.

They are designed as a platform for information exchange where external stakeholders and relevant organisations provide insights into the role that innovative approaches can play in addressing drought impacts at all scales.

The story so far...

10 WEBINARS
International expert contributions
1 introductory | 4 thematic | 5 technical

8 eLECTURES
Technical expert presentations by GlobeDrought consortium partners

100 PARTICIPANTS REGISTERED PER LEARNING BLOCK

- 33% RESEARCHERS
- 23% STUDENTS
- 13% Other
- 20% PRACTITIONERS
- 11% POLICY MAKERS

- 41% ACADEMIC INSTITUTIONS
- 18% GOVERNMENT AGENCIES
- 20% Other
- 12% NGOs
- 9% PRIVATE COMPANIES

Upcoming: Two more learning blocks on the GlobeDrought Information System and droughts in the context of the post-2015 agenda.

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

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Project partners and tools to be used

Prof. Dr. Stefan Siebert
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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
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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
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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
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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)
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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
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Development, hosting and marketing of the web-based drought information system, remote sensing-based analysis of land use and vegetation anomalies

Daniel Rupp
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Vulnerability and risk assessment Zimbabwe and other regions; analysis of trade flows and emergency food aid; assessment of information from own project network