



GAR19

- Drought Risk Component -

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The Sub-Chapter on drought:

- Will dive deeper into aspects of systemic risk [...]. By **mapping relative risk of drought impacts on different sectors including secondary and cascading effects**, it will illustrate pathways to systems risk assessment, assessing natural and human-induced causes and determinants of drought.
- Is expected to **highlight the complex nature of assessing global and localized drought risk**, describing the propagation of drought through the hydrological cycle, the potential for amplification from climatic instability, and related direct and indirect impacts across various sectors.
- Is expected to provide an **analysis of [...] the exposure and vulnerability** based on social, economic and infrastructural indicators at national, subnational and administrative unit level, using the Global Human Settlements Layer (GHSL).
- As a **precursor to a 2020 GAR Special Report on Drought**, it will examine the consequences across economic and environmental sectors for example, and potentially the corollary impacts on inter alia food security and food systems, water access and availability, markets, employment and energy distribution, or related socio-political and security outcomes.



1. Introduction (5 pages)

- 1.1 What is a drought?
- 1.2 Drought Indicators

2. Climate Variability, Climate Change and Drought Hazard (7 pages)

- 2.1 Past Droughts
- 2.2 Sub-seasonal to Seasonal Variability and ENSO
- 2.3 Climate Change and Future Droughts

3. Assessing Global Drought Risk (14 pages)

- 3.1 Concept
- 3.2 Assessing the risk for agriculture and other primary sectors (hazard, exposure, vulnerability, risk)
- 3.3 Considerations for other sectors
- 3.4 Scale considerations



4. Drought Impacts (12 pages)

4.1 Introduction

4.2 Case studies

A: Argentina (Impact on market oriented agriculture)

B: South Africa (Impact on public water supply)

C: Syria (Impact on agriculture, land degradation and conflict)

D: California (The 2011-2015 drought)

5. Drought Risk Management (11 pages)

5.1 Approaches to drought risk management

5.2 Components of a pro-active drought risk management

5.3 Benefits of action against costs of inaction

5.4 Adaptation and strengthening resilience

6. The way forward (2 pages)

- Opportunities and challenges

1. Introduction

- No unique definition
- Rainfall deficit, atmospheric water demand, temperatures, wind, ...
- Different drought types (meteorological, soil moisture, hydrological)
- Megadroughts, Flashdroughts
- Timing
- To be distinguished from aridity and water scarcity
- Water and land management as important factors

- Different drought indicators → reference to Handbook
- Key variable to characterize droughts (frequency, severity, intensity, duration, area affected,)

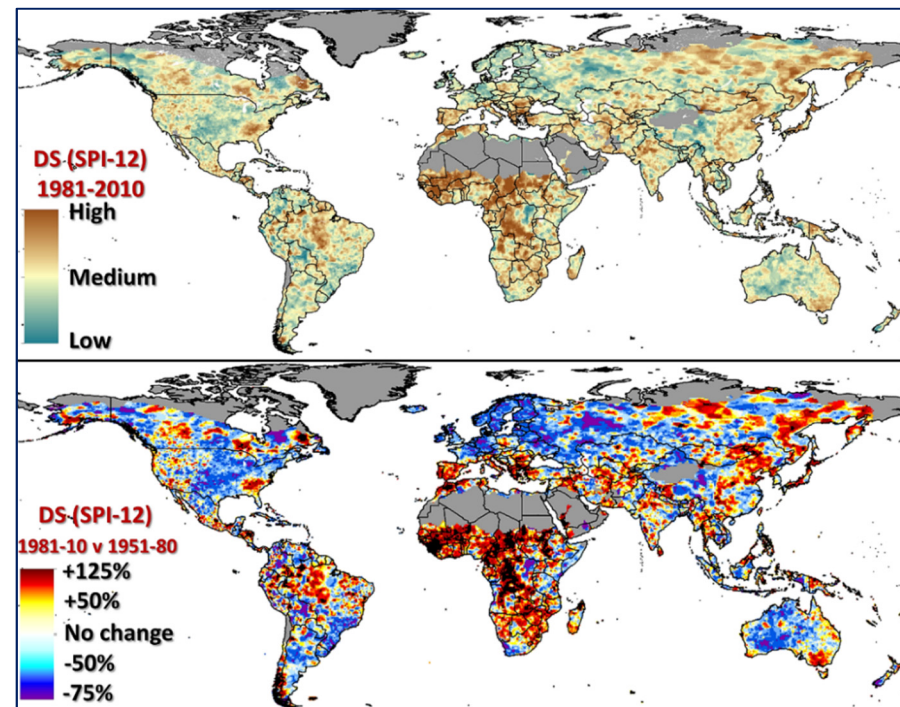
2. Climate Variability, Climate Change and Drought Hazard

2.1 Past Droughts

- Short discussion of past drought events
- Example of trends in meteorological drought severity (1951-1980 vs 1981-2010)

- Cumulative drought severity (SPI < -1)
- GPCC V7 & CRUTS V4.01
- 0.5 dgr. resolution

Spinoni et al. 2018



2. Climate Variability, Climate Change and Drought Hazard

2.2 Sub-seasonal to Seasonal Variability and ENSO

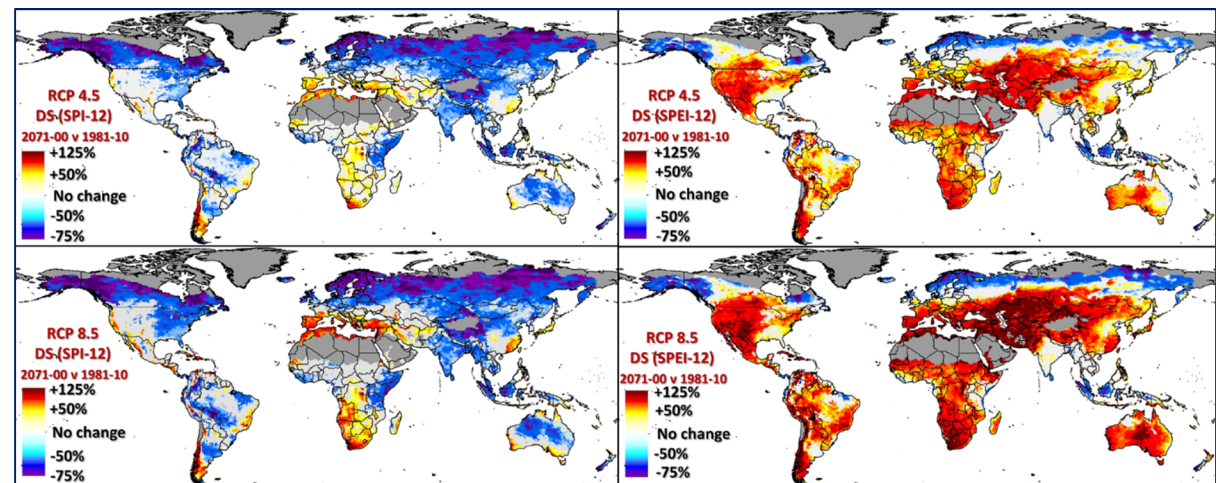
- Influence of low frequency climate features like ENSO
- Ocean-atmosphere interactions
- Sub-seasonal events (flashdroughts) that can intensify longer-term droughts

2.3 Climate Change and Future Droughts

- Influence of temperature trend
- Uncertainties
- Hot spots

- Cumulative drought severity (SPI < -1)
- 109 simulations from CORDEX
- 0.5 dgr. Resolution

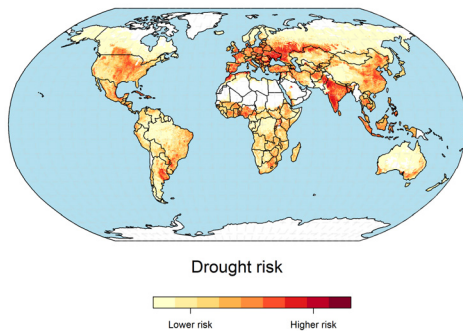
Spinoni et al. 2018





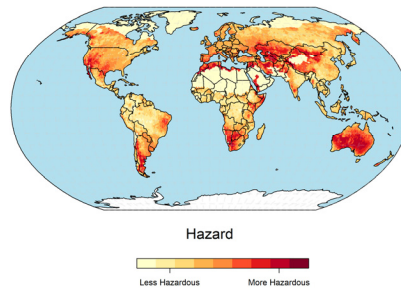
3. Assessing Global Drought Risk

Risk



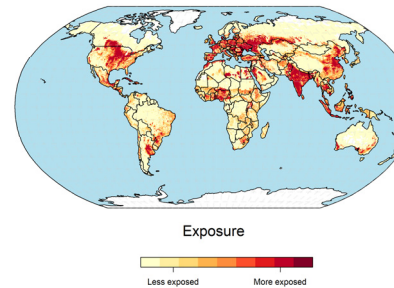
Likelihood of drought impact

Hazard



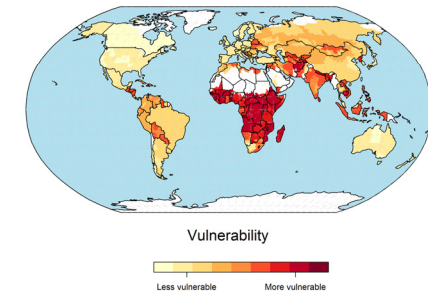
Probability of a drought event with a certain severity.

Exposure



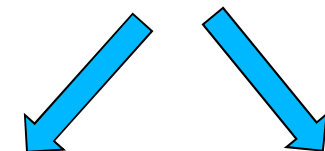
Amount of population, livelihoods, assets, resources, services potentially affected.

Vulnerability



Susceptibility to suffer adverse effects

➡ Risk is sector specific!



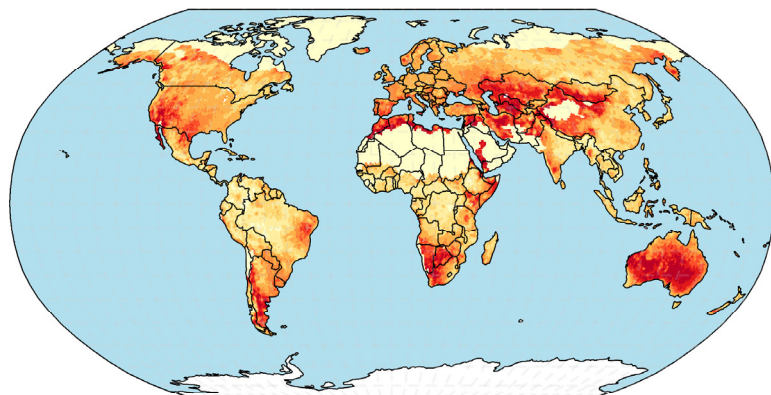
Sensitivity

Coping & Adaptive Capacities

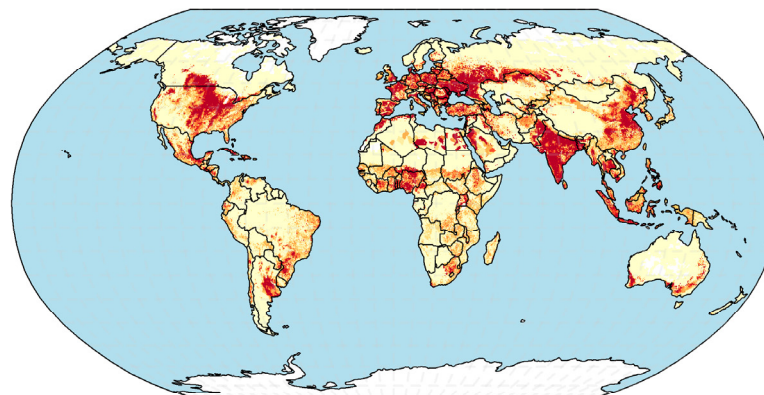


Example of Agriculture

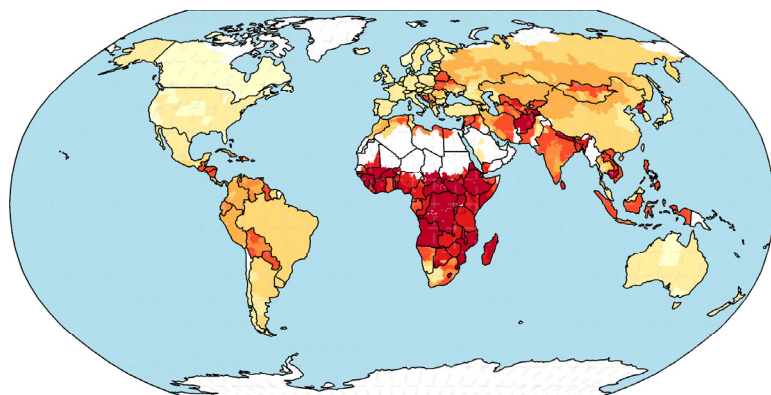
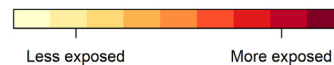
Component	Data and Methodology
Hazard	<ul style="list-style-type: none">• Probability of exceedance of median severe precipitation deficits (1901-2010)• Weighted Anomaly of Standardized Precipitation Index (WASP)
Exposure	<ul style="list-style-type: none">• Population (GHSL, 2015)• Agricultural lands (2000)• Gridded livestock of the world (2005)• Baseline water stress (2010)
Vulnerability	<ul style="list-style-type: none">• Composite indicators, including social, economic, environmental and infrastructural components
Overall risk	<ul style="list-style-type: none">• Aggregation of the risk components following a multivariate, non-parametric linear programming algorithm (Data Envelopment Analysis)• Relative statistic that provides a regional ranking of potential impacts• Scale dependent



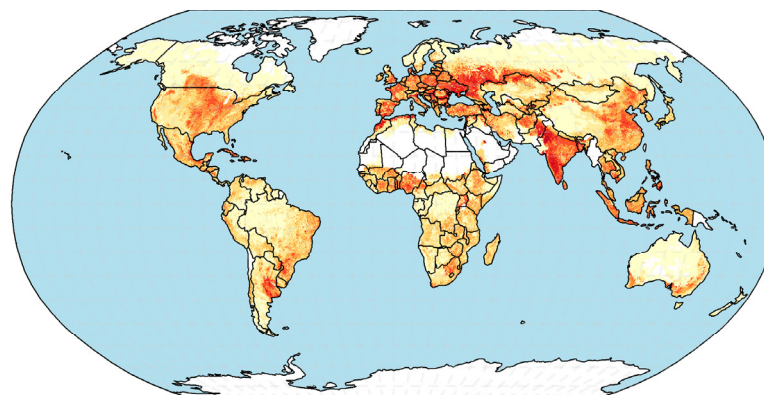
Hazard



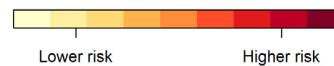
Exposure



Vulnerability



Drought risk





Discussing other sectors and indicators:

- Results for different hazard indicators (e.g. based on soil moisture, low flows)
- Power generation
- Waterborne transport
- Public water supply

Influence of scale and data quality

- Example of Argentina



4. Drought Impacts

Discussion of various impact types

- Direct and indirect, cascading
- Market-related and non-market related
- Quantification in terms of damages and losses

Examples:

- Economic (production, sales, business)
- Socio-economic (welfare, health, safety, conflicts)
- Environment (forestry, wildfires, biodiversity, ...)
- Agriculture (farming, livestock)
- Public water supply
- Power generation (hydro power, thermal, nuclear)
- Waterborne transport
- Tourism, recreation
- ...

Four Case Studies

- Exemplifying different impacts



5. Drought Risk Management

- Reactive vs proactive
- Components of DRM (3 pillars)
- 10-step approach
- Benefits of action against costs of inaction
- Adaptation and strengthening resilience
- Example of implementation in IDMP CEE
- Example of an EWS (GDO)



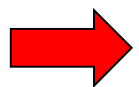
Pischke & Stefanski, 2018



6. The way forward

Highlighting six areas of concern and opportunity:

1. Risk assessment (sectorial and multi-hazard)
2. Uncertainties associated with a changing climate (regional and local levels)
3. The increasingly complex pathways of drought impacts: Water-Energy-Food nexus
4. The costs of drought impacts, including the benefits of action and costs of inaction
5. The role of technology, efficiency and policy
6. Links to human security and conflict: an area for future research



To be discussed in detail in the Special Report 2020!