

# Climatic extremes

## Scientific basics of 2018/2019 droughts in Germany and Europe



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### Introduction

#### What is a drought? [1]

- a water deficiency, resulting from a shortage of precipitation and/ or an increase of evaporation due to a higher temperatures (or wind) in comparison to a reference period (1961-1990)

<b>meteorological drought</b>	1-2 months	
<b>agricultural drought</b>	2-4 months	harvest loss
<b>hydrological drought</b>	>4 months	groundwater and water levels affected
<b>socio-economic drought</b>	>1 year	water deficiency slows economy

#### Drought Indices [2]

- are used for the detection and assessment of droughts
- Assessment of a drought includes the consideration of the water deficiency in relation to precipitation of a reference period

<b>SPI</b>	Standardized Precipitation Index
<b>SPEI</b>	Standardized Precipitation Evapotranspiration Index
<b>GPCC-DI</b>	Global Precipitation Climatology Centre Drought Index, combination of <b>SPI</b> and <b>SPEI</b>

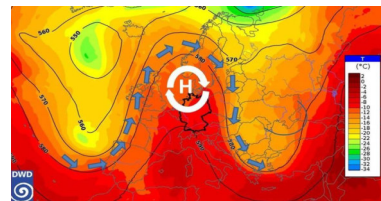
German Meteorological Service (DWD) calculates the **SPI** and the **GPCC-DI** for Germany

#### Development: [3]

- since April the Middle and North Europe were influenced by long-running warm and dry weather course
- caused by a formation of persistent Omega block
- stable high-pressure systems formed over Great Britain and South Scandinavia
- relocated their position a little northward in June
- Westwind drift collapsed and low-pressure systems were blocked
- moist air masses were transported towards Norwegian sea and could not reach Middle and North Europe
- Areas received continental dry and warm air masses from south-east direction
- due to little cloud cover many regions reached very high sunshine durations
- Affected areas could become more and more hot and dry
- led to extraordinary high temperature deviations
- intense hot spell in July

### 2018 drought vs. 2019 drought

- Droughts in Europe are strongly related to Omega blocks [4]
- stable and immovable high-pressure system between two low-pressure systems
- structure looks like the Greece letter Omega



Typical formation of an Omega block [10]

#### Development: [5]

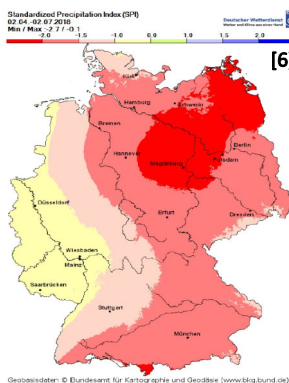
- summer 2019 in Europe is characterized by several hot spells
- **first hot spell** in transition from June to July
- stable high-pressure system over Europe and Atlantic low- pressure system situated in front of Spain and Great Britain
- Europe received warm and dry air from Sahara
- low-pressure system over the Baltic region led to formation of an Omega Block
- **second hot spell** in transition from July to August
- stable high-pressure system from Sahara over Europe and strong Atlantic low-pressure system built an Omega block
- **third hot spell** in middle of August with similar conditions
- moreover South and East Europe were under influence of an Azores high
- **fourth hot spell** in end of August is caused by combination of Atlantic high from America and a Sahara high
- expanded over Europe to the White Sea area

### Standardized Precipitation Index (SPI) of Germany

#### 2018

02.04.2018 to 02.07.2018

**Facts:** [7]  
mean temperature: 10,5°C  
Sunshine hours: 2015,4 h  
Precipitation: 586,3 mm



[6]

#### Map legend:

	<-2,0	extreme dry
	-2,0 to < -1,5	very dry
	-1,5 to < -1,0	moderately dry
	-1,0 - < 1,0	normal
	1,0 - < 1,5	moderately wet
	1,5 - < 2,0	very wet
	2,0	extreme wet

#### Reference period 1961-1990:

mean temperature: 8,2°C  
Sunshine hours: 1544 h  
Precipitation: 788,9 mm [7]

Standardized Precipitation Index - SPI

April - Juni 2019

Min / Max: -2,35 / 0,31

Standardized Precipitation Index - SPI

April - Juni 2018

Min / Max: -2,35 / 0,31

Standardized Precipitation Index - SPI

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Standardized Precipitation Index - SPI

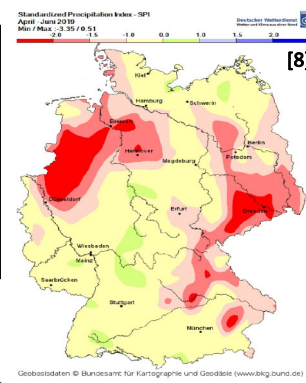
April - Juni 2018

Min / Max: -2,35 / 0,31

#### 2019

02.04.2018 to 02.07.2018

**Facts:** [9]  
mean temperature: 10,3°C  
Sunshine hours: 1834,2 h  
Precipitation: 735,0 mm



[8]

### Consequences

#### 2018

[6,7]

**Agriculture:** crops were affected in the time of bolting, consequently the harvest quality and quantity was reduced, wind erosion happened in parts of North-and East-Germany  
**Forestry:** high bush- and wildfire-risk, dying of trees with high water demand (e.g. spruce)  
**Transport:** low water levels caused reduced inland marine transport in autumn

#### 2019

[8,9]

**Agriculture:** reduced harvest of winter wheat and winter rye, severe problems with vegetables like sugar beet, corn and potatoes  
**Forestry:** high bush- and wildfire-risk, dying of trees with high water demand (e.g. spruce)  
**Transport:** in July 2019 was a reduced inland marine transport due to falling below mean low water level of rivers like Elbe, Saale, Oder, Spree, Aller and Untermain

#### Sources:

- <https://www.dwd.de/DE/service/lexikon/Functions/glossar.html?lv2=100578&lv3=603288>
- <https://www.dwd.de/DE/service/lexikon/Functions/glossar.html?lv2=100578&lv3=603290>
- [https://www.dwd.de/DE/leistungen/besondereereignisse/duerre/20180705\\_trockenheit\\_in\\_deutschland\\_2018.pdf?\\_\\_blob=publicationFile&v=2](https://www.dwd.de/DE/leistungen/besondereereignisse/duerre/20180705_trockenheit_in_deutschland_2018.pdf?__blob=publicationFile&v=2)
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#### Images:

[10] <https://www.dwd.de/DE/service/lexikon/Functions/glossar.html?lv2=101946&lv3=101968>

#### Background-Image:

<https://previews.123rf.com/images/iskandarov/iskandarov1306/iskandarov130600006/20272637-cracks-in-the-ground-near-the-pond-the-dried-up-land-without-water.jpg>