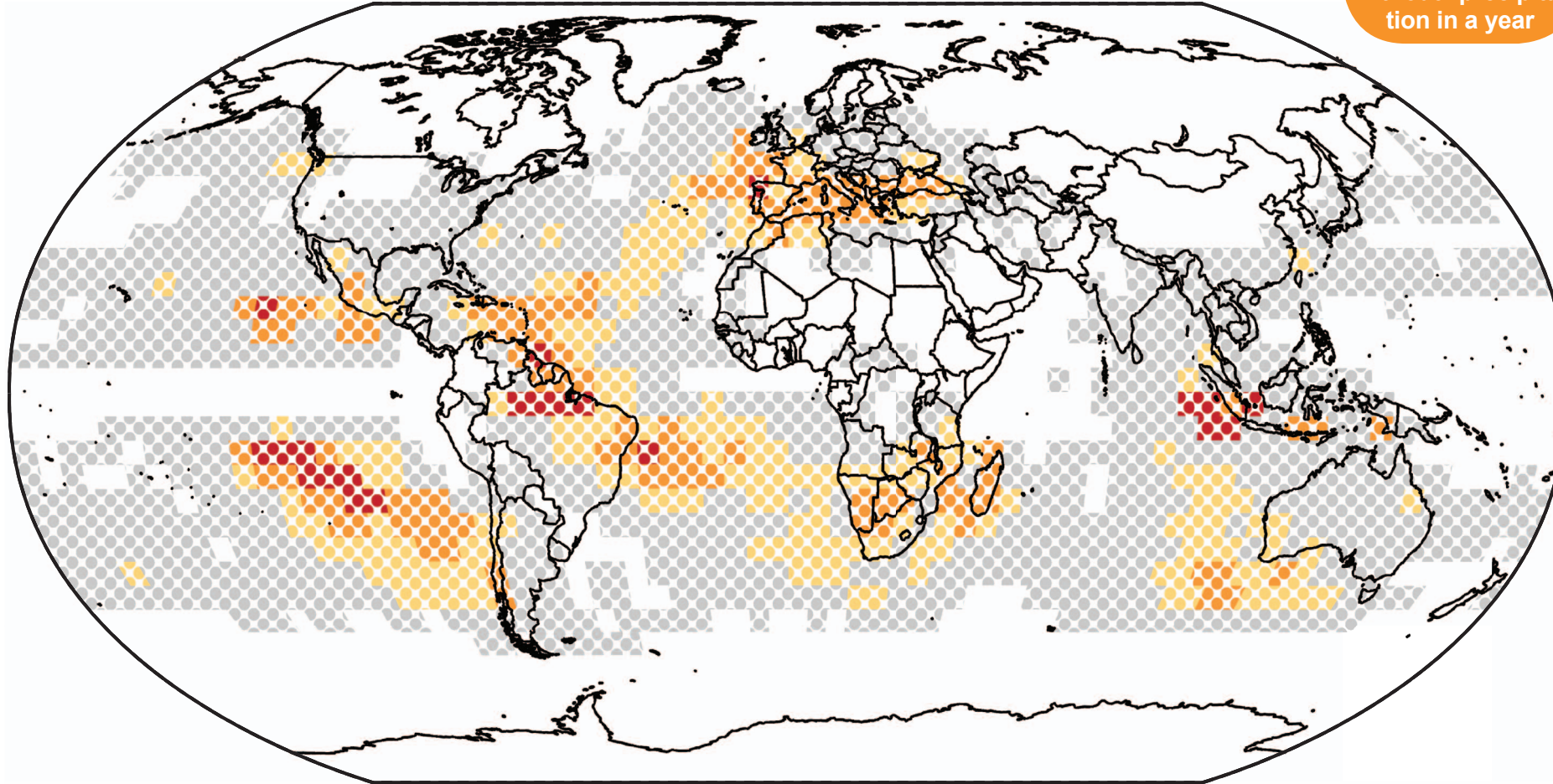


Climate-Signal-Map

Increase in the duration of extended dry periods per year

Extended dry periods are defined as the longest period of consecutive days without precipitation in a year



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Background information

A Climate-Signal-Map shows the mean projected change of a climate parameter averaged for the time period of 2036 to 2065 compared to the average for the time period of 1971 to 2000.

The map is based on a set of 66 climate change projections from a multitude of recent global climate models, resampled on a regular 5° x 5° grid. It combines simulations following three different emission scenarios.

Projected changes are regarded as robust, if at least 2/3 of all models project changes that are:

- in the same direction (decrease/increase), and
- statistically significant, and
- insensitive to small shifts of the reference and scenario time periods.

All areas with robust climate change signals are highlighted with color. All areas with non-robust changes are marked with grey.

White areas depict regions with a change in the opposite direction than indicated in the map.

More details on the method can be found under www.climate-service-center.de/climate-signal-maps

Legend

- Extension** of extended dry periods:
- more than 15 percent
 - between 10 and 15 percent
 - less than 10 percent
 - projected extension not robust
- Shortening** of extended dry periods

On behalf of



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Eine Einrichtung des Helmholtz-Zentrums Geesthacht

Zusammenfassung

Climate-Signal-Maps

- können strategischen Portfolioideen dienen.
- sind ein Tool zur schnellen und leicht verständlichen Überprüfung der Robustheit der verfügbaren Klimaänderungsinformationen.
- dienen zur Sensibilisierung im Umgang mit Klimainformationen.
- basieren auf state-of-the-art Klimainformationen und wissenschaftlichen Analysen.
- bieten als Ergänzung zu den Climate-Fact-Sheets auch regional aufgegliederte Informationen.
- können auch für weitere Klimaparameter erzeugt werden.

Was hinter den Climate-Signal-Maps steckt

Climate-Signal-Maps

- basieren auf 66 verschiedenen Klimaprojektionen aktueller globaler Klimamodelle (IPCC AR5) für 3 verschiedene Emissionsszenarien (RCP 2.6; RCP 4.5 und RCP8.5) mit der Periode 2036 bis 2065 als Projektions- und der Periode 1971 bis 2000 als Referenzzeitraum.
- sind für verschiedene Klimaparameter und Indikatoren verfügbar.
- haben (in den meisten Fällen) eine Richtung und zeigen die projizierte Zu-/ oder Abnahme eines Parameters, basierend auf dem damit verbundenen Gefährdungspotential.
- zeigen die Größe der projizierten Änderungen nur dann, wenn die Änderungen auch **robust** sind.

Robustheitstests:

Es werden für alle Klimaprojektionen drei verschiedene Robustheitsabfragen durchgeführt. Nur wenn mindestens 2/3 aller Klimaprojektionen den jeweiligen Test bestehen, werden die Änderungen farblich in der Karte dargestellt.

Test 1 – Übereinstimmung der Richtung der simulierten Änderungen

Basiert auf der "likely"- Annahme des IPCC AR4 (und auch AR5) und den Climate-Fact-Sheets.

Test 2 – Statistische Signifikanz der simulierten Änderungen

Dient der Unterscheidung zwischen Signal und Rauschen. Ein parameterfreier, verteilungsunabhängiger Signifikanztest wird verwendet.

Test 3 – Sensitivität gegenüber kleinen zeitlichen Änderungen

Hier wird der Einfluss von dekadischen Schwankungen auf das Klimaänderungssignal untersucht. Insgesamt wird die Referenz- und die Klimaänderungsperiode 10 mal um jeweils 1 Jahr verschoben und dann getestet, ob sich die Mittelwerte der projizierten Änderungen unterscheiden.

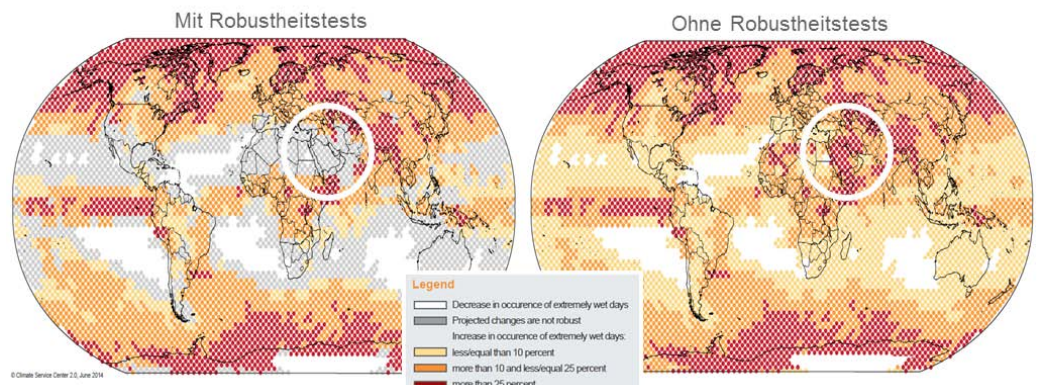
... 2035-2064 vs 1970-1999 ← 2036-2065 vs 1971-2000 → 2037-2066 vs 1972-2001 ...

Mehrwert der Climate-Signal-Maps

Climate-Signal-Maps zeigen auf einen Blick

- für welche Regionen basierend auf heutigem Wissen robuste ("verlässlichere") Klimaänderungsinformationen zur Verfügung stehen
- in welchen Regionen die projizierten robusten Änderungen am stärksten sind

Beispiel: Projizierte Änderungen im Auftreten von Tagen mit sehr starkem Niederschlag



What is shown in the maps?

- The maps show the possible increase in the duration of extended dry periods under future climate conditions (averaged for the time period of 2036 to 2065 compared to the average of the time period from 1971 to 2000).
- White regions indicate a decrease in the duration of extended dry periods.
- Grey regions indicate where the projected increase in the duration of extended dry periods is not robust.

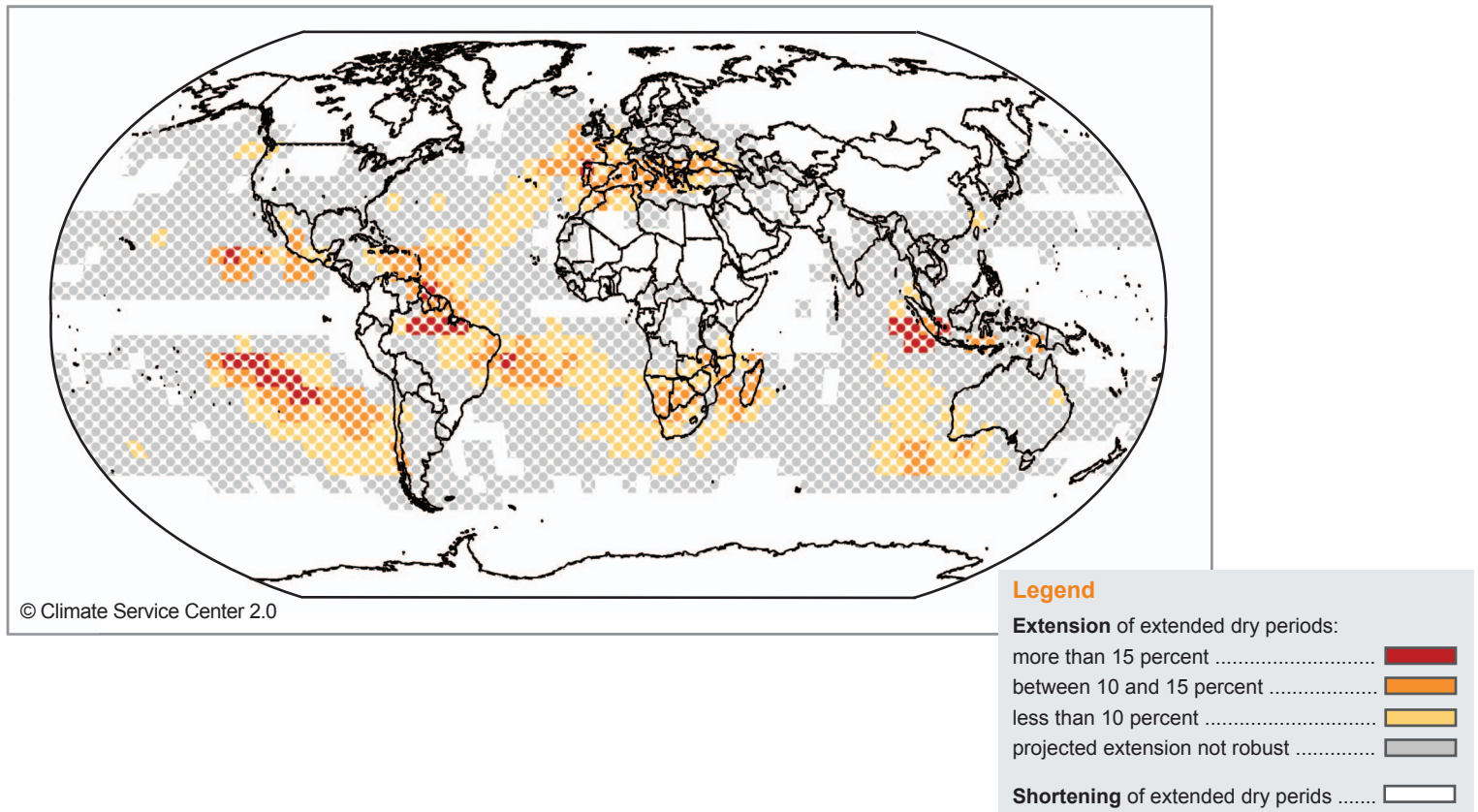
How is an extended dry period defined?

- Extended dry periods are defined as the longest period of consecutive days without precipitation per year.
- It is a region specific index (as the length of a dry period differs from the semi-arid regions compared to the humid regions) which is calculated from today's precipitation statistics.

Why is it interesting to know if extended dry periods will last longer in the future?

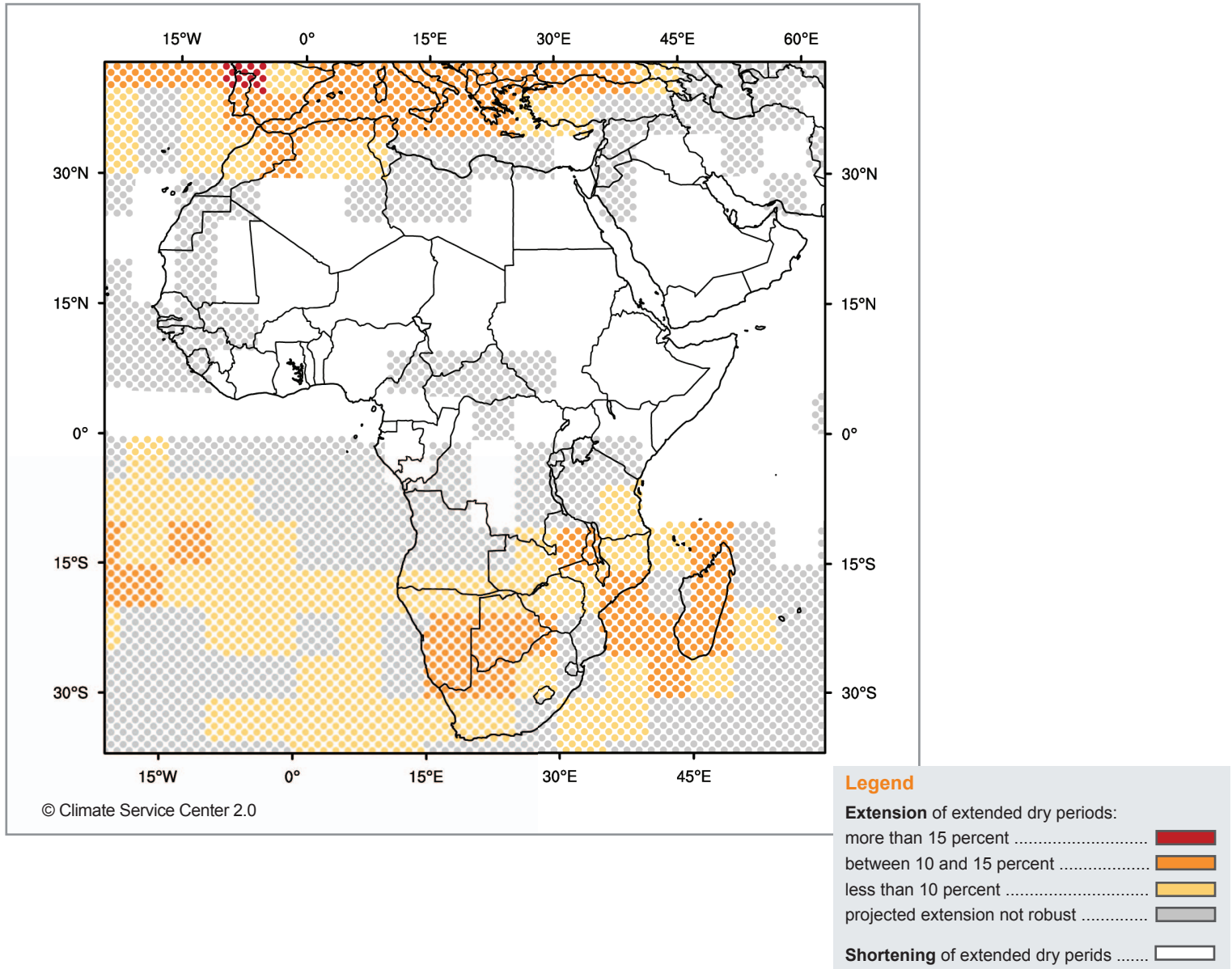
- The knowledge about the future duration of extended dry periods is important as longer dry periods could e. g.:
 - cause/aggravate droughts.
 - cause/aggravate food shortages.
 - increase the risk of shortages of drinking water.
 - increase the risk of low water levels in rivers with consequences for transport, energy and industries.
 - increase the risk of low groundwater levels.
 - increase the demand for the installation of irrigation facilities.

Global distribution - Increase in the duration of extended dry periods per year



Regional distribution - Increase in the duration of extended dry periods per year

Africa

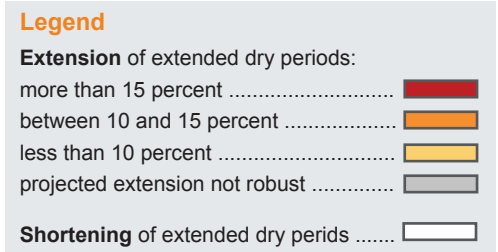
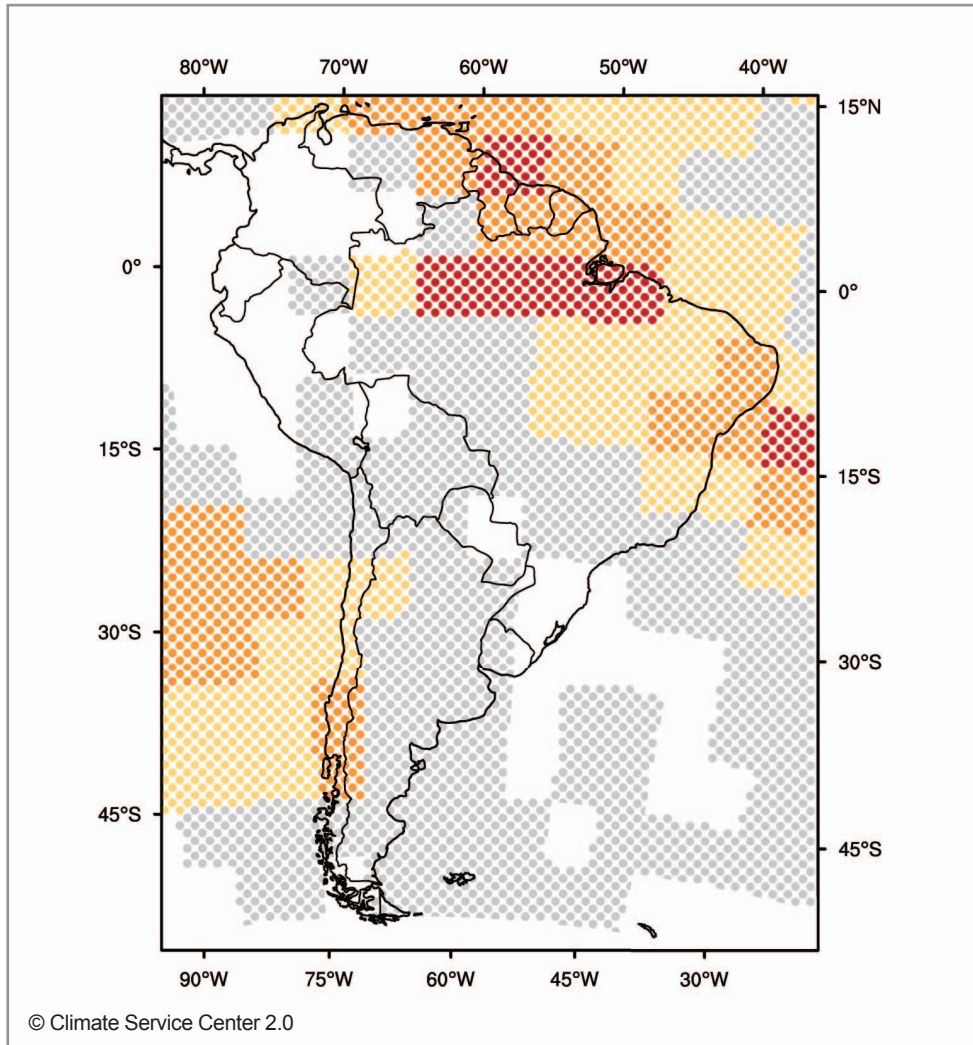


Short explanation of figure

- For large parts of the region between the Equator and 30°N, the models do not project an increase in the duration of extended dry periods.
- Robust increases in the duration of extended dry periods are projected only for some parts of South Africa, Namibia, Botswana, Zimbabwe, Zambia, northern Mozambique, Malawi, south-eastern Tanzania, southern Angola and Madagascar. Also for the north-western region (northern Morocco, Algeria and Tunisia), robust results are projected. For all these regions, the projected increase in the duration of extended dry periods does not exceed 15%.

Regional distribution - Increase in the duration of extended dry periods per year

South America

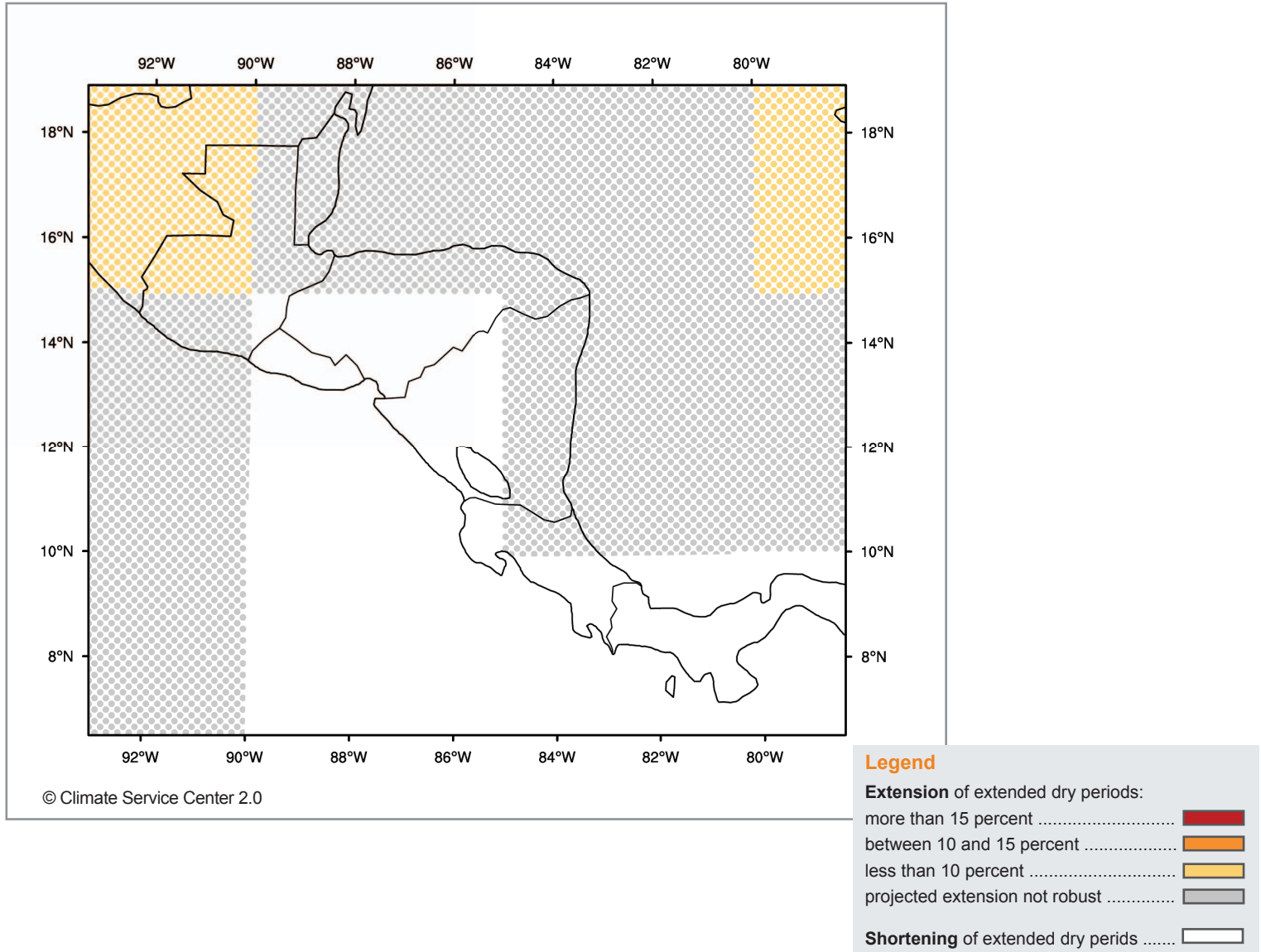


Short explanation of figure

- Only for the north-western part of South America (Ecuador, parts of Columbia, Venezuela, Peru and northern Bolivia) and for central Paraguay and a small region in south Brazil, the duration of extended dry periods is projected to decrease.
- For the major part of South America, an increase in the duration of extended dry periods is projected.
- The projected increase is robust only for the north-eastern part of Brazil, eastern Venezuela, Guyana, Suriname, French Guyana, and for central Chile. The strongest increase (more than 15%) is projected for the Amazon region in Brazil and for northern Guyana.

Regional distribution - Increase in the duration of extended dry periods per year

Central America

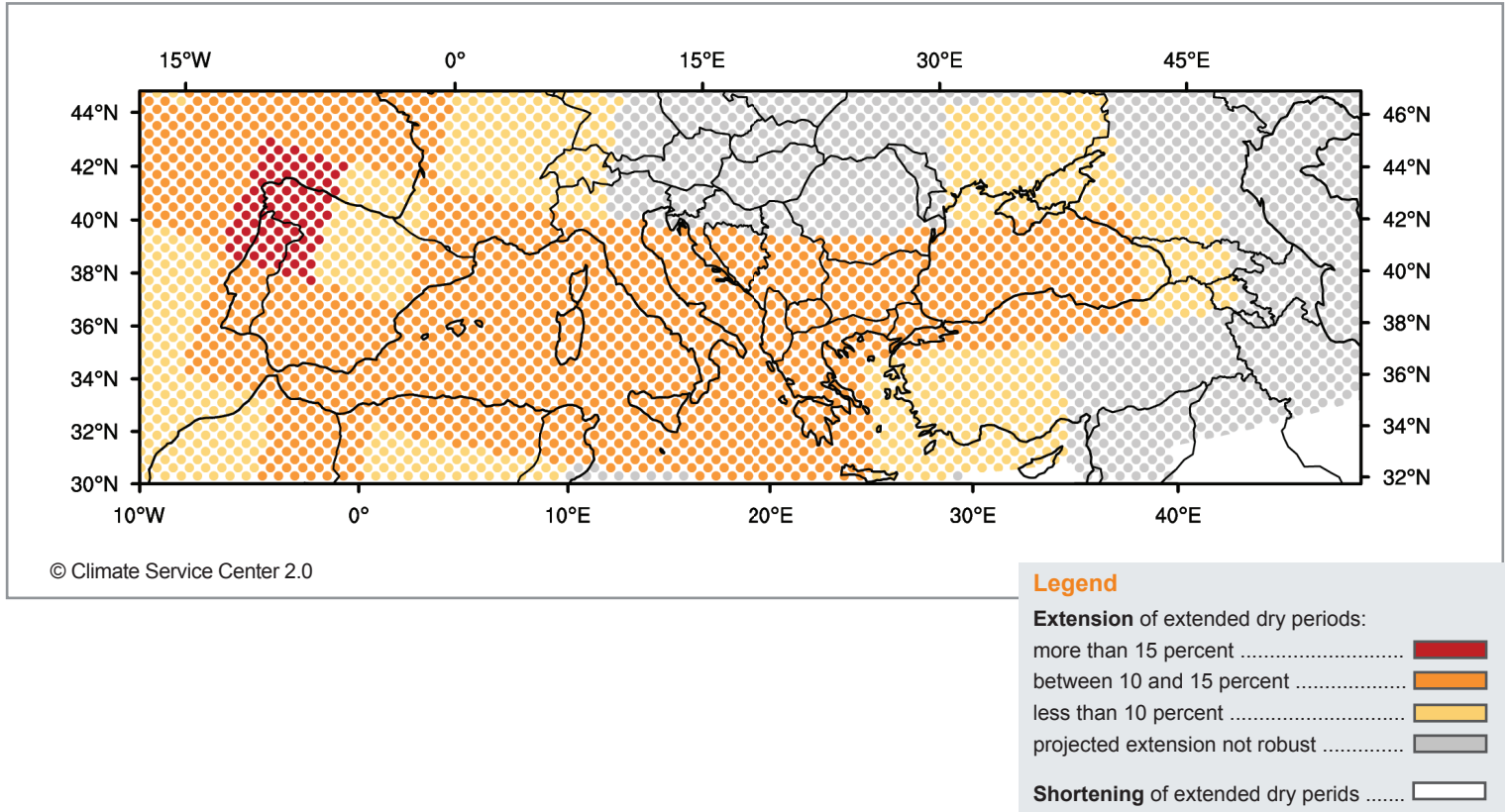


Short explanation of figure

- For Panama, southern Costa Rica, western Nicaragua, southern Honduras and for El Salvador, the duration of extended dry periods is projected to decrease.
- For the remaining region, the duration of extended dry periods is projected to increase. The projected increase is robust only for north-western Guatemala, and southern Mexico with however only a small increase of less than 10%.
- Due to the small size of the land surface, and the comparably large grid boxes of the climate models, the model results have to be treated with extra caution in this region.

Regional distribution - Increase in the duration of extended dry periods per year

Southern Europe & Caucasus

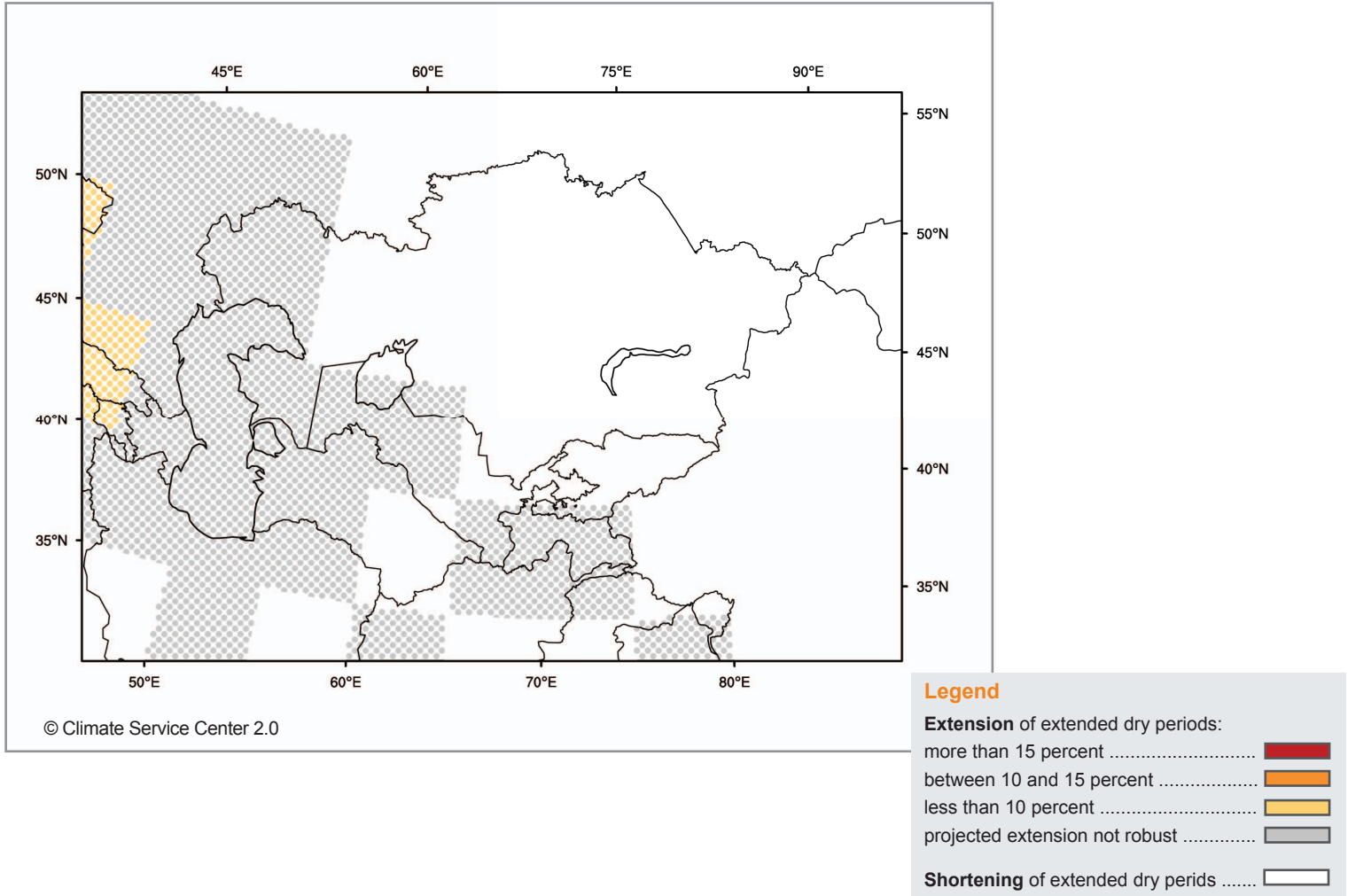


Short explanation of figure

- For almost the entire region of Southern Europe & Caucasus, the duration of extended dry periods is projected to increase.
- For the western and southern parts of the region, the projected increase of the duration of extended dry periods is robust with largest values of more than +15% for northern Portugal and Spain.
- For the northern and eastern parts of south-east Europe (with the exception of the Black Sea region, Georgia, eastern Ukraine and western Turkey), the projected increase is not robust.

Regional distribution - Increase in the duration of extended dry periods per year

Central Asia

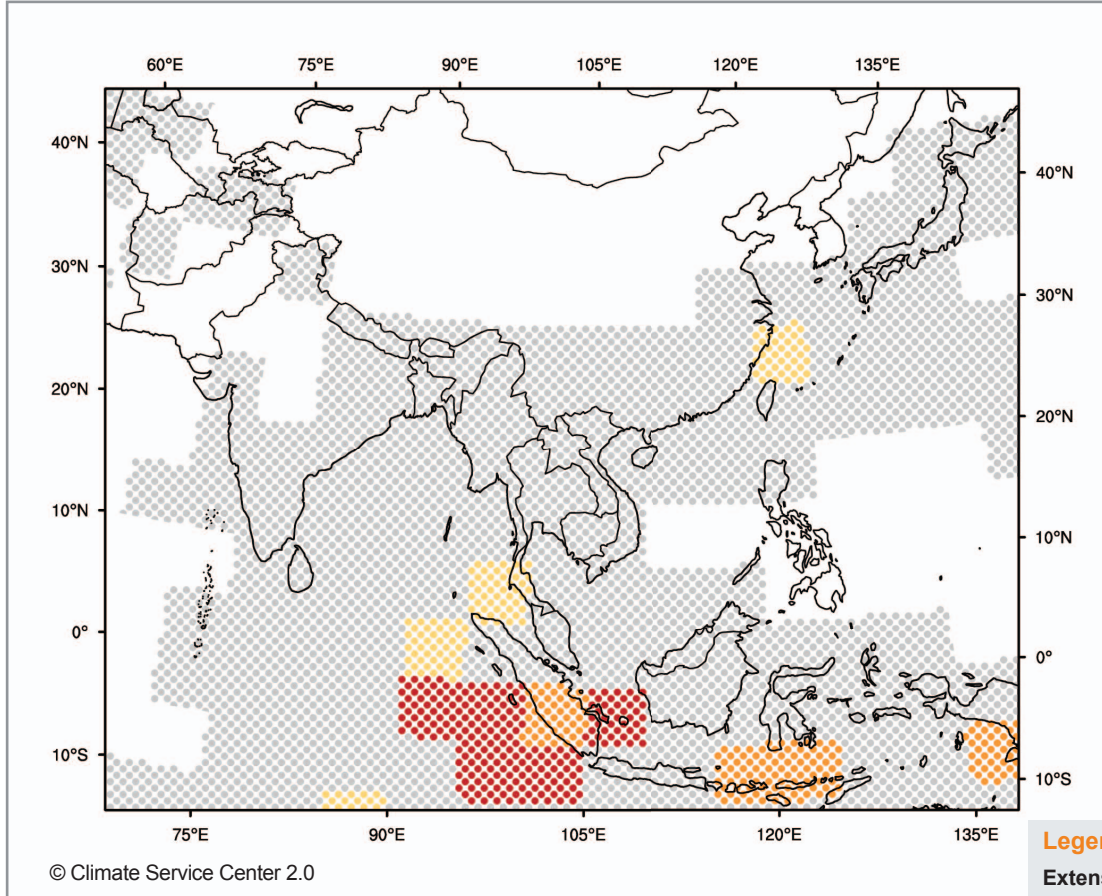


Short explanation of figure






- For the north-eastern part of Central Asia, the duration of extended dry periods is projected to decrease.
- For the western part and some southern regions, an increase in the duration of extended dry periods is projected; however this is not robust.

Regional distribution - Increase in the duration of extended dry periods per year

South & East Asia



Legend

Extension of extended dry periods:	
more than 15 percent	
between 10 and 15 percent	
less than 10 percent	
projected extension not robust	
Shortening of extended dry perids	

Short explanation of figure

- For the northern and western part of the region and for the Philippines and Ocean region east of them, the duration of extended dry periods is projected to decrease.
- For the remaining parts of the South & East Asia region, an increase in the duration of extended dry periods is projected, which is however only robust for some parts of Indonesia.