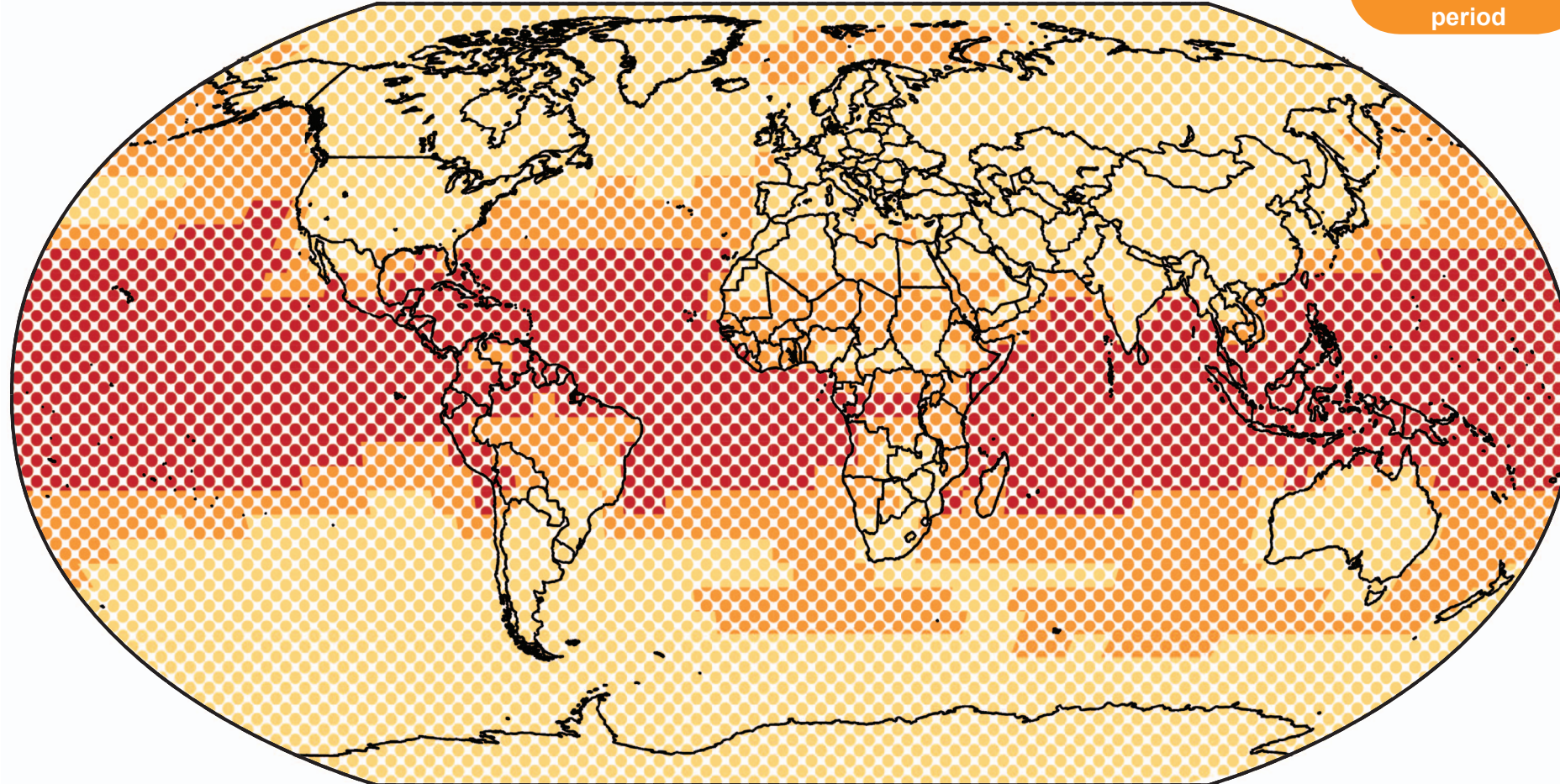


Climate-Signal-Map

Increase in the occurrence of warm days per year

A warm day has a higher maximum temperature than 90 percent of all days of the 1971 to 2000 period



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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

Increase in the occurrence of warm days:

more than 200 percent 

between 125 and 200 percent 

less than 125 percent 

projected increase not robust 

Decrease in the occurrence of warm days 

On behalf of



Contact details of editors:

Climate Service Center 2.0
Fischertwiete 1
D-20095 Hamburg
Telephone: +49-(0)40-226 338 0
E-Mail: cs-info@hzg.de
www.climate-service-center.de



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.

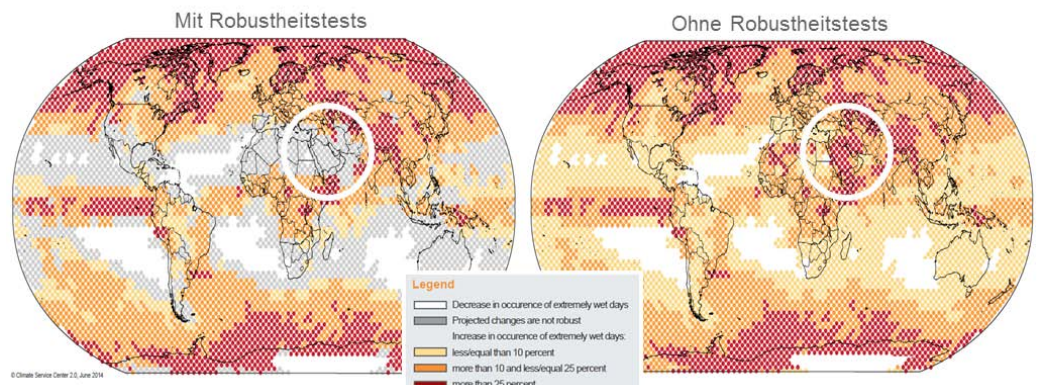
... 2035-2064 vs 1970-1999 ← 2036-2065 vs 1971-2000 → 2037-2066 vs 1972-2001 ...

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 frequency of warm days 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 frequency of warm days (does not apply here).
- Grey regions indicate where the projected increase in the frequency of warm days is not robust (does not apply here).

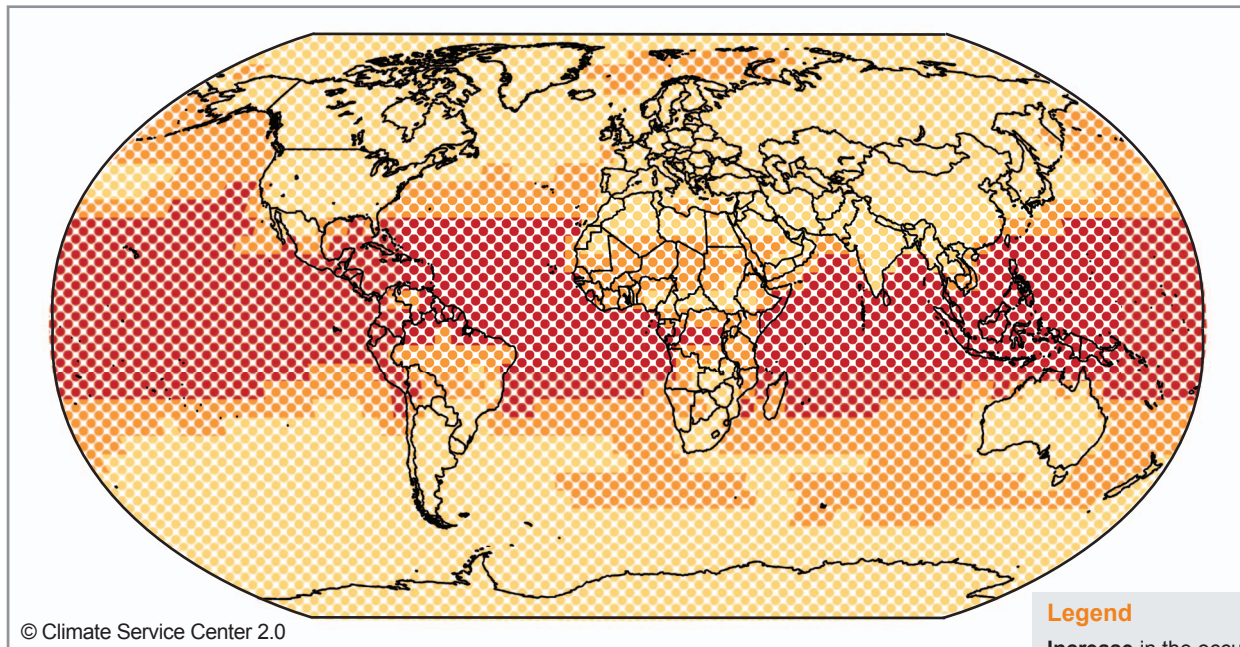
How is a warm day defined?

- A warm day is defined as a day having a daily maximum temperature higher than 90% of all days in the period of 1971-2000. It thus belongs to the 10% warmest days of present-day climate.
- It is a region specific index (as a warm day in polar regions differs from a warm day in temperate regions) which is calculated from today's temperature statistics.






Why is it interesting to know if warm days will occur more frequent in the future?

- The knowledge about the future frequency of warm days is important as more warm days could e. g.:
 - increase the need for cooling for households, transport (e. g. food), industries, stocking, etc. incl. consequences for the energy demand.
 - cause adaptation needs for agriculture due to changes in the growing and dormant seasons.
 - cause health problems.
 - cause adaptation needs in the design/materials/usage of buildings, roads, etc.

Global distribution - Increase in the occurrence of warm days per year

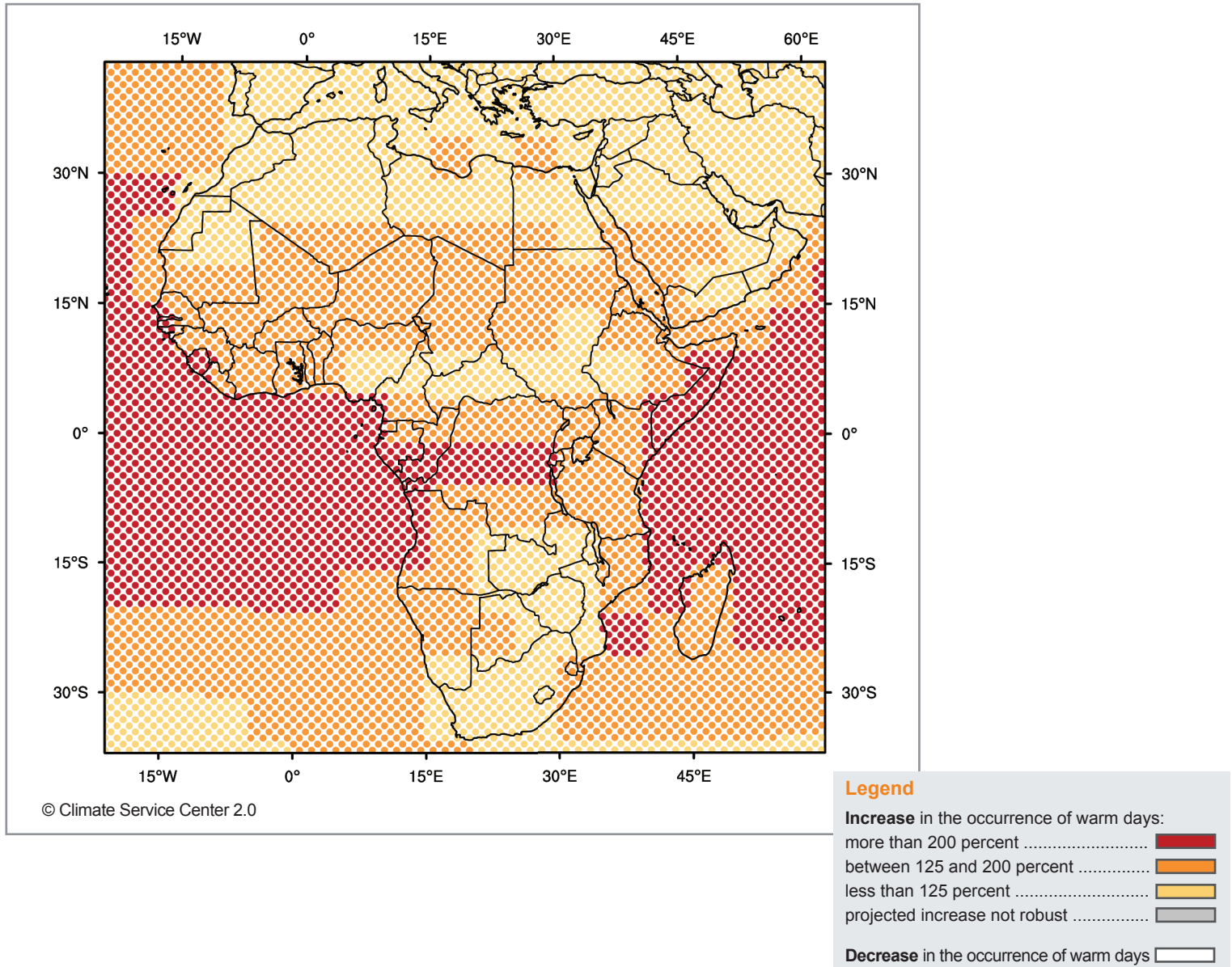


Legend

Increase in the occurrence of warm days:	
more than 200 percent	
between 125 and 200 percent	
less than 125 percent	
projected increase not robust	
Decrease in the occurrence of warm days	

Regional distribution - Increase in the occurrence of warm days per year

Africa

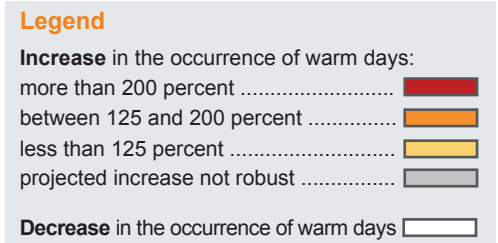
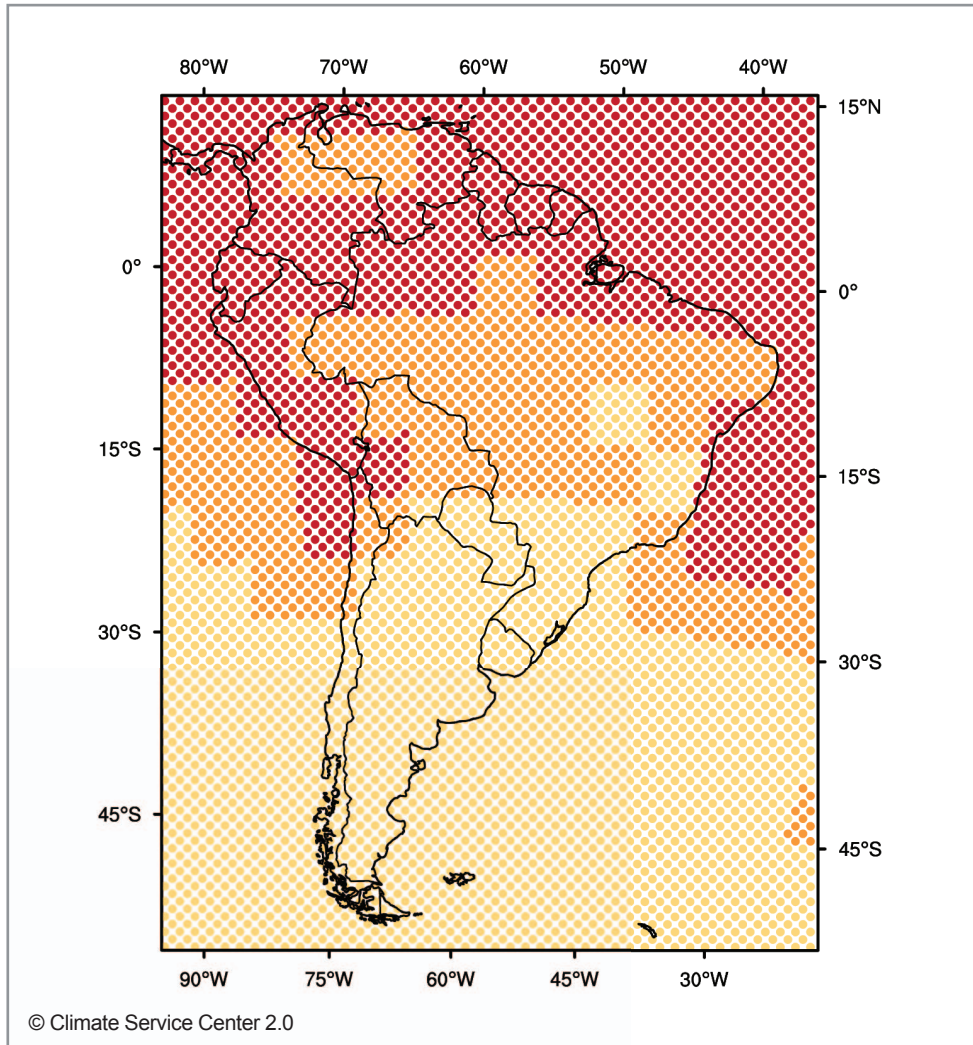


Short explanation of figure

- For the entire region of Africa, the frequency of warm days is projected to increase.
- The results are robust for the entire region.
- Largest increases in the frequency of warm days are projected for the south-west equatorial region with an increase of the occurrence of warm days of more than 200%. Values between +125% and +200% are projected for large regions of Africa. Only for the very southern and northern regions, and for a region north of the Equator stretching from Nigeria to Ethiopia, values of less than +125% are projected.

Regional distribution - Increase in the occurrence of warm days per year

South America

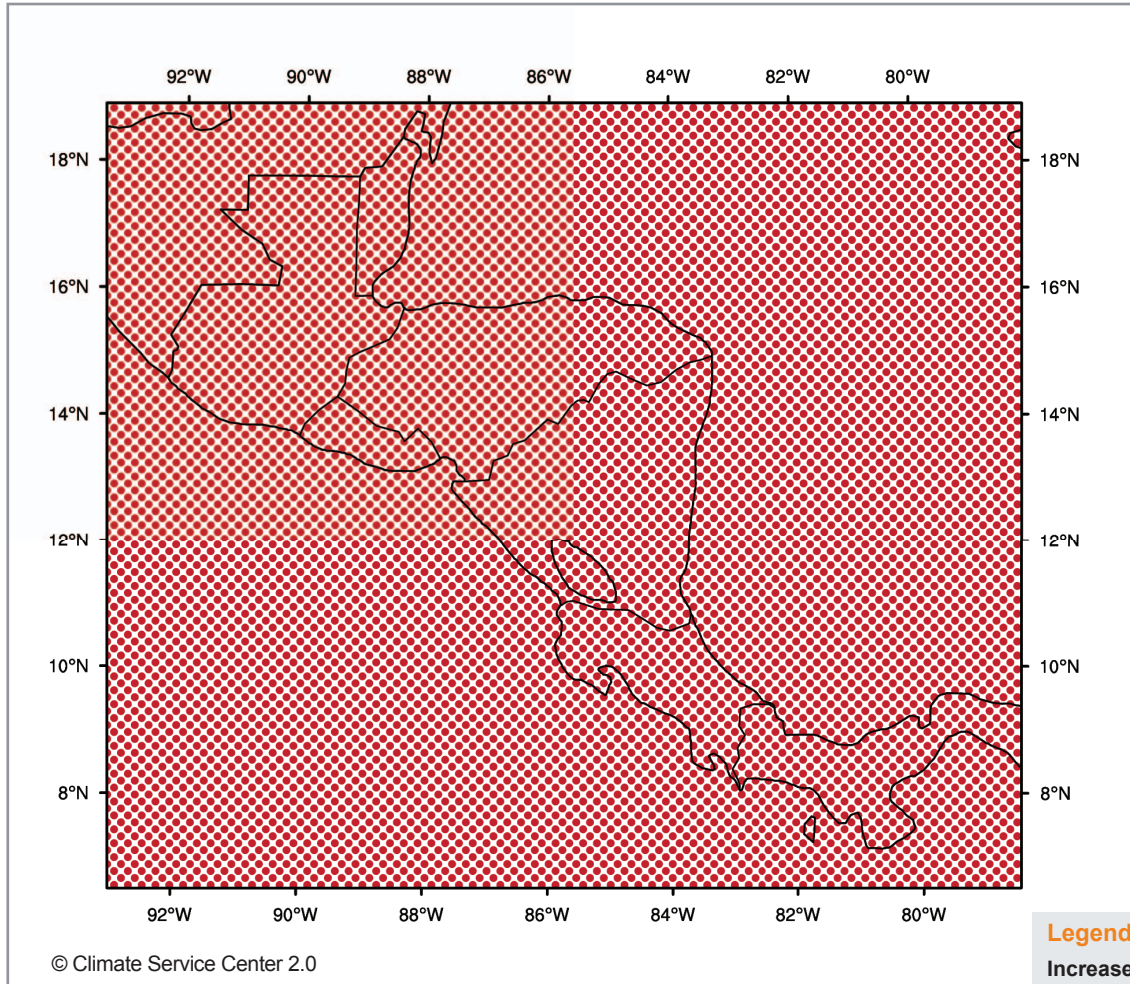


Short explanation of figure

- For the entire region of South America, the frequency of warm days is projected to increase.
- The results are robust for the entire region.
- Largest increases in the frequency of warm days are projected for most of the northern region with an increase of the occurrence of warm days of more than 200%. Values between +125% and +200% are projected for central South America (large parts of Brazil, Bolivia), and for parts of Columbia and Venezuela. For the southern regions (Chile, Argentina, Paraguay, Uruguay), lower values of less than +125% are projected.


Regional distribution - Increase in the occurrence of warm days per year


Central America





Legend


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more than 200 percent 

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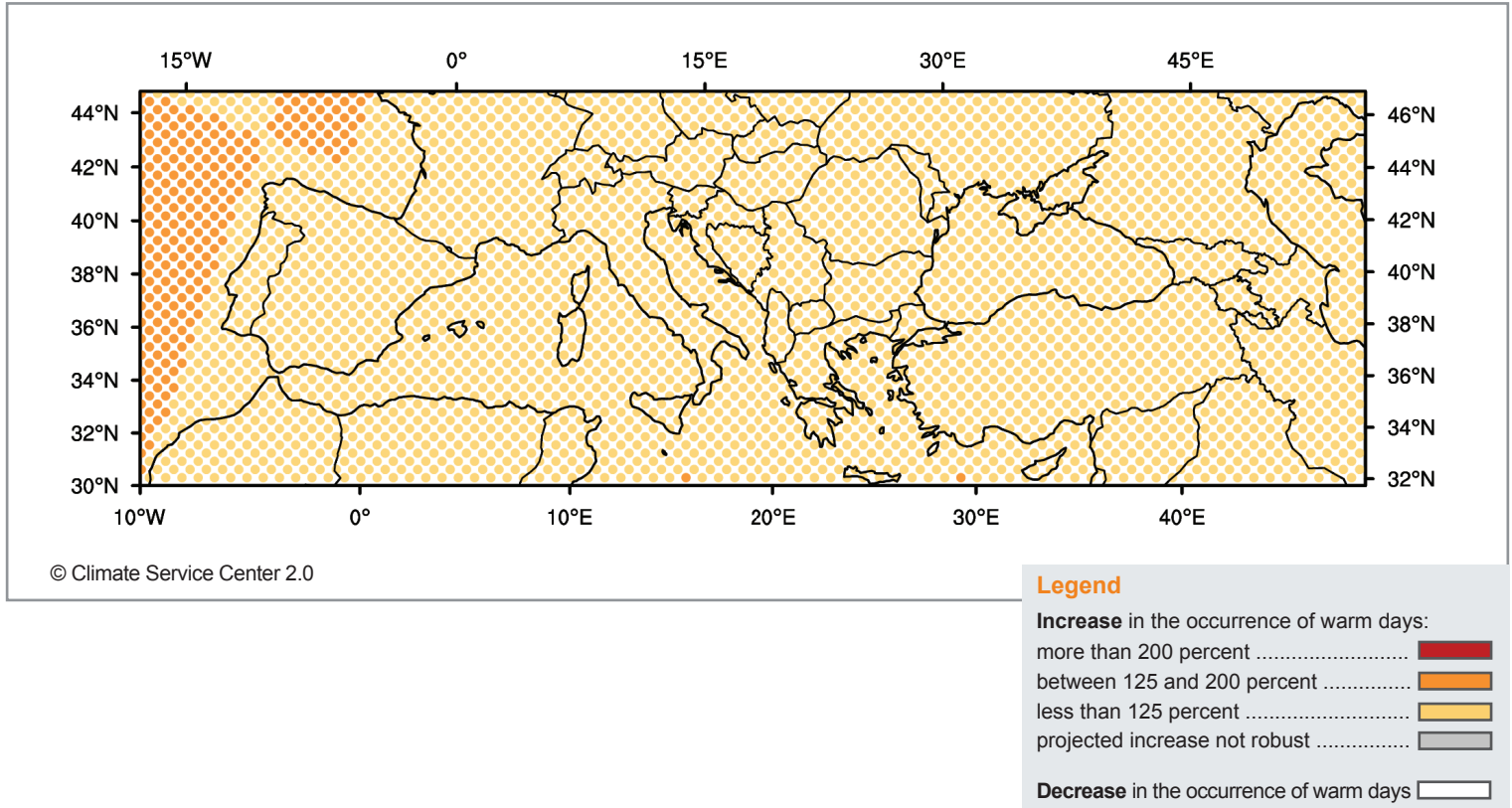
Decrease in the occurrence of warm days 

Short explanation of figure

- For the entire region of Central America, the frequency of warm days is projected to increase.
- The results are robust for the entire region.
- For the entire region, large increases in the frequency of warm days are projected with an increase of the occurrence of warm days of more than 200%.
- 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 occurrence of warm days per year

Southern Europe & Caucasus

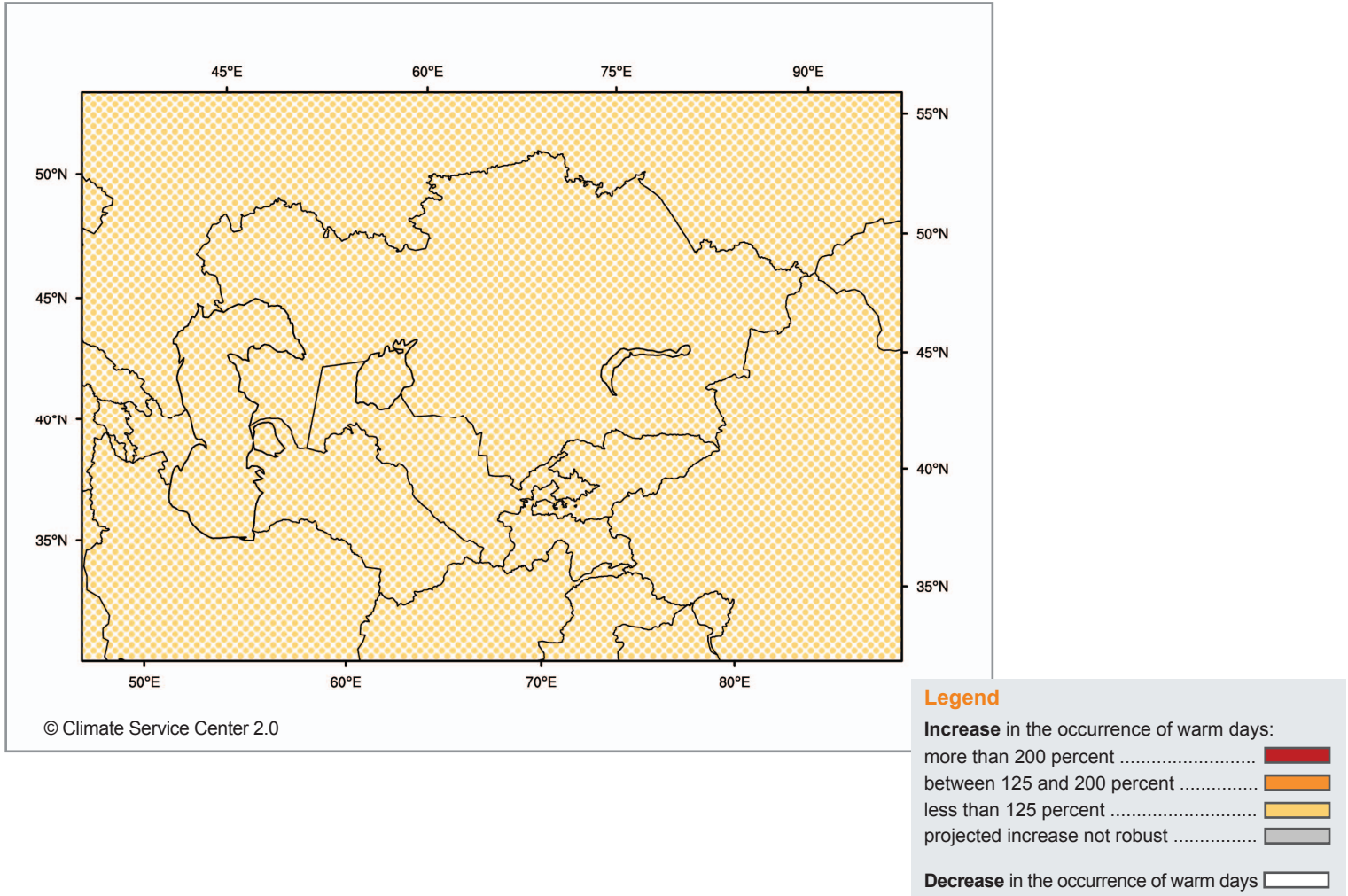


Short explanation of figure

- For the entire region of Southern Europe & Caucasus, the frequency of warm days is projected to increase.
- The results are robust for the entire region.
- For the entire region, a comparably lower increase (when compared to other regions of the globe) in the frequency of warm days are projected with an increase of the occurrence of warm days of less than 125%.

Regional distribution - Increase in the occurrence of warm days per year

Central Asia

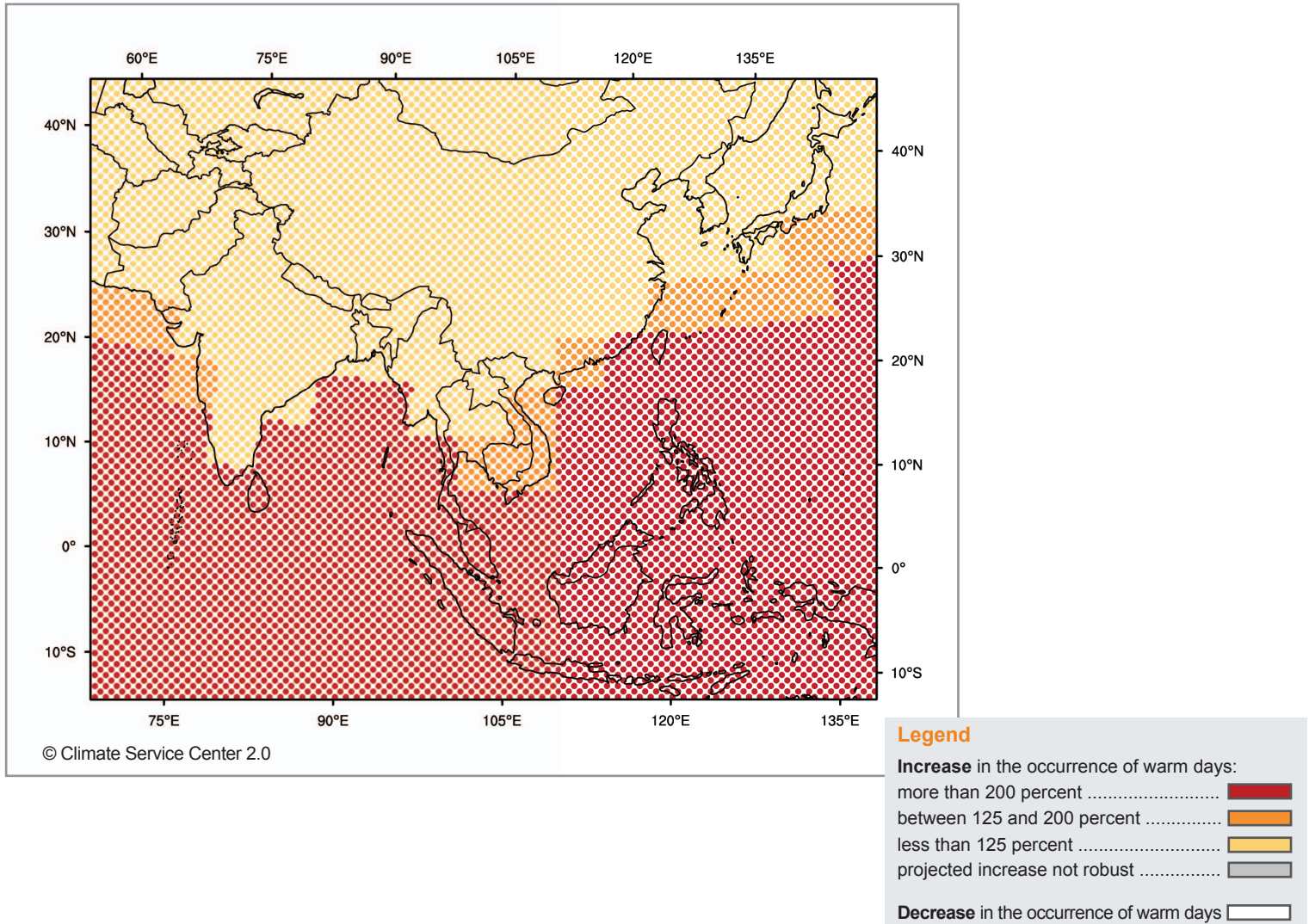


Short explanation of figure

- For the entire region of Central Asia, the frequency of warm days is projected to increase.
- The results are robust for the entire region.
- For the entire region, a comparably lower increase (when compared to other regions of the globe) in the frequency of warm days are projected with an increase of the occurrence of warm days of less than 125%.

Regional distribution - Increase in the occurrence of warm days per year

South & East Asia



Short explanation of figure

- For the entire region of South & East Asia, the frequency of warm days is projected to increase.
- The results are robust for the entire region.
- The regions shows a sharp north-south gradient with stronger increases in the frequency of warm days in the south and small to moderate values in the north.