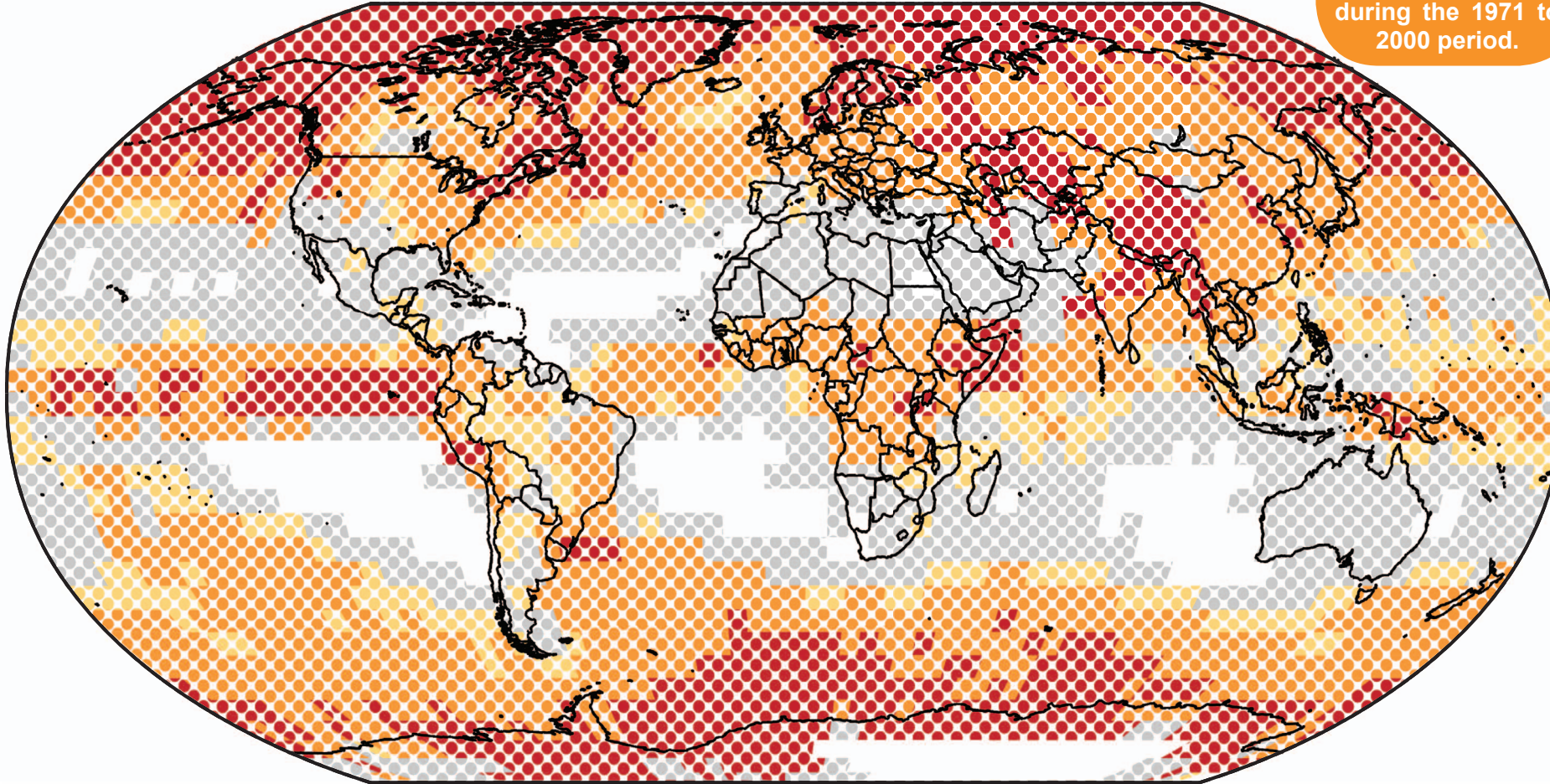


Climate-Signal-Map

Increase in the occurrence of extremely wet days per year

The amount of rain falling on an extremely wet day is reached only at one percent of all rainy days a year during the 1971 to 2000 period.



© Climate Service Center 2.0, December 2014

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 occurrence of extremely wet days:

- more than 45 percent
- more than 25 and less/equal 45 percent
- less than/equal to 25 percent
- projected increase not robust

Decrease in occurrence of extremely wet 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.

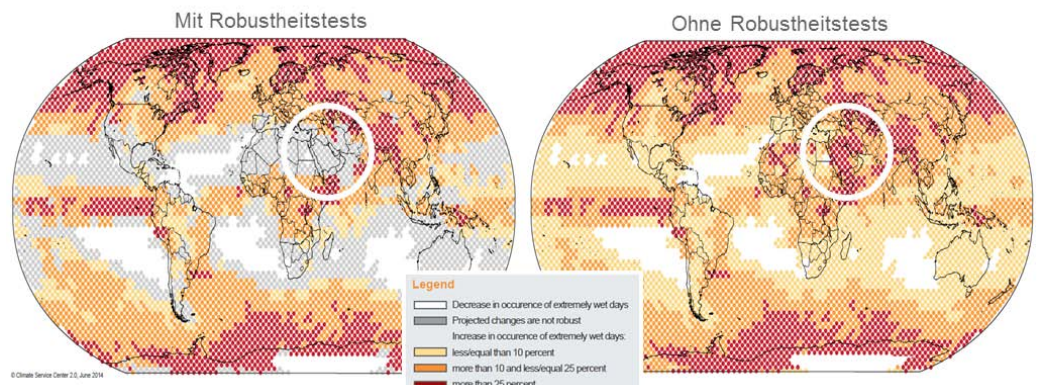
... 2035-2064 vs 1970-1999 ← 2036-2065 vs 1971-2000 → 2037-2066 vs 1972-2001 ...

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 extremely wet 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 occurrence of extremely wet days.
- Grey regions indicate where the projected increase in the frequency of extremely wet days is not robust.

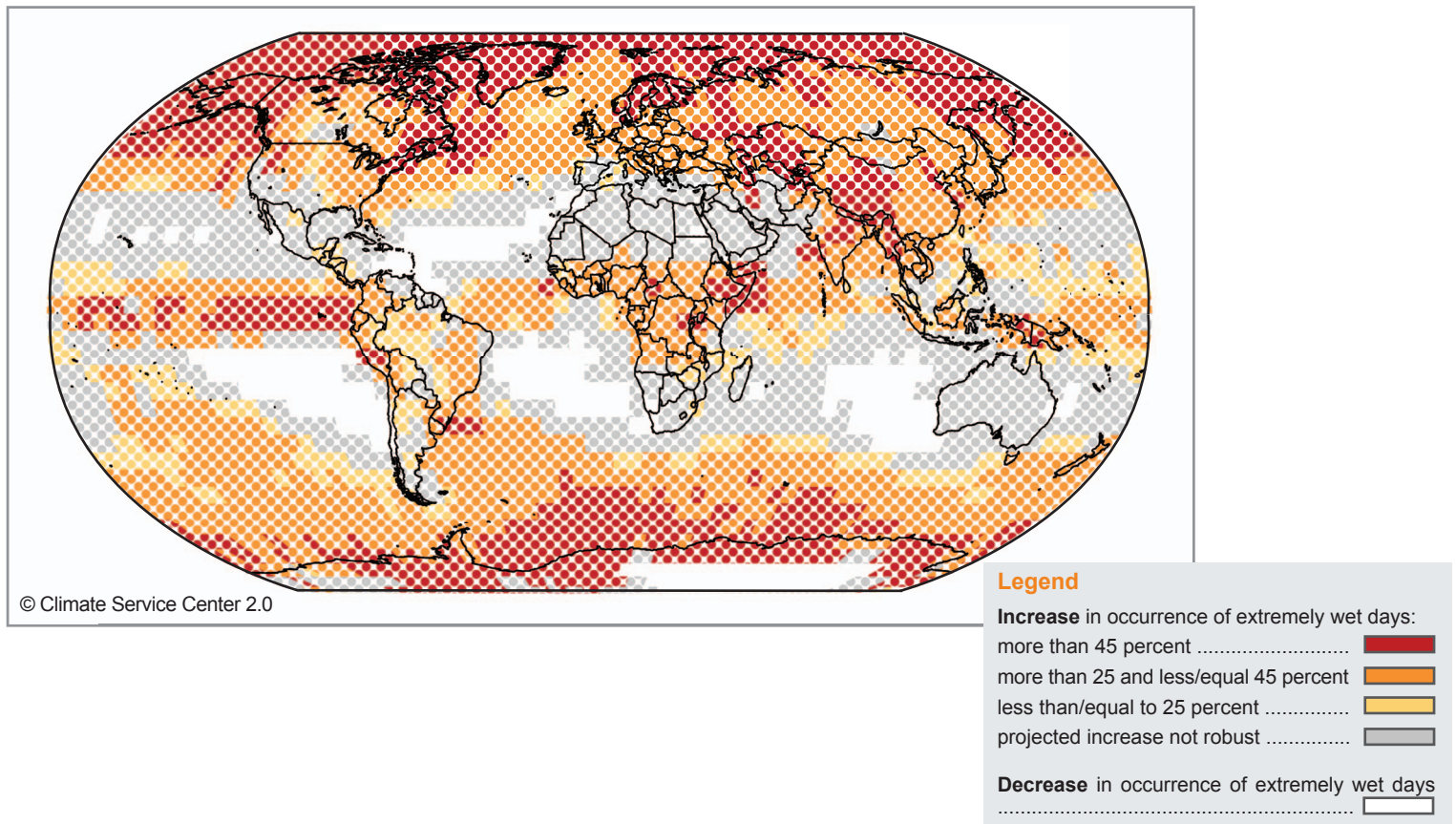
How is an extremely wet day defined?

- An extremely wet day is defined as a day having an amount of precipitation higher than 99 percent of all rainy days in the period from 1971 to 2000. Thus it belongs to the 1 percent wettest days of present day climate.
- It is a region specific daily precipitation threshold (as an extremely wet day in drier regions differs from an extremely wet day in the humid tropics), calculated from today's precipitation statistics.

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

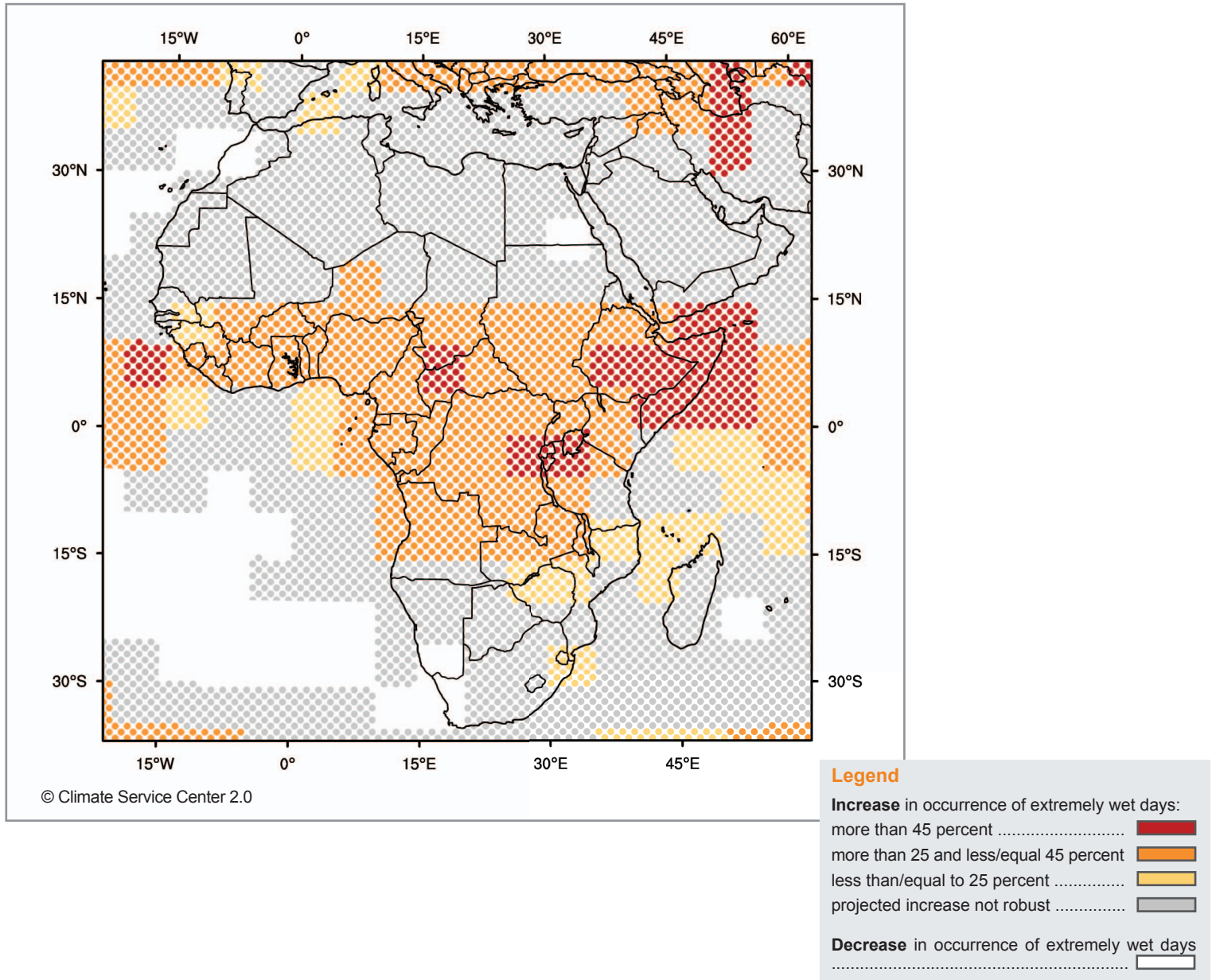
- The knowledge about future changes of extremely wet days is important as a more frequent occurrence of extremely wet days could e. g.:
 - exceed the capacity of retention basins.
 - cause erosion and land slides.
 - increase the risk of flooding and diseases in regions where the sewage water systems are not designed appropriately.

Global distribution - Increase in the occurrence of extremely wet days per year



Regional distribution - Increase in the occurrence of extremely wet days per year

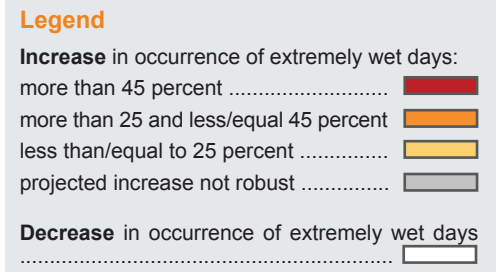
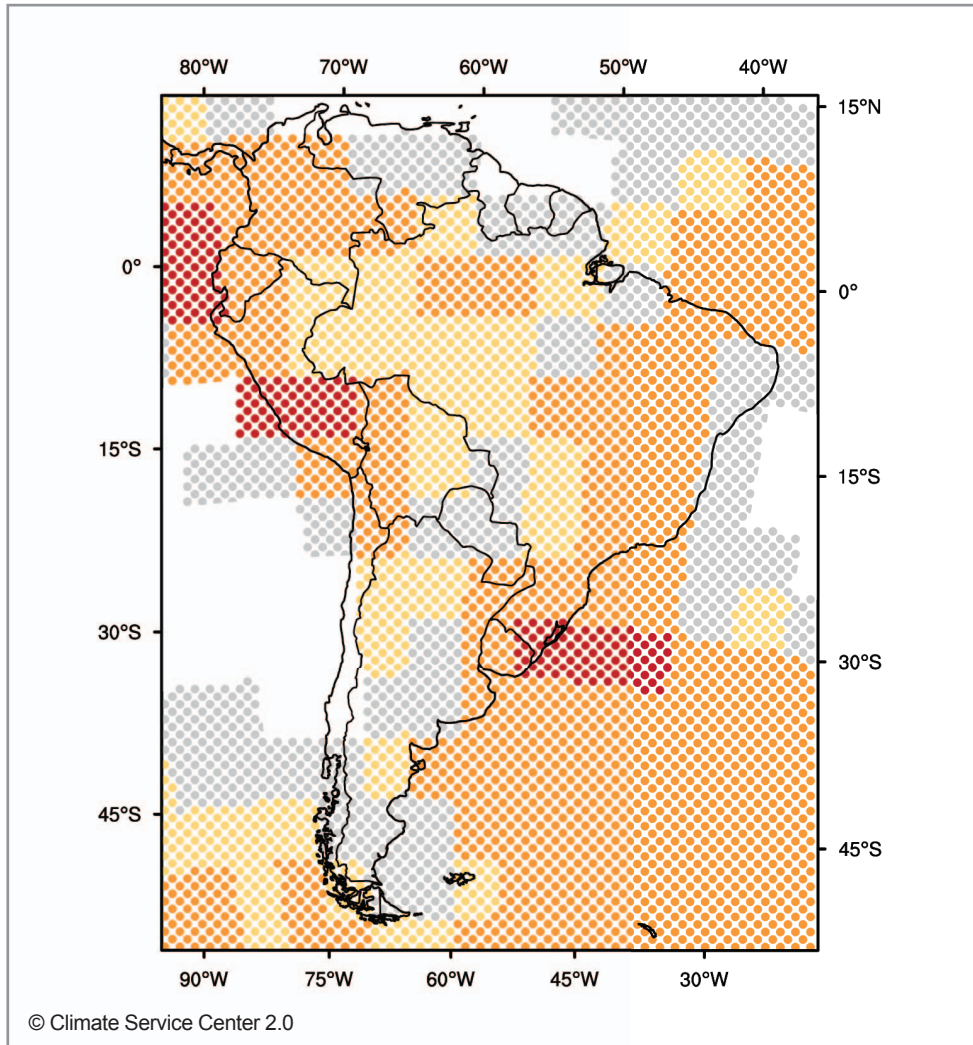
Africa



Short explanation of figure

- Only for very few and small regions (parts of south Africa, Namibia, Morocco, Egypt and Sudan), the frequency of extremely wet days is projected to decrease.
- For the major part of Africa, an increase in the frequency of extremely wet days is projected.
- The projected increases are robust only for the equatorial region from 15°S to 15°N, with largest increases (more than 45%) for parts of southern Chad, western Central African Republic, parts of the Democratic Republic of the Congo, Rwanda, Burundi, the north-western part of Tanzania, southern Ethiopia and Somalia.

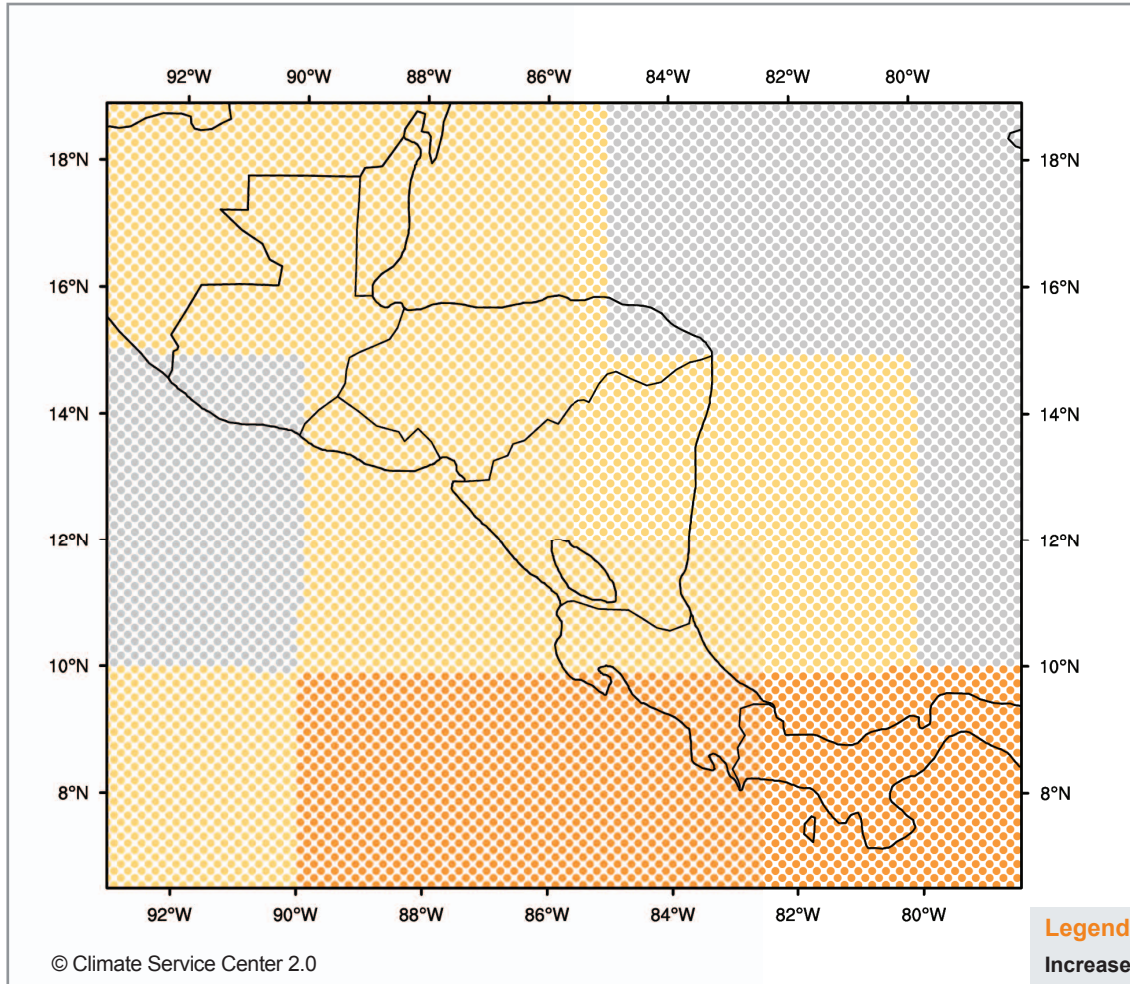
Regional distribution - Increase in the occurrence of extremely wet days per year South America



Short explanation of figure





- Only for very few and small regions (parts of Chile and northern Venezuela, northern Guyana, northern Suriname), the frequency of extremely wet days is projected to decrease.
- For the major part of South America, an increase in the frequency of extremely wet days is projected.
- The projected increases are robust for major parts of Brazil, Uruguay, Columbia, Ecuador, Peru, Bolivia, northern Chile, and some regions in Argentina. The strongest increase (more than 45%) is projected for the southern part of Peru and for a small region in south Brazil.

Regional distribution - Increase in the occurrence of extremely wet days per year Central America




Legend

Increase in occurrence of extremely wet days:

- more than 45 percent 
- more than 25 and less/equal 45 percent 
- less than/equal to 25 percent 
- projected increase not robust 

Decrease in occurrence of extremely wet days

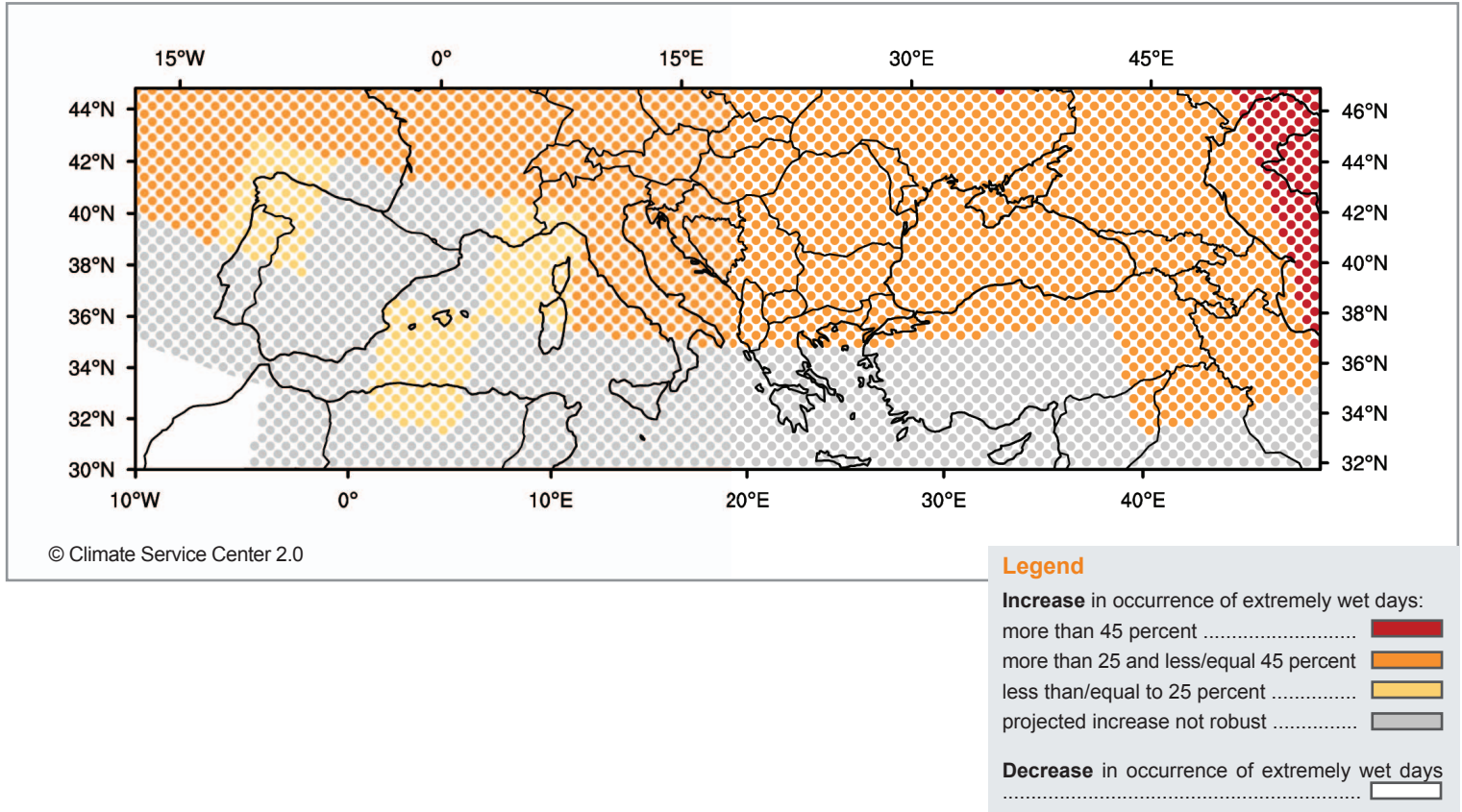
- 

Short explanation of figure

- For Central America, an increase in the frequency of extremely wet days is projected.
- The projected increases are robust for the major part of Central America. Only small regions in southwest Guatemala and eastern Honduras do not show robust results.
- Costa Rica and Panama show stronger increases in the frequency of extremely wet days (between +25% and +45%) than the regions north of 10°N.
- 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 extremely wet days per year

Southern Europe & Caucasus

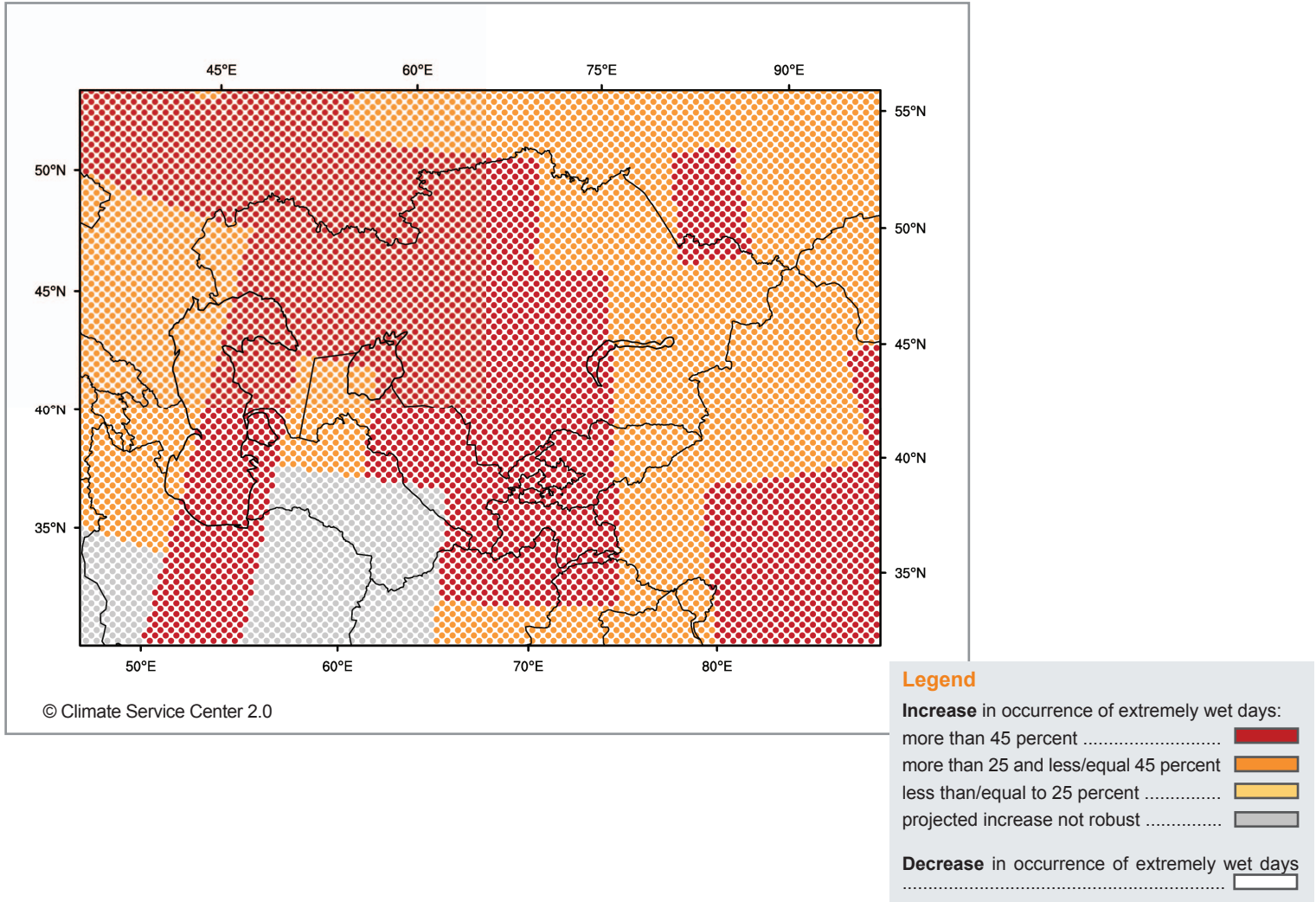


Short explanation of figure

- Only for the south westerly regions (western Morocco), the frequency of extremely wet days is projected to decrease.
- For the major part of Southern Europe & Caucasus, an increase in the frequency of extremely wet days is projected.
- The projected increases are robust mainly for regions north of 40°N, with the exception of Northern Spain and southern France, where the results are not robust.
- Most of South East Europe shows moderate increases in the frequency of extremely wet days of 25% to 45%.

Regional distribution - Increase in the occurrence of extremely wet days per year

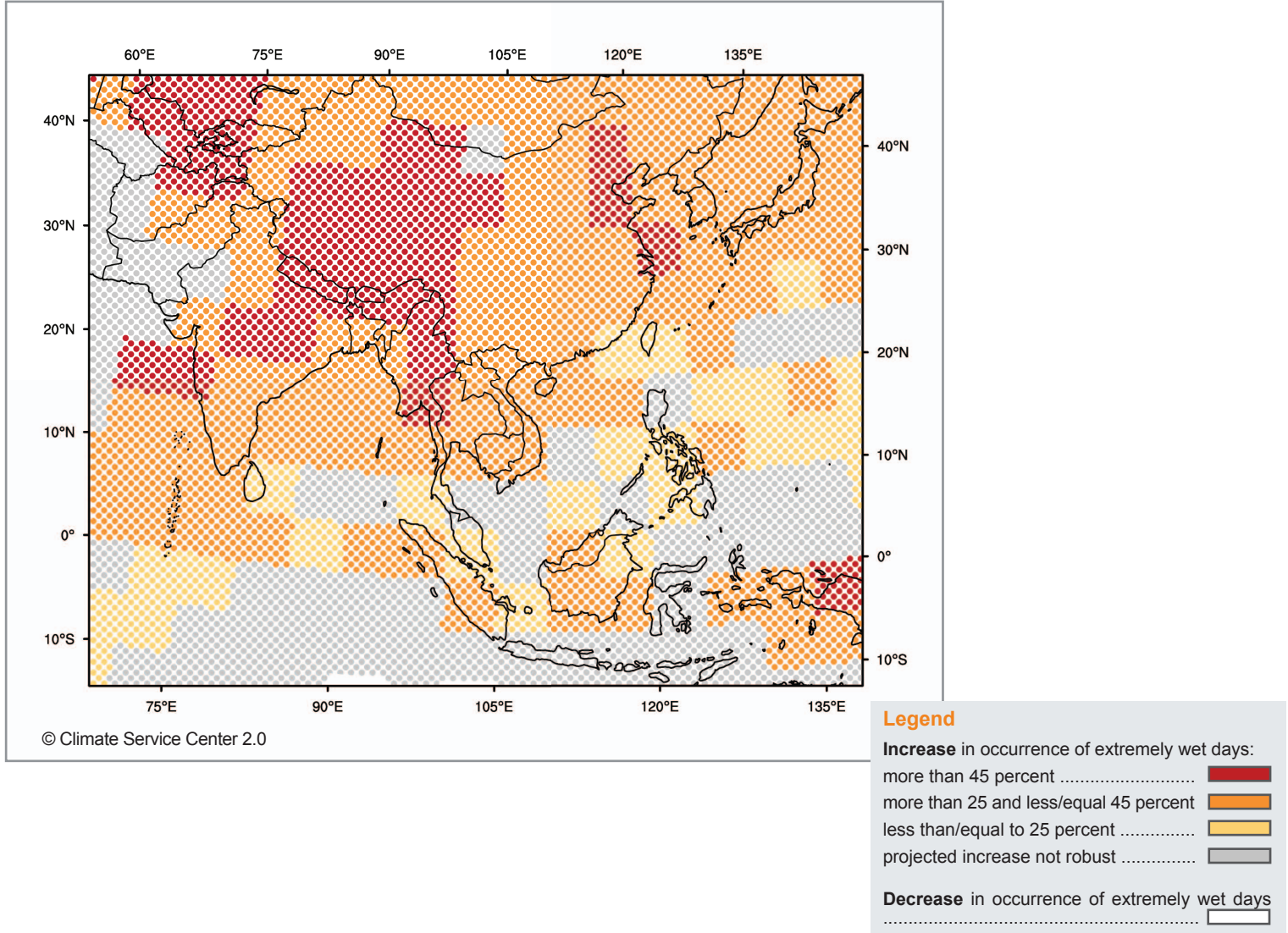
Central Asia



Short explanation of figure

- For the entire region of Central Asia, the frequency of extremely wet days is projected to increase.
- The projected increase is robust for almost the entire regions, only for some parts of Iran, Turkmenistan and Afghanistan, the projected changes are not robust.
- Large parts of Central Asia show substantial increases of more than 45%.

Regional distribution - Increase in the occurrence of extremely wet days per year South & East Asia



Short explanation of figure

- For the entire region of South & East Asia, the frequency of extremely wet days is projected to increase.
- The projected increase is robust for most of the land covered regions, only for western Afghanistan, southern Pakistan, small regions in north-west India and some parts of Indonesia and the Philippines, the projected changes are not robust.
- Most parts of South & East Asia show moderate increases of between 25% and 45%, some regions in western China, central India, Tadjhikistan, Kirghizia, Kazakhstan, Uzbekistan and eastern Indonesia show substantial increases of more than 45%.