Climate-Fact-Sheet

Philippines

Updated Version 2015

Abstract

The Philippine archipelago comprises of more than seven thousand islands and is situated between the western Pacific Ocean and the Asian continent. Based on the Köppen climate classification the country has dominant regions of equatorial (Af) and monsoon (Am) climate types and distributed regions of humid subtropical or subtropical oceanic highland (Cwb) and tropical savannah (Aw) climate types. Because of its maritime location, the climate is generally characterized by relatively high temperature, humidity, and heavy rainfall events. The mean annual temperature is about 26°C. Only in the highlands the mean annual temperature is cooler with 18 °C (Baguio). Annual rainfall amounts vary between 960 mm in the driest valleys and 4000 mm in the mountains.
The climate can be divided into two major seasons. The rainy season is dominated by the Southwest Monsoon which sets in from May to October and brings rain to the western part of the country. The dry season is dominated by the Northeast Monsoon and is characterised by cool air from November to March. In April and May the dry season becomes hot, due to the influence of the North Pacific trade winds. Depending on the topography and location, the occurrence of the rainy and dry seasons can vary and some regions experience rain all throughout the year. Due to its location the Philippine archipelago is frequently hit by tropical cyclones.

For the mean annual temperature no clear trend was observed over the last 30 years. For the future, projections from global climate models suggest a medium-strong increase in temperature. For the end of the century, a warming in the range of +1.2 to +3.1°C (compared to the reference period from 1971 to 2000) is likely. Furthermore, a strong increase in the duration of heat waves as well as a strong reduction in cold spell length is projected.

For annual precipitation amounts, a large statistically significant increase of about +23% was observed over the last 30 years. Also for the future, the majority of the climate models project a tendency towards an increase in annual total precipitation. For the end of the century, a change in annual total precipitation in the range of +1 to +11% (compared to the reference period from 1971 to 2000) is likely. Furthermore, projections suggest a tendency towards more intense and more frequent heavy rainfall events as well as a slight increase in the duration of dry spells.

For the climatic water balance the majority of the analysed climate model simulations project an increase for the future. Regarding solar irradiance and annual mean wind speed, global climate model projections suggest no clear trend over the 21st century. However, the skill of the global models in reproducing mean wind speed and solar irradiance is limited.

Coastal areas in the Philippines have experienced substantial changes in mean sea level in the past in the order of about +5.4 mm/yr observed at a station near Legazpi (Philippine Sea) in the period from 1947 to 2009, but only about +0.19 mm/yr at Jolo (Sulu Sea) for the period from 1947 to 1996. Projections of changes in future mean sea level from global atmosphere-ocean general circulation model simulations suggest a sea level rise in the range from +0.38 to +0.98 m near Legazpi and from +0.40 to +0.96 m near Jolo by 2090 for the high emission scenario.

Zusammenfassung

Die Philippinen sind ein Inselstaat aus mehr als 7000 einzelnen Inseln, die zwischen westlichen Pazifik und asiatischem Kontinent liegen. Das Klima der Philippinen ist zumeist tropisch und wird durch die Nähe zum Meer und Monsunwinde geprägt. Laut Köppen und Geiger wird der östliche Teil der Inseln vom tropischen Regenwaldklima (Af) charakterisiert. Im Westen dominiert tropisches Monsun- (Am) und Savannenklima (Aw). Auf der nördlichen Insel sind in den Bergen auch Regionen mit subtropischem Hochlandklima (Cwb) zu finden. Das Klima der Philippinen ist insgesamt sehr warm und feucht. Die Jahresmitteltemperatur liegt bei ca. 26°C, nur in den Bergen ist es kühler mit einer durchschnittlichen Jahrestemperatur von 18 °C (Baguio). Die jährliche Niederschlagsmenge beträgt zwischen 960 mm in einzelnen Tälern und 4000 mm in den Bergen. Das Klima kann allgemein in Regen- und Trockenzeit eingeteilt werden. Die Regenzeit wird durch den Südwestmonsun dominiert, der zwischen Mai und Oktober weht und insbesondere den westlichen Regionen Regen bringt. Die Trockenzeit wird durch den Nordostmonsun bestimmt, der zwischen November und März trockene und kühlere Luft bringt. Im April und Mai bringen die Passatwinde trockene und wärmere Luft in die gesamte Inselgruppe. Das Auftreten der Trocken- und Regenzeit fällt allerdings je nach Topographie und genauer Position sehr unterschiedlich aus und einzelne Regionen erhalten das ganze Jahr über Niederschlag. Aufgrund ihrer Lage werden die Philippinen regelmäßig von tropischen Wirbelstürmen heimgesucht.

Beobachtete Jahresmitteltemperaturen zeigten in den letzten 30 Jahren keinen eindeutigen Trend. Für die Zukunft projizieren Klimamodellrechnungen für die Region einen mittelstarken Temperaturanstieg. Zum Ende des Jahrhunderts kann eine Temperaturzunahme zwischen +1.2 und +3.1°C im Vergleich zum Basiszeitraum von 1971 bis 2000 als wahrscheinlich betrachtet werden. Einhergehend mit dem Temperaturanstieg sind eine starke zeitliche Ausdehnung von Hitzeperioden sowie eine deutliche Verkürzung von Kälteperioden.

Für den Jahresniederschlag wurde in den letzten 30 Jahren eine deutliche, statistisch signifikante Zunahme um +23% beobachtet. Auch für die Zukunft projiziert die Mehrzahl der Klimamodellrechnungen einen positiven Niederschlagstrend. Zum Ende des 21. Jahrhunderts kann eine Niederschlagsveränderung zwischen +1 und +11% im Vergleich zum Basiszeitraum von 1971 bis 2000 als wahrscheinlich betrachtet werden. Weiterhin wird eine Tendenz zu intensiveren und häufigeren Starkniederschlägen sowie eine Verkürzung von Trockenperioden von den Modellrechnungen projiziert.

Für die klimatologische Wasserbilanz zeigen die Mehrzahl der analysierten Klimamodellrechnungen eine positive Tendenz. Für die solare Einstrahlung sowie für die mittlere Windgeschwindigkeit sind dagegen keine eindeutigen Änderungen zum Ende des Jahrhunderts aus den analysierten Globalmodelldaten ersichtlich. Allerdings können diese Größen nur bedingt verlässlich von Klimamodellen wiedergegeben werden.

Für die Küsten der Philippinen wurde in der Vergangenheit ein deutlicher Anstieg des Meeresspiegels von ca. +5.4 mm/Jahr an einer Station bei Legazpi (Philippinisches Meer) für die Periode von 1947 bis 2009, aber nur ca. +0.19 mm/Jahr bei Jolo (Sulusee) beobachtet. Modellsimulationen zeigen für die Zukunft einen Anstieg bis 2090 zwischen +0.38 und +0.98 m bei Legazpi und zwischen +0.40 und +0.96 m bei Jolo für das Szenario mit hohen Emissionen.

On behalf of KFW

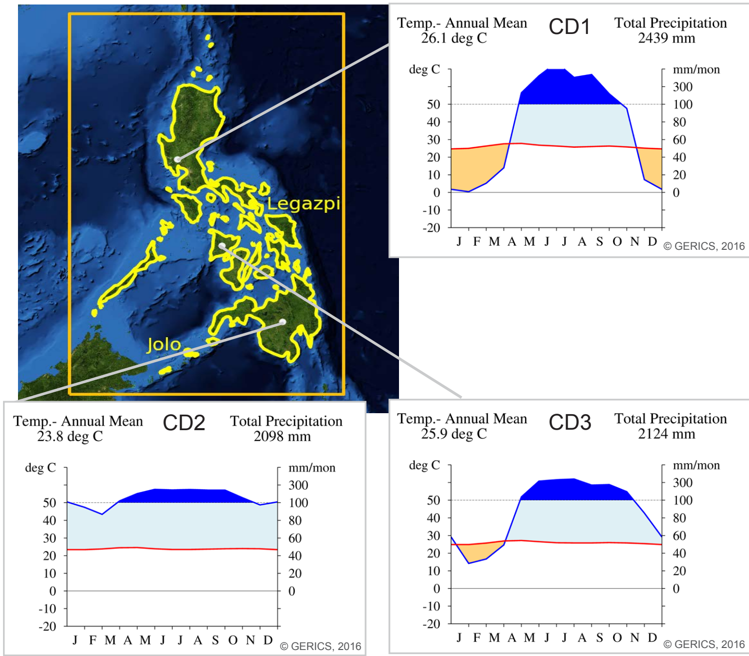
BMZ Federal Ministry for Economic Cooperation and Development

GERICS Climate Service Center Germany

Current climate

Observed mean values are taken from literature and available global data sets (averaged over the whole region**):

- Major climate zones (see also climate diagrams - CD1-3): Mainly tropical (mainly Am- CD1;CD3, Af - CD2 and Aw) and subtropical (CwB) climates
- Annual mean temperature: 26°C
- Annual total precipitation: 2386 mm/yr
- Annual mean actual evaporation: 1187 mm/yr
- Annual mean climatic water balance***: 2445 mm/yr
- Intensity of heavy rain events*: 38 mm/day
- Mean duration of dry spells*: 11 days
- Mean duration of heat waves*: 6 days
- Mean duration of cold spells*: 7 days
- Annual mean solar irradiance (surface): 1547 kWh/(m^2 yr)
- Annual mean wind speed (10 m above surface): 3.5 m/s



Reported recent extreme events:

- The Philippines are frequently affected by serious flood events and hit by tropical cyclones.
- In 2014 a tropical cyclone affected 13 Million people and caused economic damages in the order of about 1 Billion US$.
- In 2015 a tropical cyclone affected 3.6 Million people and caused economic damages in the order of about 1.8 Billion US$.

Note: In this Climate-Fact-Sheet projected changes over land and ocean areas are considered, while in the standard Climate-Fact-Sheet only data over land areas is considered. This needs to be taken into account when interpreting the results. In particular, values of actual evaporation (and therefore also climatic water balance), differ substantially between land areas and open water surfaces (potential evaporation).

The climate parameters marked with * are defined in the manual „How to read a Climate-Fact-Sheet". Whenever mentioned in the fact-sheet, statistical significance is indicated at the 95% confidence level. The description of the climate zones is based on the Köppen-Geiger climate classification.
** Due to the coarse horizontal resolution of the underlying data sets all information presented in this Climate-Fact-Sheet are valid for the larger orange box depicted in the map.
***The climatic water balance is derived from a different data set than precipitation and evaporation, therefore it is possible that the values do not sum up.

Historical climate trends (based on the global CRU data set and literature sources)

Observations from globally available data (CRU) show:

- A small but significant temperature increase of +0.07°C per decade was observed between 1901 and 2013. However, over the last 30 years there was no substantial change.
- Over the same 113-years period no substantial change in precipitation was observed. However, over the last 30 years there was a large significant precipitation increase (+23%/30yrs).

Additional information from literature shows:

- There has been an increase in mean temperatures, in maximum and in minimum temperatures in the Philippines since 1951.
- There has been a significant increase in the frequency of hot days since 1971.
- There has been a significant decrease in the frequency of cold nights.

Summary of projected future climate (for a 30-year period centred around 2085 and combined for all scenarios)

Temperature The likely range of projected change in annual mean temperature is from +1.2 to +3.1°C by 2085, and the very likely range is from +0.8 to +3.7°C. Confidence in these figures is high. The change in annual mean temperature can be considered to be medium-strong. The likely range of projected change in maximum temperature is from +1.3 to +3.3°C by 2085 and in the minimum temperature from +1.1 to +3.0°C.

Heat waves The likely range of projected change in the duration of long-lasting heat waves is from +28 to +521 days by 2085, and the very likely range is from +11 to +1307 days. Confidence in these figures is medium. The change in the duration of long-lasting heat waves can be considered to be strong.

Cold spells The likely range of projected change in the duration of long-lasting cold spells is from -10 to -3 days by 2085, and the very likely range is from -14 to -2 days. Confidence in these figures is medium. The change in the duration of long-lasting cold spells can be considered to be strong.

Precipitation The likely range of projected change in annual total precipitation is from +1 to +11% by 2085, and the very likely range is from -1 to +17%, with only a few projections showing a decrease. The projected change in precipitation shows for the majority of model simulations an increase in future precipitation amound for the wetter season from June to December (likely range from -7 to +25%). No clear trends in precipitation amounts is projected for the drier season from January to May (likely range from -18 to +25%). Confidence in these figures is medium. The change in annual total precipitation can be considered to be weak.

Dry spells The likely range of projected change in the duration of long-lasting dry spells is from -0 to +1 days by 2085, and the very likely range is from -1 to +2 days, with most projections showing an increase. Confidence in these figures is medium. The change in the duration of long-lasting dry spells can be considered to be weak.

Heavy rains The likely range of projected change in the intensity of heavy rain events is from +2 to +12% by 2085, and the very likely range is from -1 to +18%, with only a few projections showing a decrease. Confidence in these figures is medium. The change in the intensity of heavy rain events can be considered to be weak. The likely range of projected change in the frequency of heavy rain events is from +6 to +31% by 2085.

Evaporation The likely range of projected change in the annual mean actual evaporation is from +1 to +6% by 2085, and the very likely range is from +0 to +10%. Confidence in these figures is medium. The change in the annual mean actual evaporation can be considered to be weak.

Water balance The likely range of projected change in the annual mean climatic water balance is from -29 to +173 mm/yr by 2085, and the very likely range is from -86 to +269 mm/yr, with most projections showing an increase. Confidence in these figures is low. The change in the annual mean climatic water balance can be considered to be medium-strong.

Solar irradiance The likely range of projected change in the annual mean solar irradiance is from -46 to +16 kWh/(m^2 yr) by 2085, and the very likely range is from -67 to +68 kWh/(m^2 yr), with some projections showing an increase and some a decrease. Confidence in these figures is medium. The change in the annual mean solar irradiance can be considered to be weak.

Wind speed Almost no change is projected for annual mean wind speed by 2085. Confidence in these findings is medium.

Sea level The likely range of projected change in mean sea level rise near Jolo is from +0.23 to +0.63 m for the low emission scenario and from +0.40 to +0.96 m for the high emission scenario by 2090. The likely range of projected change in mean sea level rise near Legazpi is from +0.21 to +0.63 m for the low emission scenario and from +0.38 to +0.98 m for the high emission scenario by 2090. The used projections are derived from the best available and most consistent dataset which considers the most uncertainties for which estimates can presently be obtained.

Note: The Climate-Fact-Sheets provide an overview of projected possible changes for selected climate parameters at the national or regional level. The Climate-Fact-Sheets are generated on the basis of the best currently available multi-model ensembles of regional and/or global climate models. Accordingly, the Climate-Fact-Sheets provide a first impression of the magnitude of potential future climate change averaged over a given country/region. As such, the information presented in the Climate-Fact-Sheets does not contain information on the finer local scale changes that may occur, and which may be of more interest, in for example, impact or adaptation studies. The Climate-Fact-Sheets are not intended, nor were they designed, to provide this kind of information. If more local scale information is the nature of your interest, or requirement, then alternative methods or tools should be used. Finally, the description of the current climate of the country as well as the observed historical trends is kept to a minimum, as the focus of the Climate-Fact-Sheets is on projected future changes.

Data sources and references

Data sources:
All projections are based on the results of the global model climate and sea level change projections, which are the base of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR5 - www.ipcc.ch). Additionally, the results of the global model climate projections, which are the base of the Fourth Assessment Report of IPCC are used for comparison.
Information on current climate and historical trends, as well as the climate diagrams, are based on the available global data set compiled by the Climatic Research Unit from the University of East Anglia (CRU). Also, data from the so called WATCH forcing data (compiled within the EU-project WATCH - Water and Global Change) has been used. Data on evaporation and climatic water balance has been taken from reanalyses data (ERA40) compiled by the European Centre for Medium-Range Weather Forecasts (ECMWF).

References:
Information on recent extreme events and their impacts has been taken from:
The International Disaster Database: http://www.emdat.be/country_profile/index.html, last viewed 03/09/2015, 08:36.

Information on the classification of climate zones and of the current climate has been taken from the following literature:
Climate Change Knowledge Portal. http://sdwebx.worldbank.org/climateportal/ [accessed March 16 2016]
Concepcion RN. (2004): Gateway to land and water information: Philippine national report. http://www.apipnm.org/swlwpnr/reports/y_ta/z_ph/ph.htm [accessed March 16 2016)
Dolan, R. E. ed. (1991): Philippines: A Country Study. Washington: GPO for the Library of Congress.
„Effektive Klimaklassifikation". In: Wikipedia, Die freie Enzyklopädie. Bearbeitungsstand: 28. Februar 2016, 14:16 UTC. URL: https://de.wikipedia.org/w/index.php?title=Effektive_Klimaklassifikation&oldid=151998222 [accessed March 16 2016]
Kottek, M., Grieser J., Beck C., Rudolf B. and Rubel F. (2006): World Map of the Köppen-Geiger climate classification updated. In: Meteorologische Zeitung, 15, 259-263.
Peel, M.C., Finlayson, B.L., McMahon, T.A. (2007): Updated world map of the Köppen-Geiger climate classification. In: Hydrology and Earth System Sciences. 11, 5, S. 1633–1644, doi:10.5194/hess-11-1633-2007.

Information on historic trends and for projected future changes (mainly for cross-checking) has been taken from the following literature (in alphabetical order):
Christensen, J.H. et al. (2007): Regional Climate Projections. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
Climate Change (2007): Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry et al. Eds.,Cambridge University Press, Cambridge, UK, 469-506.
IPCC (2014): Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 688 pp.
Spearheaded by the Department of Science and Technology - Philippine Atmospheric, Geophysical & Astronomical Services Administration (2011) : Climate change in the Philippines, http://www.dilg.gov.ph/PDF_File/reports_resources/DILG-Resources-2012130-2ef223f591.pdf

Information on historic and projected changes in mean sea level has been taken from the following literature (in alphabetical order):
Church, J. A., et al (2013): Sea level change, in Climate Change 2013: The Physical Science Basis, edited by T. F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P. Midgley, Cambridge University Press, Cambridge, UK and New York, NY. USA.
Church, J.A., et al (2013): Sea Level Change Supplementary Material. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)].
Dasgupta, S et al. (2009): Sea-Level Rise and Storm Surges. A Comparative Analysis of Impacts in Developing Countries. The World Bank Development Research Group Environment and Energy Team, Policy Research Working Paper 4901.
Nicholls R.J. and Cazenave A. (2010): Sea-level rise and its impact on coastal zones. Science 328,1517.
NOAA / National Ocean Service (2013): Tides and Currents - Sea Level Trends. http://tidesandcurrents.noaa.gov/sltrends/sltrends.html (accessed March 14 2016)
Rhein, M., S.R. Rintoul, S. Aoki, E. Campos, D. Chambers, R.A. Feely, S. Gulev, G.C. Johnson, S.A. Josey, A. Kostianoy, C. Mauritzen, D. Roemmich, L.D. Talley and F. Wang (2013): Observations: Ocean. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Update of the Climate-Fact-Sheets in a nutshell

The Climate-Fact-Sheets have been developed in 2011 jointly by the KfW Development Bank and the Climate Service Center Germany (GERICS) to present projected climate change in a condensed manner. Now an update of the Climate-Fact-Sheets has been made.

What is new in the updated version?

- The data presented has been updated to the data basis of the 5th Assessment Report of the Intergovernmental Panel on Climate Change (AR5 IPCC). These climate change projections are based on the so-called Representative Concentration Pathways (RCPs). Projections for three different emission scenarios are analysed: RCP2.6 representing a low scenario; RCP4.5 representing a moderate scenario and RCP8.5 representing a high scenario. Altogether, many more climate change simulations are now included allowing a more robust identification of projected changes.
- Additionally, a range of projected changes under two different assumptions of a possible future global climate development is shown in the updated change figures: the political target of a world below two degree warming (2°C target; mitigation) and a world above 4°C warming at the end of this century is included (see below).
- Information on future sea level change on the basis of the information used in IPCC AR5 is included.

What is still the same?

- Climate change figures are still based on a large ensemble of projections from different global climate models for three different scenarios (low, medium, high).
- Climate change information is still provided for a large set of parameters.
- The range of projected changes of IPCC AR4 (database of the original Climate-Fact-Sheets) is still included in the figures.
- Expert judgement of signal strength and confidence in projected changes is still shown.
- A detailed (updated) manual on „How to read a Climate-Fact-Sheet“ is provided.

What exactly is presented in the updated climate change figures?

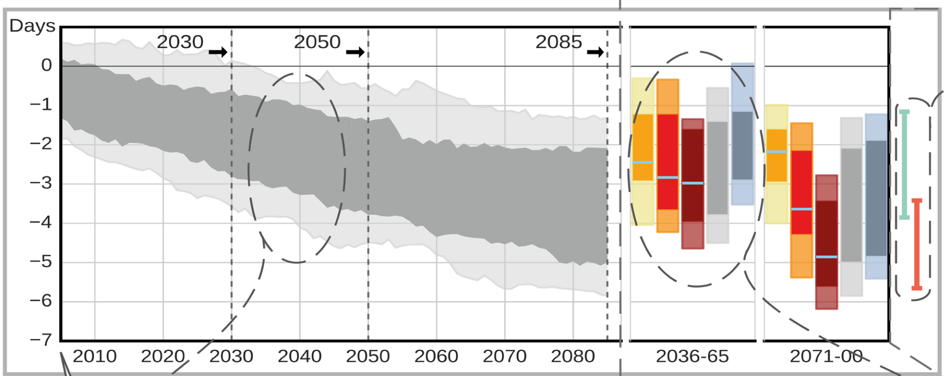
Left part of climate change figures

The bandwidth of projected changes (compared to the reference period from 1971 to 2000) combined for all scenarios over the 21st century (from 2006 to 2085) of data used in IPCC AR5 is shown:
- All values are smoothed in time by a 30 year running mean - so the bandwidth indicated for the year 2085 is actually the bandwidth of the period from 2071 to 2100.
- Three dedicated periods indicated with stippled lines (2030; 2050; 2085) represent the 30 year periods mentioned in the text and/or are presented in more detail on the right part of the diagram.
- Different colour shadings of the bandwidth are explained below the figure.

Note:
For more details on the different climate change projections, RCP scenarios, climate parameters and a more detailed description of the climate change figures, please have a look in the Climate-Fact-Sheet Manual.

Right part of climate change figures

A more detailed view on projected changes for two specific future 30 year periods centred around 2050 (period from 2036 to 2065) and around 2085 (period from 2071 to 2100) with respect to the reference period from 1971 to 2000 is given:
- The yellow, orange and red bars represent the projected changes for the different emission scenarios, represented by different RCPs. The yellow bar represents the low (RCP2.6) scenario; the orange bar the medium (RCP4.5) scenario and the red bar the high (RCP8.5) scenario.
- The grey bar represents the bandwidth of projected changes combined for all three scenarios (IPCC AR5 only) and reflects the information given on the left part of the figure at the same time periods (either 2050 or 2085; both indicated by the stippled lines).
- The blueish bar represents the bandwidth of projected changes from data used in the IPCC AR4 and reflects the information which was provided in the earlier version of the Climate-Fact-Sheets.
- Different colour shadings of the bars are explained below the figure.



Additional information on the right edge of climate change figures

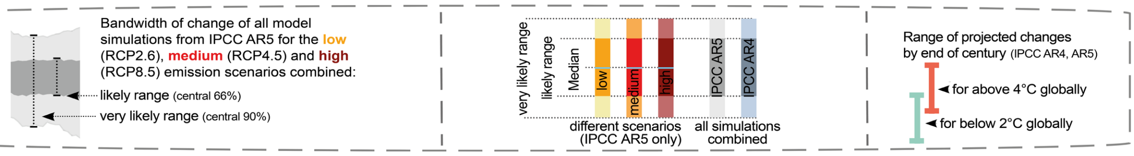
Here, information of projected changes under two different assumptions of the global climate development are given, in order to demonstrate the potential impact of climate change mitigation measures: The turquoise bar represents the range of projected changes of all model simulations (IPCC AR4 & AR5) which project a global mean warming by the end of the century compared to preindustrial of below or equal 2°C (2°C target). Likewise the light red bar represents the range of projected changes of all model simulations which project a global mean warming by the end of the century compared to preindustrial equal or more than 4°C. The information is based on the same data as depicted in the other parts of the diagramm (IPCC AR4 & AR5), but the sorting has been done according to projected global mean temperature change instead of emissions. It is important to note that the two bars sometimes overlap and sometimes do not.

Vertical axis: magnitude and unit of projected changes; Horizontal axis: time periods

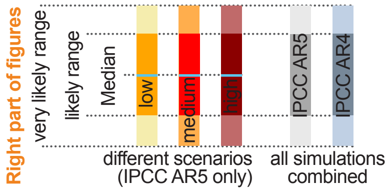
The two different grey shadings reflect different ranges of projected changes, which can be classified by different likelyhoods according to IPCC. A change is *likely* to occur if 66% of all model projections lie within this range. A change is *very likely* to occur if 90% of all projections are within this range. In order to exclude single outliers the *likely* and *very likely* ranges are defined around the median of the projected bandwidth.

As indicated above, the different colours of the five bars reflect the different scenarios as well as different data sources from the IPCC AR4 and AR5 respectively. Additionally, the different colour shading within each bar reflects the *likely* range and *very likely* range of the projected changes as defined on the left. The blue line in the three bars for the different scenarios represents the median (50% value) of the projected changes. Please note that the grey bar (AR5) does not necessarily span the full range defined by the three coloured scenario bars.

This information is also given in the legends on top of each page



Bandwidth of change of all model simulations from IPCC AR5 for the low (RCP2.6), medium (RCP4.5) and high (RCP8.5) emission scenarios combined:
likely range (central 66%)
very likely range (central 90%)



Other information:
Range of projected changes by end of century (IPCC AR4, AR5)
for above 4°C globally
for below 2°C globally

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Projections of possible development of temperature, heat waves and cold spells

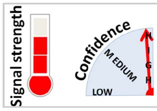
Annual mean temperature

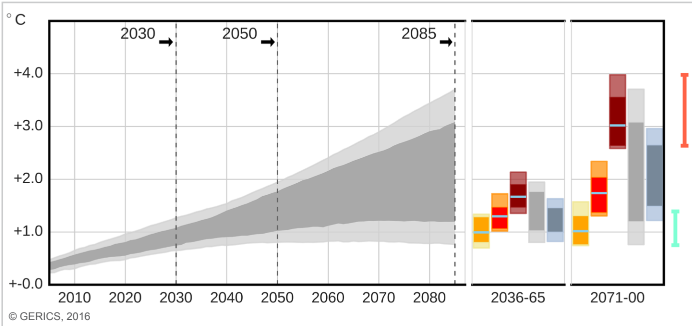
- Likely range of projected change in annual mean temperature is from +0.7 to +1.1°C by 2030, from +1.0 to +1.8°C by 2050 and from +1.2 to +3.1°C by 2085.
- Very likely range: +0.6 to +1.3°C by 2030; +0.8 to +1.9°C by 2050; +0.8 to +3.7°C by 2085.

Separate scenario examination (by 2085):
- **Low-Scenario:** Median +1.0°C
- **High-Scenario:** Median +3.0 °C

Comparison to projections of IPCC AR4:
- Latest AR5 projections show the same magnitude of increase but with a substantially larger bandwidth.

Range of projected changes for all simulations with global mean warming below 2°C or above 4°C (by 2085):
- below 2°C-target: +0.7 to +1.4°C
- **above 4°C-threshold:** +2.6 to +4.0°C

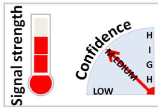


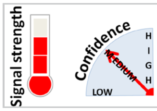


Maximum and minimum temperature

The trends of maximum and minimum temperature are consistent with the trend of annual mean temperature depicted above.

- Likely range of projected change in annual maximum temperature is from +0.8 to +1.1°C by 2030, from +1.1 to +1.8°C by 2050 and from +1.3 to +3.3°C by 2085.
- Likely range of projected change in annual minimum temperature is from +0.7 to +1.1°C by 2030, from +0.9 to +1.7°C by 2050 and from +1.1 to +3.0°C by 2085.





Projected change by 2085

in°C	Scenario	Measure	Max-Temperature	Min-Temperature
	ALL	**likely** very likely	**+1.3 to +3.3** +0.8 to +3.8	**+1.1 to +3.0** +0.7 to +3.7
	Low	Median **likely** very likely	+1.0 **+0.8 to +1.3** +0.7 to +1.6	+1.0 **+0.7 to +1.4** +0.6 to +1.7
	Medium	Median **likely** very likely	+1.7 **+1.4 to +2.1** +1.4 to +2.4	+1.8 **+1.3 to +2.0** +1.1 to +2.5
	High	Median **likely** very likely	+3.2 **+2.8 to +3.8** +2.7 to +4.0	+2.9 **+2.4 to +3.7** +2.2 to +3.9
	Warming thresholds	below 2°C	+0.7 to +1.4	+0.6 to +1.4
		above 4°C	**+2.8 to +4.0**	**+2.4 to +3.8**

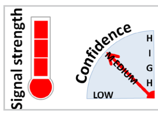
Heat waves

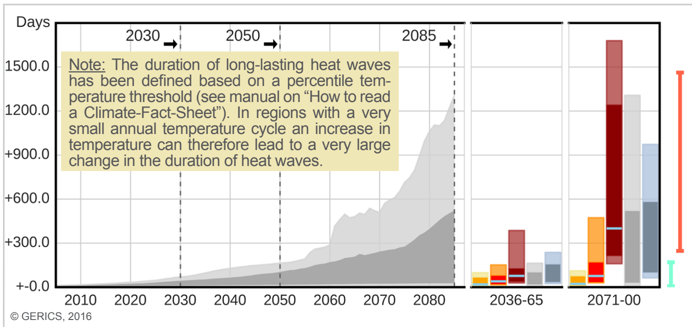
- Likely range of projected change in the duration of long-lasting heat waves is from +9 to +42 days by 2030, from +17 to +103 days by 2050 and from +28 to +521 days by 2085.
- Very likely range: +7 to +71 days by 2030; +11 to +164 days by 2050; +11 to +1307 days by 2085.

Separate scenario examination (by 2085):
- **Low-Scenario:** Median +23 days
- **High-Scenario:** Median +401 days

Comparison to projections of IPCC AR4:
- Latest AR5 projections show the same magnitude of increase but with a larger bandwidth.

Range of projected changes for all simulations with global mean warming below 2°C or above 4°C (by 2085):
- below 2°C-target: +7 to +169 days
- **above 4°C-threshold:** +247 to +1462 days





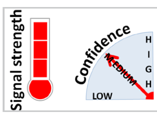
Cold spells

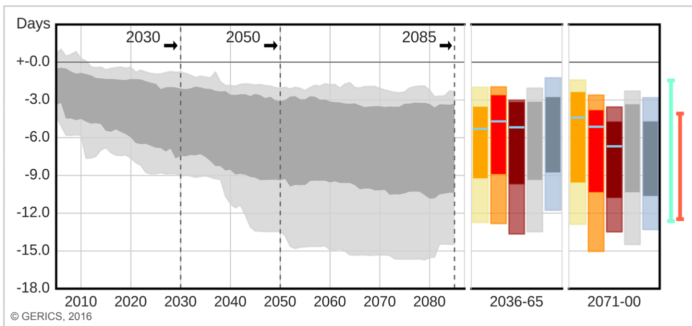
- Likely range of projected change in the duration of long-lasting cold spells is from -7 to -2 days by 2030, from -9 to -3 days by 2050 and from -10 to -3 days by 2085.
- Very likely range: -9 to -1 days by 2030; -13 to -2 days by 2050; -14 to -2 days by 2085.

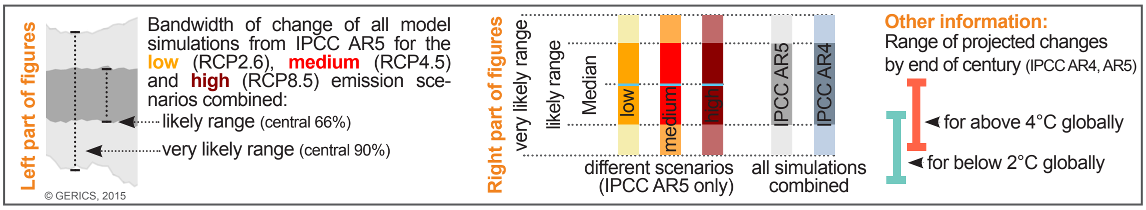
Separate scenario examination (by 2085):
- **Low-Scenario:** Median -4 days
- **High-Scenario:** Median -7 days

Comparison to projections of IPCC AR4:
- Latest AR5 projections show the same magnitude of decrease with a similar bandwidth.

Range of projected changes for all simulations with global mean warming below 2°C or above 4°C (by 2085):
- below 2°C-target: -13 to -1 days
- **above 4°C-threshold:** -12 to -4 days







Projections of possible development of precipitation and water availability

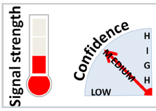
Annual total precipitation

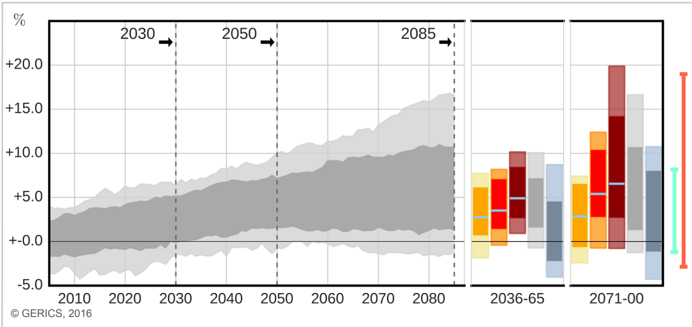
- Likely range of projected change in annual total precipitation is from 0 to +5% by 2030, from +2 to +7% by 2050 and from +1 to +11% by 2085.
- Very likely range: -2 to +6% by 2030; -1 to +10% by 2050; -1 to +17% by 2085.

Separate scenario examination (by 2085):
- **Low-Scenario:** Median +3%
- **High-Scenario:** Median +7%

Comparison to projections of IPCC AR4:
- Latest AR5 projections show a tendency towards an increase, whereas no clear trend is present in AR4 data.

Range of projected changes for all simulations with global mean warming below 2°C or above 4°C (by 2085):
- **below 2°C-target:** -1 to +8%
- **above 4°C-threshold:** -3 to +19%

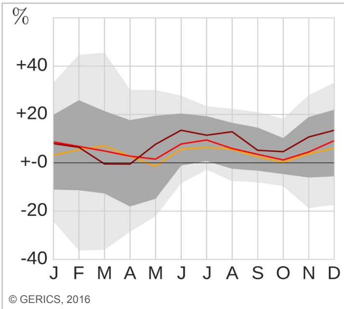




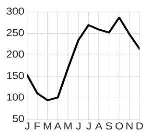
Precipitation seasonality (by 2085)

- The majority of model simulations project an increase in future precipitation amounts for the period from June to February. No clear trend in precipitation amounts is projected for the months March to May.
- Likely range of projected change in total precipitation is from -7 to +25% (wetter season from June to December) and from -18 to +25% (drier season from January to May).
- Very likely range: -18 to +35% (wetter season); -38 to +45% (drier season).

The projected increase in the period from June to February is slightly stronger under the **high** scenario than under the **low** scenario.



Left figure: relative change in the seasonal precipitation cycle by 2085. The coloured lines represent the median for the different scenarios, respectively; the grey shadings the different ranges.



Bottom figure: observed seasonal cycle of precipitation (in mm/month) derived from globally available monthly observation data (CRU). It is depicted to support the interpretion of the projected changes.

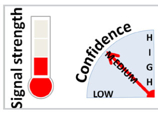
Dry spells

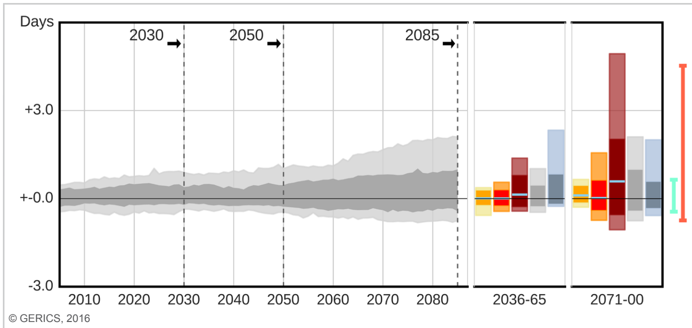
- Likely range of projected change in duration of long-lasting dry spells is from 0 to 0 days by 2030, from 0 to 0 days by 2050 and from 0 to +1 day by 2085.
- Very likely range: 0 to +1 days by 2030; 0 to +1 days by 2050; -1 to +2 days by 2085.

Separate scenario examination (by 2085):
- **Low-Scenario:** Median 0 days
- **High-Scenario:** Median +1 days

Comparison to projections of IPCC AR4:
- Latest AR5 projections show the same tendency towards a slight increase with a similar bandwidth.

Range of projected changes for all simulations with global mean warming below 2°C or above 4°C (by 2085):
- **below 2°C-target:** 0 to +1 days
- **above 4°C-threshold:** -1 to +5 days





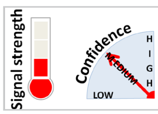
Heavy rains

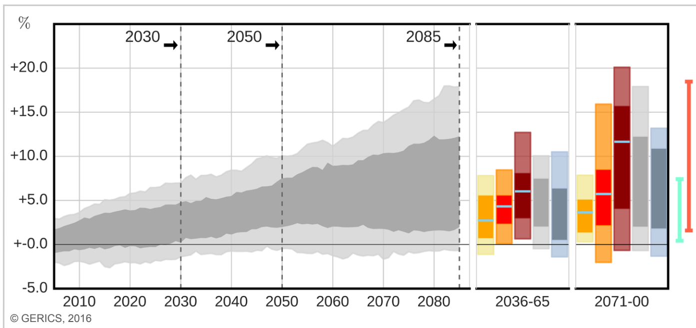
- Likely range of projected change in the intensity of heavy rainfall events is from 0 to +5% by 2030, from +2 to +7% by 2050 and from +2 to +12% by 2085.
- Very likely range: -1 to +7% by 2030; 0 to +10% by 2050; -1 to +18% by 2085.

Separate scenario examination (by 2085):
- **Low-Scenario:** Median +4%
- **High-Scenario:** Median +12%

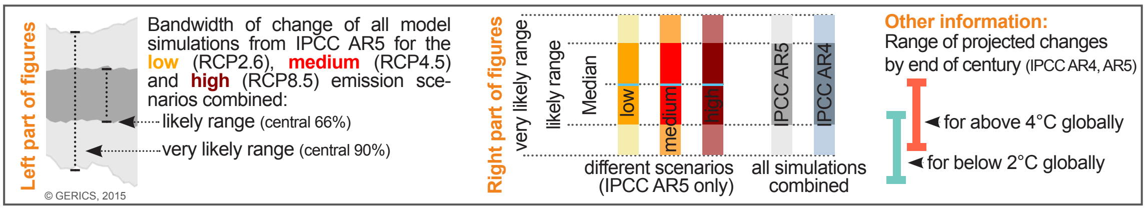
Comparison to projections of IPCC AR4:
- Latest AR5 projections show the same tendency towards an increase with a similar bandwidth.

Range of projected changes for all simulations with global mean warming below 2°C or above 4°C (by 2085):
- **below 2°C-target:** 0 to +7%
- **above 4°C-threshold:** +2 to +18%





Likely range of projected change in the frequency of a heavy rainfall event of today's intensity is from +1 to +14% by 2030, from +4 to +23% by 2050 and +6 to +31% by 2085.



GERICS Climate Service Center Germany

Actual evaporation

- Likely range of projected change in annual total actual evaporation is from 0 to +2% by 2030, from +1 to +4% by 2050 and from +1 to +6% by 2085.
- Very likely range: -1 to +3% by 2030; -1 to +5% by 2050; 0 to +10% by 2085.

Separate scenario examination (by 2085):

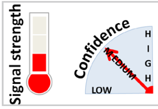
- **Low-Scenario :** Median +2%
- **High-Scenario:** Median +6%

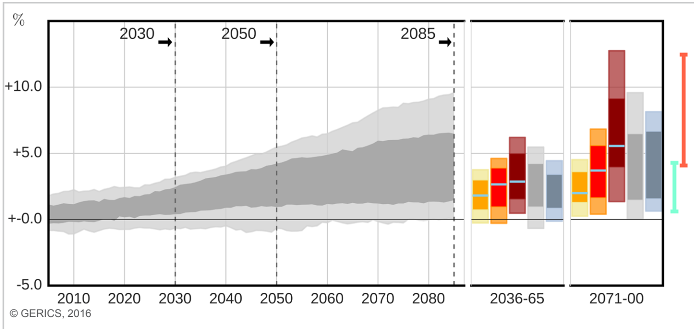
Comparison to projections of IPCC AR4:

- Latest AR5 projections show the same magnitude of a slight increase with a similar bandwidth.

Range of projected changes for all simulations with global mean warming below 2°C or above 4°C (by 2085):

- **below 2°C-target**: +1 to +4%
- **above 4°C-threshold:** +4 to +12%





Climatic water balance (difference between annual mean precipitation and annual mean actual evaporation)*

- Likely range of projected change in climatic water balance is from -21 to +109 mm/yr by 2030, from -9 to +151 mm/yr by 2050 and from -29 to +173 mm/yr by 2085.
- Very likely range: -57 to +141 mm/yr by 2030; -57 to +206 mm/yr by 2050; -86 to +269 mm/yr by 2085.

Separate scenario examination (by 2085):

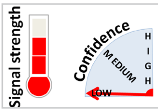
- **Low-Scenario :** Median +19 mm/yr
- **High-Scenario:** Median +75 mm/yr

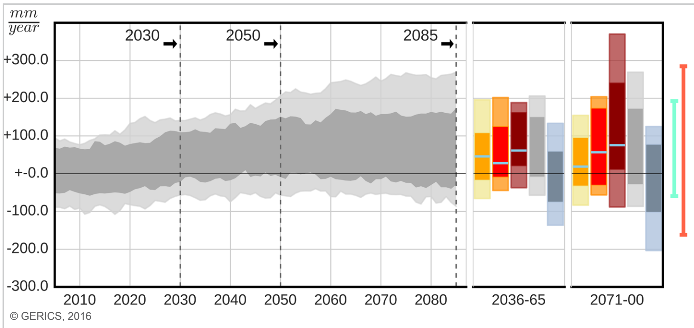
Comparison to projections of IPCC AR4:

- Latest AR5 projections show a tendency towards an increase, whereas no clear trend is present in AR4 data.

Range of projected changes for all simulations with global mean warming below 2°C or above 4°C (by 2085):

- **below 2°C-target**: -59 to +192 mm/yr
- **above 4°C-threshold:** -162 to +285 mm/yr





* The climatic water balance is derived from projected precipitation and projected actual evaporation amounts. Therefore the bandwidth of both parameters is accumulated in this parameter. Due to this, the climatic water balance shows a rather high bandwidth. Because the climatic water balance can have positive or negative values for today's or future conditions, the changes are given in mm/yr.

Projections of possible development of solar irradiance

- Likely range of projected change in solar irradiance is from -33 to +5 kWh/(m² yr) by 2030, from -33 to +13 kWh/(m² yr) by 2050 and from -46 to +16 kWh/(m² yr) by 2085.
- Very likely range: -43 to +11 kWh/(m² yr) by 2030; -65 to +38 kWh/(m² yr) by 2050; -67 to +68 kWh/(m² yr) by 2085.

Separate scenario examination (by 2085):

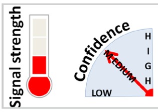
- **Low-Scenario :** Median 0 kWh/(m² yr)
- **High-Scenario:** Median -31 kWh/(m² yr)

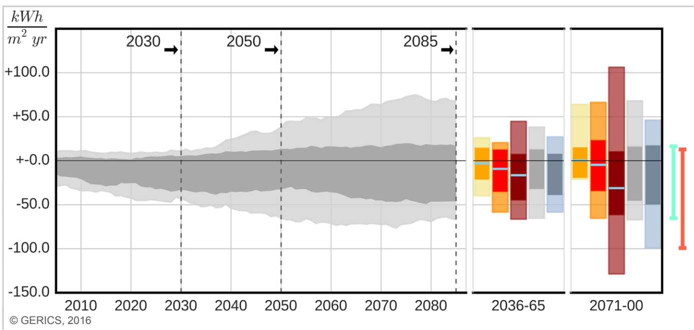
Comparison to projections of IPCC AR4:

- Latest AR5 projections show the same outcome of no clear trend combined with a substantial bandwidth.

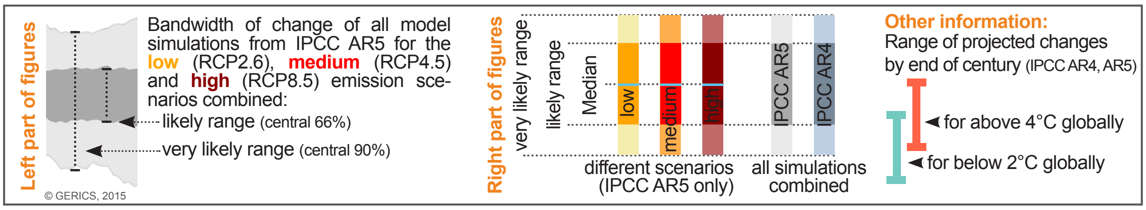
Range of projected changes for all simulations with global mean warming below 2°C or above 4°C (by 2085):

- **below 2°C-target**: -65 to +16 kWh/(m² yr)
- **above 4°C-threshold:** -99 to +13 kWh/(m² yr)





All projected changes presented in the Climate-Fact-Sheet are with respect to the reference period from 1971 to 2000. Whenever a single year is referenced in the climate change section it refers to the 30 year period centred around this single year (e.g. by 2085 reflects the change for the period from 2071 to 2100). Exception to these periods are only the projections for sea level rise (if applicable).
The evaluation of the signal strength includes not only the actual climate change signal but also the statistical significance of the projected change. Signal strength is separated into weak, medium-strong or strong signal.
The assessment of the confidence in the climate model projections is based on the models' performance in simulating today's climate as well as on the bandwidth of projected climate change. This bandwidth results from the fact that every climate model projects a slightly different climate change signal. Confidence is separated into low, medium or high confidence.
For more details see „How to read a Climate-Fact-Sheet".



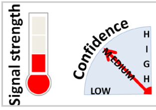
Projections of possible development of wind speed

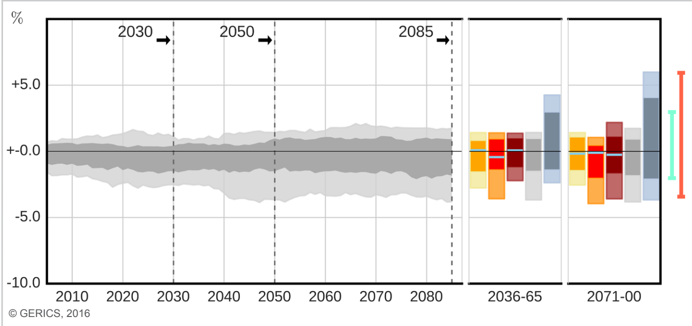
- Likely range of projected change in annual mean wind speed is from -1 to 0% by 2030, from -1 to +1% by 2050 and from -2 to +1% by 2085. Very likely range: -3 to +1% by 2030; -4 to +1% by 2050; -4 to +2% by 2085.

Separate scenario examination (by 2085):
- **Low-Scenario :** Median 0%
- **High-Scenario:** Median 0%

Comparison to projections of IPCC AR4:
- Latest AR5 projections show the same outcome of almost no change but with a smaller bandwidth.

Range of projections reaching the 2°C target or are above 4°C in the global mean (by 2085):
- **below 2°C target**: -2 to +3%
- **above 4°C-threshold:** -3 to +6%





Projections of possible changes in regional sea level

General information on mean sea level change:
Observed global mean sea level rise based on independent observing systems from 1993 to 2010 is in the order of 3.2 mm/yr. Regional sea level changes may differ substantially from the global average, showing complex spatial pattern which results from ocean dynamical processes, movements of the sea floor and changes in gravity due to water mass redistribution in the climate system (IPCC AR5).

What is presented in the sea level change figures?
For the future, projections of mean sea level change data are based on different coupled atmosphere-ocean general circulation model simulations, which are the basis of the IPCC AR5 chapter 13 on sea level change. Due to data availability, projected changes in sea level are presented for two 20-year-periods from 2046 to 2065 and 2081 to 2100 to be consistent with the reference period from 1986 to 2005. Projected changes are shown separately for each of the three emission scenarios: low (RCP2.6) - orange bars; medium (RCP4.5) - red bars and high (RCP8.5) - dark red bars. The bars do not present the full range, but a measure of uncertainty. The blue lines crossing the bars represent the ensemble mean.

Vulnerability to sea level change:
Coastal areas of the Philippines are vulnerable to future changes in sea level. First estimates indicate that a potential expansion of the inundation zone* would have a financial impact for the Philippines of about 52% of its GDP generated in coastal regions.
Out of 84 countries from all parts of the globe, that were included in an analysis which is summarized in the World Bank Report: „Sea-Level Rise and Storm Surges“, the Philippines is the ninth most vulnerable country.

*The calculation of the inundation zone includes the following factors: Observed 1-in-100-years surge height, a 1m sea-level-rise with an additional 0.5m sea-level-rise in delta regions, 10% intensification of storm surges only in coastal areas currently prone to tropical storms, corrections for continental uplift and subsidence effects. The reduction in wave height with distance from the coastline is estimated to be 0.3m/km. Please note that the GDP changes are highly uncertain estimates, that depend on the method and the datasets used. For this reason the presented GDP changes should only be used to compare the vulnerabilities among different countries.

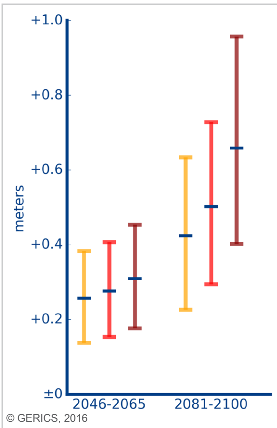
Observed regional sea level change:
At the coastal station of Legazpi (Philippine Sea), an increase in the mean sea level of about 5.38 mm/yr has been recorded in the period from 1947 to 2009 based on monthly mean sea level data.
At the coastal station of Jolo (Sulu Sea) an increase in the mean sea level of about 0.19 mm/yr only in the period from 1947 to 1996 was recorded.

Projected regional sea level change:

Near Jolo (6.06 °N, 121.00 °E)

Projected change by 2056:
- **Low-Scenario :** Mean +0.26 m (likely range: +0.14 to +0.38 m)
- **High-Scenario:** Mean +0.31 m (likely range: +0.18 to +0.45 m)

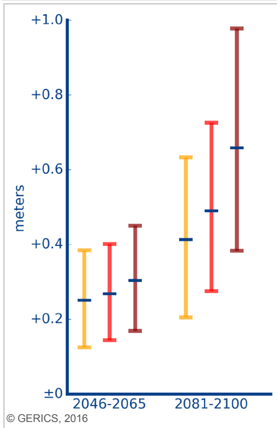
Projected change by 2090:
- **Low-Scenario :** Mean +0.42 m (likely range: +0.23 to +0.63 m)
- **High-Scenario:** Mean +0.66 m (likely range: +0.40 to +0.96 m)



Near Legazpi (13.15 °N, 123.75 °E)

Projected change by 2056:
- **Low-Scenario :** Mean +0.25 m (likely range: +0.13 to +0.38 m)
- **High-Scenario:** Mean +0.30 m (likely range: +0.17 to +0.45 m)

Projected change by 2090:
- **Low-Scenario :** Mean +0.41 m (likely range: +0.21 to +0.63 m)
- **High-Scenario:** Mean +0.66 m (likely range: +0.38 to +0.98 m)



Note: The used projections are derived from the best available and most consistent dataset which considers the most uncertainties for which estimates can presently be obtained.

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