Climate Risk Profile Iraq

Summary for policymakers

This paper summarises **projected climate parameters and related impacts on different sectors in Iraq until 2080 under different climate change scenarios provided by the IPCC** (called Representative Concentration Pathways, RCPs). RCP2.6 represents a low emissions scenario that aims to keep global warming below 2 °C above pre-industrial temperatures; RCP6.0 represents a medium to high emissions scenario. The full Climate Risk Profile can be downloaded here.

For high-quality **quantitative climate change impact data for the analysis of climate-related security risks**, we draw on the methodology developed by the AGRICA[ii] project applied to the data and modelling work by the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) at the Potsdam Institute for Climate Impact Research (PIK). ISIMIP provides a framework to assess past, current and future climatic changes and related impacts under different climate change scenarios in a comprehensive and consistent way. It synthesises the results of various global and regional impact models to better understand how climate change affects different sectors such as water, agriculture and health and how impacts in different sectors interact and amplify each other.[iii] The simulations from the Climate Risk Profile Iraq are based on the output data of different global models.[iv]

Main findings

Uncertainties are always part of climate change projections. They arise from a variety of factors, including natural variabilities, uncertainties in greenhouse gas (GHG) emissions scenarios and differences in the models used. Consequently, no future climate change projection comes without some level of uncertainty. The level of uncertainty differs in either the range or in the direction of impacts. We present the results of ten different global models. To indicate the (un)certainty of the projections we consider model agreement.

High-certainty projections

Temperature: The average annual air temperature in Iraq is 22.6 °C[v], but temperatures vary widely across the country and between seasons. While daily temperatures in the north of the country average to around 25 °C in summer, they exceed 40 °C in southern Iraq.[vi] In Baghdad and Basra, temperatures of over 50 °C have been measured repeatedly in recent summers.[vii] Depending on the climate change scenario, **temperature in Iraq will very likely rise by between 1.6 and 2.4 °C by 2030, 1.9 and 3.2 °C by 2050, and 1.8 and 4.8 °C by 2080**, compared to pre-industrial levels. **Rising air temperatures will affect the whole country, with the strongest increase in the northeast**. Furthermore, the **annual number of very hot days (with a maximum temperature above 35 °C) is projected to rise with high certainty all over Iraq**. The rise will be highest in the northeast and the west of Iraq.

Health: High exposure and limited adaptation capacities make Iraq highly vulnerable to the health-related effects of climate change. **Rising temperatures and the increasing number of very hot days will very likely result in higher heat-related mortality**. According to the best estimates, heat-related mortality will increase from 1.6 deaths per 100 000 people and year in 2000 to 3.0 (RCP2.6) and 3.2 (RCP6.0) deaths per 100 000 people and year until 2030. By 2080, heat-related deaths will rise to 3.8 (RCP2.6) and 7.4 (RCP6.0) per 100 000 people annually. **Under a high emissions scenario, temperature extremes will exceed a threshold for human habitability in many cities in the Middle East North Africa (MENA) region towards the end of the century.**[viii]

Sea level rise: In addition, the sea level is **projected to very likely rise**[ix] **under both emissions scenarios affecting the Southern Basra Governorate**. The median of all climate models projects a sea level rise of 9.6 cm by 2030, 17.9 cm by 2050 and 30.2 cm by 2080 under RCP2.6, compared to the year 2000. Under RCP6.0, sea level will rise by 9.1 cm until 2030, 17.9 cm until 2050, and 36.1 cm until 2080, according to the multi-model median. **Under a high emissions scenario, Iraq's second-largest city Basra could be largely inundated by water by 2050**.[x]

Infrastructure: Until 2030, the **exposure of urban land area to river floods** is projected to **hardly change under either RCP**. Depending on the scenario and time period, urban land exposure to river flooding will very likely fluctuate between 0.05 and 0.80 % between 2000 and 2080.

Lower-certainty projections

For the following areas and sectors, climate projections are much less certain and therefore the results need to be interpreted with caution.

Precipitation: While under RCP2.6, models agree on **an increase in inter-annual variabilities, no clear direction of change in average precipitation levels can be derived**. **Under RCP6.0, however, despite inter-annual variabilities, precipitation will decrease** over time with the west and south of the country being most strongly affected. Future **projections regarding heavy precipitation events are uncertain**. No clear trend can be derived under RCP2.6; the projections under RCP6.0 assume a slight decrease with the southeast and the west being most strongly affected.

Water availability: Projections of water availability in Iraq are **highly uncertain under both GHG emissions scenarios.** Without accounting for future population growth, water availability is projected to very likely range between 541 and 3 883 m^3 per year by 2080 under RCP2.6, and between 384 and 3 475 m^3 under RCP 6.0. **When accounting for population growth, per capita water availability for Iraq will very likely sharply decline under both scenarios.** Despite this clear decrease, however, **model disagreement is extremely high.** Projections range between 307 and 1850 m^3 (multi-model median of 479 m^3) under RCP2.6, and between 279 and 1787 m^3 (multi-model median of 426 m^3) under RCP6.0 per person and year by 2030. This decrease will continue to decline throughout 2080. By 2080, per capita water availability is projected to very likely range between 161 and 1 160 m^3 (multi-model median of 317 m^3) under RCP2.6, and between 116 and 1 035 m^3 (multi-model median of 261 m^3) under RCP6.0. In light of the water stress threshold of 1 700 m^3 per person and year[x], these projections should be taken as a serious warning sign, even if they are highly uncertain.

Agricultural yields: In Iraq, agricultural productivity declined from around 26 % of the country's GDP in 1995 to only 6 % in 2020, mainly as a consequence of market disruptions and widespread displacement of rural communities during the ISIS crises.[xii] Nevertheless, the agricultural sector still employs around one fifth of the population.[xiii] According to our projections**, wheat production will increase** across all models, despite some inter-decadal variabilities. **Maize yields will decline, particularly along Iraq's eastern border.** For wheat and maize, however, uncertainties around the magnitude of the projected increase (wheat) and decrease (maize) rise over time. **For future projections on rice yields, no clear trend can be derived**. Furthermore, potential evapotranspiration, an important indicator for drought conditions and thus agricultural productivity, is projected to increase though the magnitude of increase is highly uncertain.

Exposure to heatwaves: Rising temperatures and the increasing number of very hot days will result in **an increased exposure to heatwaves**. Depending on the scenario, **by 2030, between around 12 and 36 % of the total population will be exposed to heatwaves annually** (very likely range). Exposure to heatwaves will continue to increase sharply until 2080 under both scenarios. However, modelling uncertainty about the magnitude of the increase is relatively large and becomes even more pronounced from 2050 onward.

GDP exposure: The **exposure of the Iraqi GDP to heatwaves is very likely to strongly increase under both GHG emissions scenarios**, though the magnitude of increase is subject to high and growing modelling uncertainty. **Depending on the GHG emissions scenario, by 2030, between approximately 13 and 35 % of the GDP of Iraq will very likely be exposed to heatwaves.** Under RCP6.0, GDP exposure is projected to rise to around 28 to 57 % by 2080 (very likely range).

Ecosystems: The **uncertainty of projections of species richness is very high under both emissions scenarios.** Model agreement on the direction of change in tree cover is equally low and consequently, no reliable conclusions can me made under either RCP.

References

[i] The information in the summary are drawn from the more comprehensive Climate Risk Profile Iraq.

[ii] AGRICA is a project implemented by PIK in cooperation with the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ).

[iii] Frieler, K. et al. (2017). Assessing the Impacts of 1.5°C Global Warming – Simulation Protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development, 10, 4321–4345.

[iv] The simulations are based on the output data of:

- 4 Global Climate Models (GCMs) that simulate the physical, chemical and biological dynamics of the climate system.
- 6 Global Hydrological Models (GHMs) that simulate the hydrological cycle at the land surface of continental-scale river basins.
- 3 Global Gridded Crop Models (GGCMs) that simulate crop growth at the grid scale for a selected number of crops.
- 3 Global Vegetation Models (GVMs) that simulate the dynamics of terrestrial vegetation and soil as well as the associated carbon pools and fluxes.
- 2 Global Species Distribution Models (GSDMs) that simulate species distribution based on known locations of a species and information on environmental conditions.
- 1 Temperature Related Mortality Model (TRMM) that simulates excess mortality attributable to high or low temperatures.

Further information on the models underlying the analysis presented in this profile is available in the Climate Risk Profile – Supplemental Information sheet.

[v] World Bank, "Climate Change Knowledge Portal - Iraq," 2022. [Online]. Available: https://climateknowledgeportal.worldbank.org/country/iraq. [Accessed 9 January 2022].

[vi] Al-Ansari, N., "Topography and Climate of Iraq," Journal of Earth Sciences and Geotechnical Engineering, vol. 11, no. 2, pp. 1-13, 2021.

[vii] BBC, "In Pictures: Iraqis Try to Stay Cool in 51C Heatwave," 30 July 2020. [Online]. Available: https://www.bbc.com/news/world-middle-east-53596229. [Accessed 21 November 2021]

[viii] Pal, J.S.; Eltahir, E. A.B., "Future Temperature in Southwest Asia Projected to Exceed a Threshold for Human Adaptability," Nature Climate Change. Letters, vol. 6, p. 197–200, 2016.

[ix] The sea level rise projections are based on two global climate models only, which limits the certainty of the projection.

[x] Abbas, N. , Nasrin, S. , Al-Ansari, N. Ali, S. , "The Impact of Sea Level Rise on Basrah City, Iraq," Open Journal of Geology, vol. 10, pp. 1189-1197, 2020.

[xi] Falkenmark, "The Massive Water Scarcity now Threatening Africa - Why isn't it being Addressed?," Ambio, vol. 18, 1989.

[xii] FAO, "Agricultural Value Chain Study in Iraq," FAO, Bagdad, 2021.

[xiii] World Bank, "World Bank Open Data," 2021. [Online]. Available: https://data.worldbank.org/.

Published by

Potsdam Institute for Climate
Impact Research (PIK) e.V.
Telegraphenberg A 31, 14473 Potsdam, Germany
http://www.pik-potsdam.de

adelphi research gemeinnützige GmbH
Alt-Moabit 91, 10559 Berlin
office@adelphi.de
https://www.adelphi.de/en

Main authors

Lisa Binder (PIK), binder@pik-potsdam.de
Barbora Šedová (PIK), sedova@pik-potsdam.de
Lukas Rüttinger (adelphi), ruettinger@adelphi.de

Layout

Alina Viehoff (adelphi)
Johanna Caitlin Dieffenbacher (adelphi)
Lisa Binder (PIK)

Date

July 2022

Led by:

adelphi

PIK

Supported by:

Federal Foreign Office

Norwegian Ministry of Foreign Affairs

UK Government

El futuro es de todos Gobierno de Colombia

Irish Aid
Rialtas na hÉireann
Government of Ireland

MINISTRY OF FOREIGN AFFAIRS OF DENMARK