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POLICY RESEARCH CENTER

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Research Policy Update

2021 IPCC Sixth Assessment Report – What is it? Why is it Important?

This research update provides an overview of the new Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report, Working Group I. The update identified key highlights on data related to climate change and additional resources.

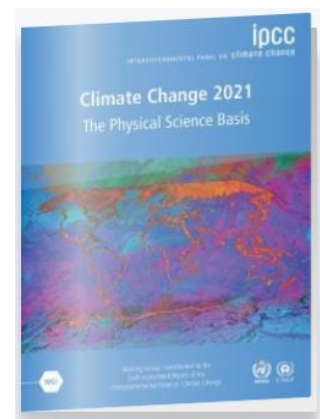
What is the IPCC Sixth Assessment Report?

The Intergovernmental Panel on Climate Change (IPCC) is a United Nations panel convened to assess and agree on science findings related to climate change from around the globe.¹ The IPCC is made up of an international group of scientists representing 195 countries.² The scientists work together to review, confirm, and agree upon climate research and findings from around the world to produce the most up to date picture of the earth and climate change. The IPCC reports intend to provide policy makers with the most robust non-partisan science-based information possible to better inform decisions on climate policy around the world as well as the United Nation's Sustainable Development Goals.³

Three working groups in the IPCC focus on different aspects of climate change. The first working group focuses on the physical sciences, the second working group focuses on the impacts of climate change, adaptation, and vulnerability (current and future risks), and the third working group focuses on potential mitigation strategies to the severity of climate change. Each of the working groups produce a report on their findings, and these three reports make up the IPCC Assessment Report.⁴ The Assessment Reports identify the status of scientific knowledge around the climate in the past, present, and future.⁵

In August 2021, the IPCC Working Group I produced an updated report on the Physical Sciences data and analysis of climate change, the progress of climate change, and the current trajectory of climate change based on data collected from and confirmed by 234 authors from 65 countries with peer reviewers from 46 countries.⁶ The last Assessment Report section from Working Group I was released in 2013.

Figure 1. IPCC Climate Change 2021: The Physical Science Basis



Read the Sixth Assessment Report: The Physical Science Basis at [ipcc.ch/report/ar6/wg1/](https://www.ipcc.ch/report/ar6/wg1/)

The IPCC can create task forces to produce additional special reports in addition to the Assessment Report by the working groups. This research update will only focus on the first part to the IPCC Sixth Assessment report, the *Physical Sciences Basis*, which was released in August 2021. The next reports, *Impacts of Climate Change, Adaptation, and Vulnerability* and *Mitigation of Climate Change*, are expected in February and March 2022.⁷

Why is the IPCC Sixth Assessment Report Important? – Key Findings

The IPCC report provides one of the most robust up to date and internationally agreed upon reviews of scientific research conducted throughout the entire world on climate change. The Working Group I report confirms findings from countries around the world to create a holistic picture of the physical science data.

The Sixth Assessment report affirmed much of the science that was already known about climate change and further confirmed with updated methodologies and technologies the level of climate change and the role of human influence. This research update covers some high-level key findings from the IPCC Sixth Assessment Report: The Physical Science Basis. To read the full report, visit: <https://www.ipcc.ch/report/ar6/wg1/#FullReport>.

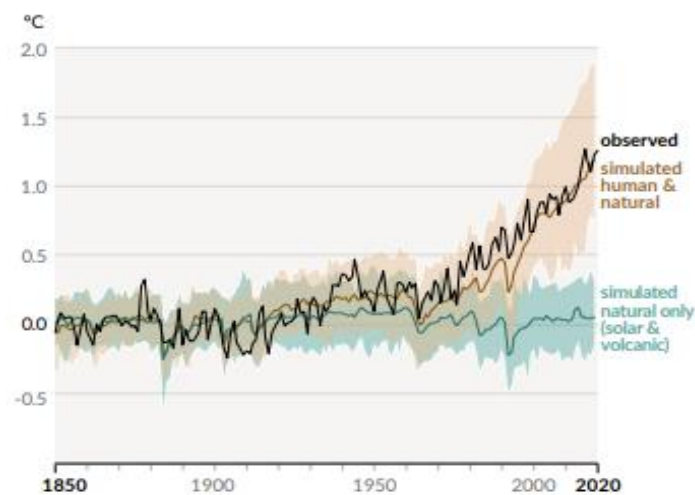
“Recent changes in the climate are widespread, rapid, and intensifying, and unprecedented in thousands of years.” – IPCC Sixth Assessment Report: Physical Science Basis Press Slides⁸

The IPCC confirmed and measured the reality of climate change and affirmed the phenomena as undisputable. Key highlights of the Physical Sciences report covered the impact of human influence on climate change, the warming global temperature and projections, ocean and ice impacts, rainfall impacts, and fire and extreme weather events. Each of these key highlights are briefly covered below at the global level:

Human Influence

A key highlight from the report identified and confirmed that human influence is the main driver of climate change. The authors affirm that the scientific evidence shows there is no debate on the role of humans on

Figure 2. Changes in Global Surface Temperature as Observed and Simulated using Human & Natural and Only Natural Factors Relative to 1850-1900



This image is from and was created in the IPCC Climate Change 2021: The Physical Science Basis Summary for Policymakers. To read the report visit: <https://bit.ly/3FjP9tM>

causing climate change. **Figure 2** shows the changes in global surface temperatures compared to the average global temperature measured between 1850-1900.⁹ The area shaded in brown shows the simulated impacts of human and natural influences on global surface temperature changes. The black line shows the observed temperature changes from human and natural influences between 1850 and 2020, compared to the average global temperature measured between 1850 and 1900. The light blue shaded area shows the simulated natural factors on the global climate temperatures.

Figure 2 illustrates the observed impacts of human and natural influences on average global temperatures in the last 70 years. "It is indisputable that human activities are causing climate change, making extreme climate events, including heat waves, heavy rainfall, and droughts, more frequent and severe."¹⁰ The data and scientific analysis show without question that humans are the main cause of climate change.

The IPCC report emphasizes the role of human influences on all aspects of climate change highlighted throughout their report. The significant role of humans in causing climate change is a key theme from the scientific review, and the findings provide measurable confidence levels backed by data.

Global Temperature Increase

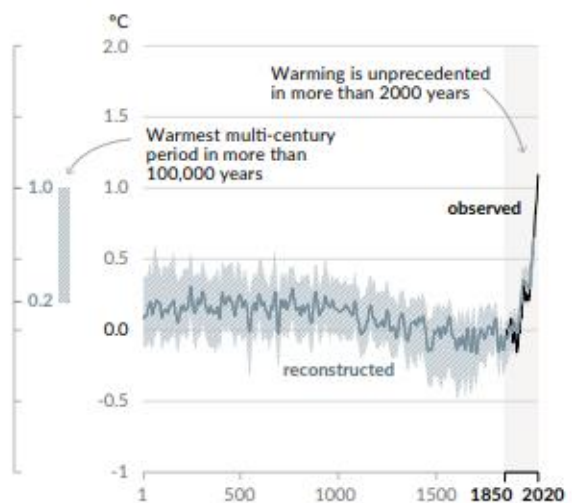
The IPCC further examined the changing average temperatures of the globe as measured by improved methodologies over the last ten years to examine past, current, and future temperature projections.

The average temperature in the last 10 years was already 1.1 degrees Celsius (1.1° C) warmer than the average temperature measured between 1850 – 1900.¹¹ Each of the last four decades has continued to be an average increase from the previous decade and warmer than the average 1850-1900 temperature.¹²

Figure 3 shows the observed and reconstructed average global temperature trends from over the last 2000 years.¹³ **Figure 3** illustrates that the average global temperature warming over the last 2000 years is unprecedented.

The IPCC also found that Carbon Dioxide (CO₂) concentrations in the atmosphere are at their highest levels in at least two million years.¹⁴ CO₂ is just one of the Greenhouse gasses that impact climate change.¹⁵ The IPCC report declared that "unless there are immediate, rapid, and large-scale reductions in greenhouse gas emissions,

Figure 3. Changes in Global Surface Temperature as Reconstructed and Observed Relative to the Average Global Temperature between 1850-1900



This image is from and was from the IPCC Climate Change 2021: The Physical Science Basis Summary for Policymakers report. To read the report visit: <https://bit.ly/3FjP9tM>

limiting warming to 1.5° C will be beyond reach.¹⁶ With the increased warming, more extreme heat events will become more frequent and more intense.¹⁷

Oceans and Ice

The Sixth Assessment Report: The Physical Science Basis reviewed data and research on several aspects of oceans and ice, and this section highlights key findings from the report.

The report found that ocean temperatures are projected to increase two to eight times as much as they had increased since the early 1970s.¹⁸ The temperature increase in the ocean causes thermal expansion of the water, which is one contributing factor to sea level rise. **Figure 4** shows key contributors to sea level rise and the percent that each contributed to sea level rise between 1971 and 2018. The sea level has increased at its fastest rate in at least 3000 years.¹⁹

The ocean continues to face increased acidification, salinity challenges, and oxygen losses, which create dead zones in addition to the increased temperatures and sea level rise.²⁰ Many contributors to the changing ocean and ice are tied to human actions with high confidence throughout the report, with exception of Antarctic Sea ice. There is “only *limited evidence with medium agreement* of human influence on the Antarctic Ice Sheet loss.”²¹

Water

The IPCC conducted an in depth look at the impacts of climate change on the global water cycle. Key measures and impacts of the global water cycle from warming temperatures include the amount of water that can be held in the air and greater and faster evaporation, both of which lead to heavier precipitation and extreme weather events.²² Rainfall in certain areas will continue to become heavier, more frequent, and more intense. Drought in certain areas will also continue to increase in duration, severity, and frequency.²³

Figure 5 shows different projections for future climate warming based on CO₂ emissions. Each 1° C increase intensifies extreme rainfall by seven percent. The yellow line is our current trajectory.²⁴ The Low and Very Low CO₂ emissions lines would mean the world would need to take immediate measures to significantly decrease emissions. The High and Very High CO₂ emissions lines project if the world increases CO₂ emissions from our current output. The grey

Figure 4. Contributors to Sea Level Rise, 1971 - 2018

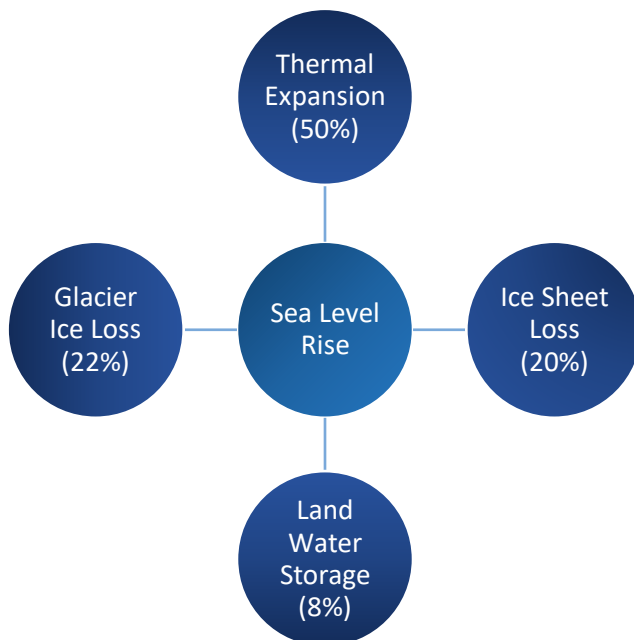


Figure 4 percentages are from the Sixth Assessment Climate Report: Physical Science Basis Summary for Policymakers. To read the report visit: <https://bit.ly/3FjP9tM>

area in the middle of the graph is where the global temperature and CO₂ emissions are now and are projected in the near future.

Figure 5. Future CO₂ Emissions Projections on Global Temperature Increase

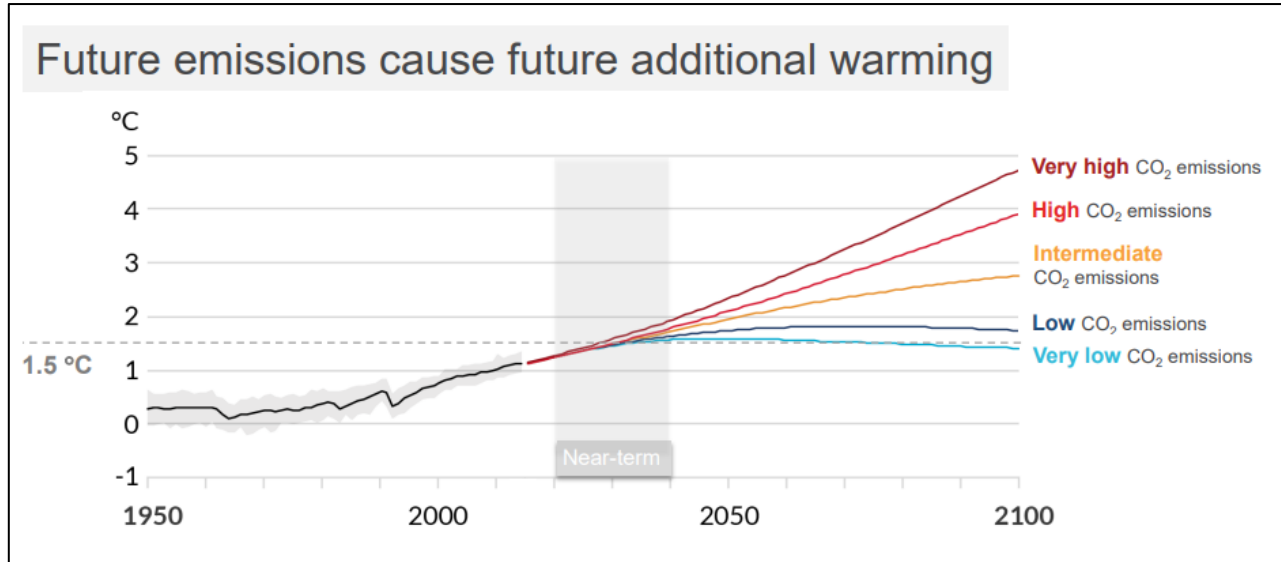


Figure 5 is from the Press Conference Slide Deck for the IPCC Sixth Assessment Report: Physical Science Basis. To read the report visit: <https://bit.ly/3FiP9tM>

If CO₂ emissions continue at the current trajectory, the earth will warm by 2° C compared to the average 1850-1900 temperature by 2050, which is only 30 years from now.²⁵ At a 2° C warming, heat extremes would more often reach critical thresholds for agriculture and human health.²⁶

Extreme Weather Events

Extreme weather events occurring at multiple locations at the same time are becoming and will become more frequent, particularly heat waves and droughts occurring together and storm surges with extreme rainfall and river flow.²⁷ Fires related to weather conditions will continue to increase in frequency and severity due to the changing dry, hot, and wind conditions.²⁸ To learn more about the different extreme events that will become more frequent, severe, and lasting, the IPCC Summary Report for Policymakers provides an overview with 10 and 50 year projections. Even more detailed projections are available in the full IPCC Sixth Assessment Report: Physical Science Basis.

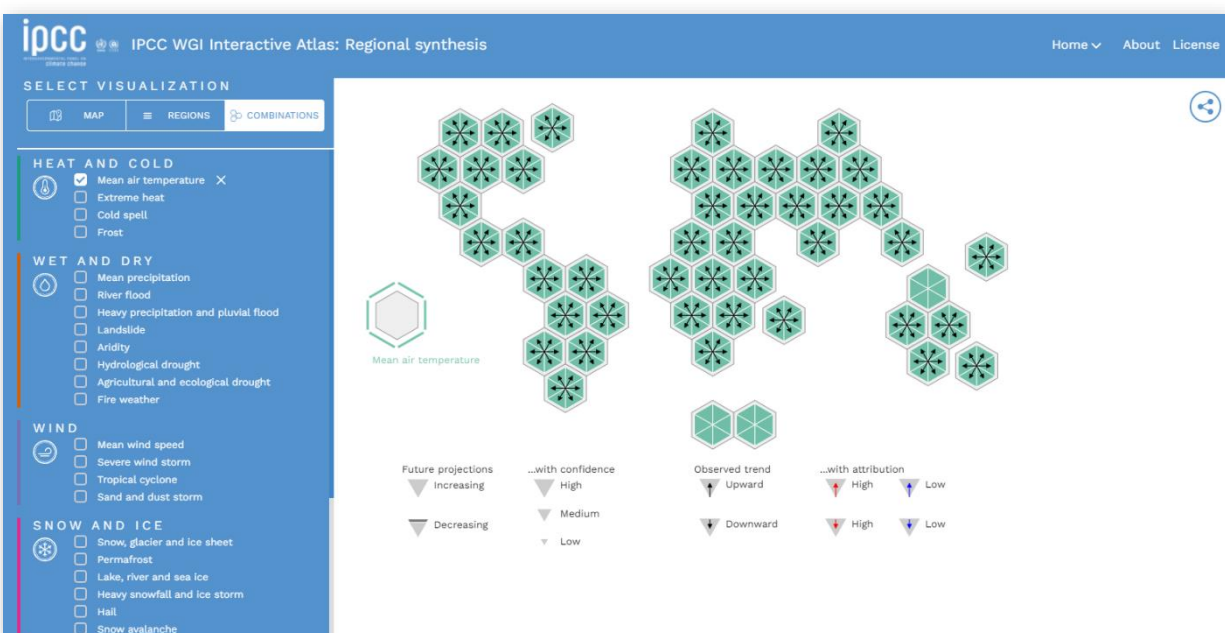
The IPCC report finds that regardless of efforts today and in the near future, some impacts to the climate cannot be reversed, such as sea level rise and ice sheet loss.²⁹ The report does find that if certain actions, such as a severe reduction in greenhouse gas emissions, are taken immediately, some changes from climate change can be slowed or even stopped.

Additional Resources – Learn More

Additional resources are included below to learn more about the findings of the IPCC Sixth Assessment Report and general climate change background information.

Interactive Atlas: The IPCC Working Group I also produced an interactive atlas with the most recent Assessment Report. The Interactive Atlas makes available to everyone regional climate change and projections for current and future change. **Figure 6** is a screen shot of the interactive Atlas.

Figure 6. IPCC Interactive Atlas



Access the Interactive Atlas by visiting: <https://interactive-atlas.ipcc.ch/>

The Interactive Atlas (**Figure 6**) allows individuals to use datasets to create their own analysis and maps to examine climate change. To view the possible climate futures, visit <https://interactive-atlas.ipcc.ch/>

For more introductory information on climate change, read the NCAI Policy Research Center's 2018 report on *Climate Change: Definitions, Impacts, Data*. This update reviews definitions of climate change, indicators of climate change, regional impacts, and data resources for Tribal Nations to measure and track as they take action for their communities. To read the report, visit: <http://bit.ly/PRCclimatedata>.

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Questions: NCAI Policy Research Center – email: research@ncai.org; website: <http://www.ncai.org/prc>

Endnotes

¹ “The Intergovernmental Panel on Climate Change.” Intergovernmental Panel on Climate Change, United Nations, <https://www.ipcc.ch/>.

² “About the IPCC.” Intergovernmental Panel on Climate Change, United Nations, <https://www.ipcc.ch/about/>.

³ “The Intergovernmental Panel on Climate Change.” Intergovernmental Panel on Climate Change, United Nations, <https://www.ipcc.ch/>.

⁴ “About the IPCC.” Intergovernmental Panel on Climate Change, United Nations, <https://www.ipcc.ch/about/>.

⁵ “Sixth Assessment Report.” Intergovernmental Panel on Climate Change, United Nations, <https://www.ipcc.ch/assessment-report/ar6/>.

⁶ “Ar6 Climate Change 2021:The Physical Science Basis Press Conference Slides.” Sixth Assessment Report, United Nations, IPCC, <https://www.ipcc.ch/report/ar6/wg1/>.

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⁸ “Ar6 Climate Change 2021:The Physical Science Basis Press Conference Slides.” Sixth Assessment Report, United Nations, IPCC, <https://www.ipcc.ch/report/ar6/wg1/>.

⁹ IPCC, 2021: Summary for Policymakers. In: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press.

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