

Keynote Address: Global Change Research: A Historical Perspective and Future Challenges

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Since the International Geophysical Year of 1957–58, systematic observations initiated by C. D. Keeling have shown a continuous increase in the atmospheric abundance of carbon dioxide. In the early 1960's, S. Manabe and his colleagues at NOAA Geophysical Fluid Dynamics Laboratory (GFDL) showed that future CO₂ emissions will lead to temperature increase in the troposphere and a temperature decrease in the stratosphere. They also show that the high-latitude surface warming will be magnified by the recession of the ice sheet. Since the 1960's, the community has made enormous progress to identify the forcing mechanisms of the climate system, to study the complex interactions inside the Earth system, and to project climate change, and to assess how the planet will respond to human activities.

International research has shown that climate change is accelerating and that humans are to a large extent responsible for these changes. These conclusions, based on systematic investigations, have led to the recognition that climate change will have substantial impacts for our society and that decisive actions are urgently needed. The Paris Agreement would not have been concluded without the input of the science.

Today, environmental security and human welfare require complementary actions as highlighted by the 2030 UN Agenda for Sustainable Development. To implement this agenda, decision-makers will increasingly need relevant and objective information to ensure for humankind a more resilient present and a sustainable future. A priority for the research community is therefore to develop the knowledge needed for the stewardship of our planet.

Fundamental research with a focus on Earth System science remains a necessity, and should be strongly encouraged. The paper will review some of the grand scientific challenges addressed by international programs and will highlight their efforts to provide actionable information of direct benefit to society.



Figure 1. The U.N.'s sustainable development goals.