

# **Climate Change Adaptation and Mitigation: Sustainability Challenges and Intelligent Technology-enabled Responses**

**Ministry of Ecology and Environment of China  
Ministry of Industry and Information Technology of China**

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# Report Content

01

**Current  
Status**

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02

**Response  
measures**

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03

**Intelligent  
Technologies**

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04

**Conclusions  
& Prospects**

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# 1 Current Status

## Utilization of fossil fuels

The combustion of fossil fuels such as coal and oil is a major source of greenhouse gas emissions.

## Greenhouse gas emissions

Greenhouse gases emitted from human activities, such as carbon dioxide and methane, are the main causes of climate change.

## Industrial Production

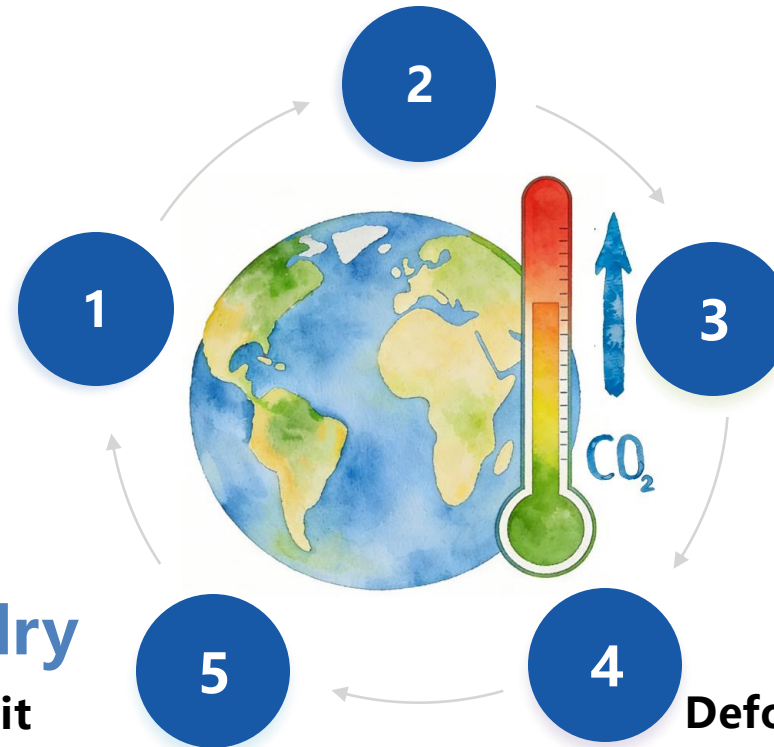
The industrial production process emits large quantities of greenhouse gases, such as carbon dioxide and nitrous oxide.

## Animal Husbandry

Animal husbandry activities emit large amounts of methane and nitrous oxide.

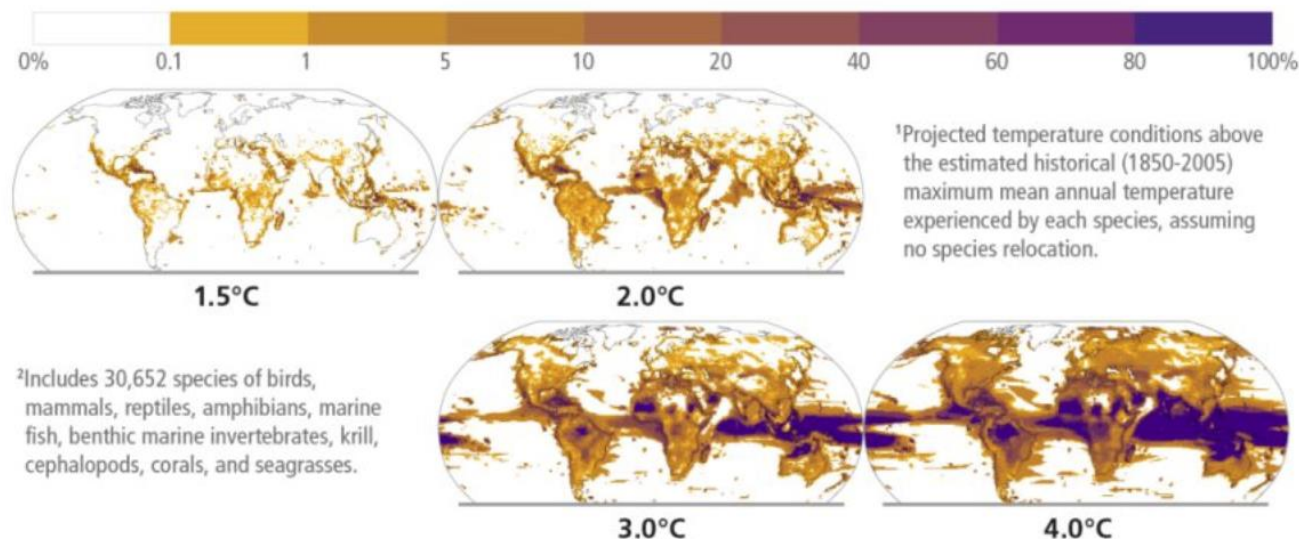
## Deforestation

Deforestation leads to a reduction in carbon sinks, exacerbating the concentration of carbon dioxide in the atmosphere.



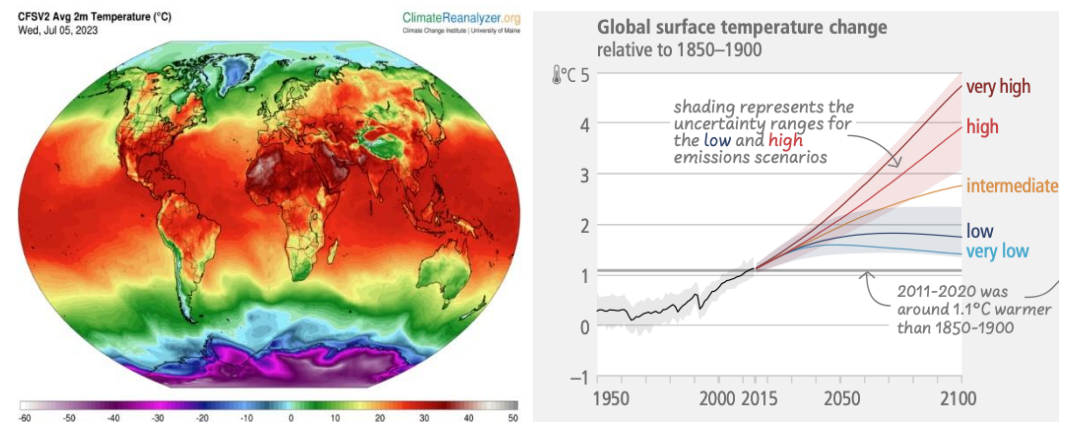
# 1 Current Status

Global climate change has significantly altered natural and social systems, led to a marked increase in the frequency of severe climate disaster events, and caused a substantial rise in the risks of major climate disasters, all of which pose a severe threat to the sustainable development of the economy and society.



<sup>2</sup>Includes 30,652 species of birds, mammals, reptiles, amphibians, marine fish, benthic marine invertebrates, krill, cephalopods, corals, and seagrasses.

(AR6 Synthesis Report: Climate Change 2023)



Over the past 50 years, the global average temperature has risen at a rate of 0.2 degrees Celsius per decade.

**Climate change mitigation and adaptation is pressing.**

# 1 Current Status

To ensure the efficient implementation of climate change response work, it is imperative to strengthen assessments of climate change impacts and risks, advance comprehensive assessments of climate change impacts as well as risk prediction and early warning systems, enhance the monitoring and analysis of the impacts of climate change on regions with limited resilience, and effectively address the adverse impacts and risks posed by climate change.



- flood disasters
- wildfires
- aridity
- oceans
- glacier retreat
- extreme weather
- desertification
- ...

**Climate change mitigation and adaptation initiatives cover diverse areas and have broad-ranging effects.**

# 2 Response measures



## Develop renewable energy sources.

Utilize solar, wind, hydro and other **renewable energy to reduce reliance on fossil fuels.**



## Energy conservation and emission reduction technologies

Develop and promote energy conservation and emission reduction technologies to **improve energy efficiency.**



## International collaboration

**Strengthen international cooperation to jointly address the challenges of climate change.**

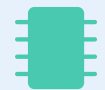
# 3 Intelligent Technologies

## Intelligent Prediction and Early Warning: Enhancing Disaster Response Capa



### AI-Driven High-Precision Meteorological Forecasting

Leveraging large models to achieve hourly forecasting at a 1-kilometer grid scale, **enabling accurate prediction of major atmospheric events.**



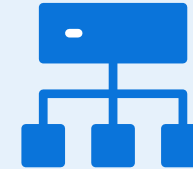
### Machine Learning-Enabled Extreme Weather Early Warning

Optimizing prediction models through deep learning to significantly improve the accuracy and lead time for forecasting extreme weather events, thereby securing critical time for disaster prevention and mitigation.



### Practical Early Warning for Haze

AI models issue red alerts for haze up to 72 hours in advance, assisting relevant authorities in timely activation of emergency responses and **markedly reducing disaster losses and impacts.**



### Schematic Diagram of AI Meteorological Prediction Model Architecture



**Multi-source data fusion** (satellite/radar/ground stations)



**Coupled computation of deep learning and physical models**



**Output from disaster early warning and decision support systems**

# 3 Intelligent Technologies

## Smart Resource Management: Enhancing Utilization Efficiency and Resilience



### Smart Energy

AI optimizes power grid dispatch to improve the grid integration efficiency of wind and solar power; **virtual power plants** aggregate distributed energy resources to enhance system flexibility.



### Smart Water

IoT sensors are used to monitor water quality and quantity in real time, and AI models are employed to accurately predict water demand and provide early warnings for pollution risks.



### Smart Agriculture

Precision agricultural technologies and **intelligent drip irrigation systems** are adopted to conserve water and fertilizers, protecting the ecological environment.

# 3 Intelligent Technologies

## Smart Cities and Communities: Building Climate-Resilient Infrastructure

### Smart Buildings and Energy

#### Conservation

IoT and AI technologies are utilized to monitor energy consumption in real time, automatically adjust air conditioning and lighting, and reduce the city's carbon footprint. In response to extreme weather warnings, emergency response measures for activated automatically.

### Smart Transportation and Travel

AI optimizes urban traffic signal control to alleviate congestion, reduce carbon emissions, and enhance traffic efficiency. Based on weather and passenger flow predictions to ensure travel safety under extreme weather conditions.



# 3 Intelligent Technologies

## Smart Carbon Footprint Management: A Necessary Path to Carbon Neutra

### IoT+AI Real-time Monitoring and



### Collection

IoT sensors and AI algorithms are employed to conduct round-the-clock real-time monitoring of enterprise carbon emission sources, **enabling the precise collection of energy consumption and emission data.**

### Blockchain Ensures Data Credibility



**Based on distributed ledger technology**, the entire life cycle of carbon data is secured against tampering, **providing a traceable and trusted foundation for carbon trading, auditing, and compliance.**

### AI Intelligent Accounting and Compliance



**AI models automatically generate carbon accounting reports**, support product carbon footprint analysis, and assist enterprises in complying with declarations for carbon tariffs such as the EU CBAM.

# 4 Conclusions & Prospects

## Intelligent Technologies Leading a Sustainable Future

### Core Tools: A Key Driving Force

**Intelligent technologies** serve as critical tools and core drivers for us to **address climate change challenges and achieve sustainable development goals**.

### Technology Integration: Comprehensive Upgrading

The **in-depth integration of technologies** such as AI, IoT, big data, smart grids, and smart cities.

### The Inevitable Path: Innovation and Guidance

**Combining sustained technological innovation with effective policy guidance** .





**Thank you !**