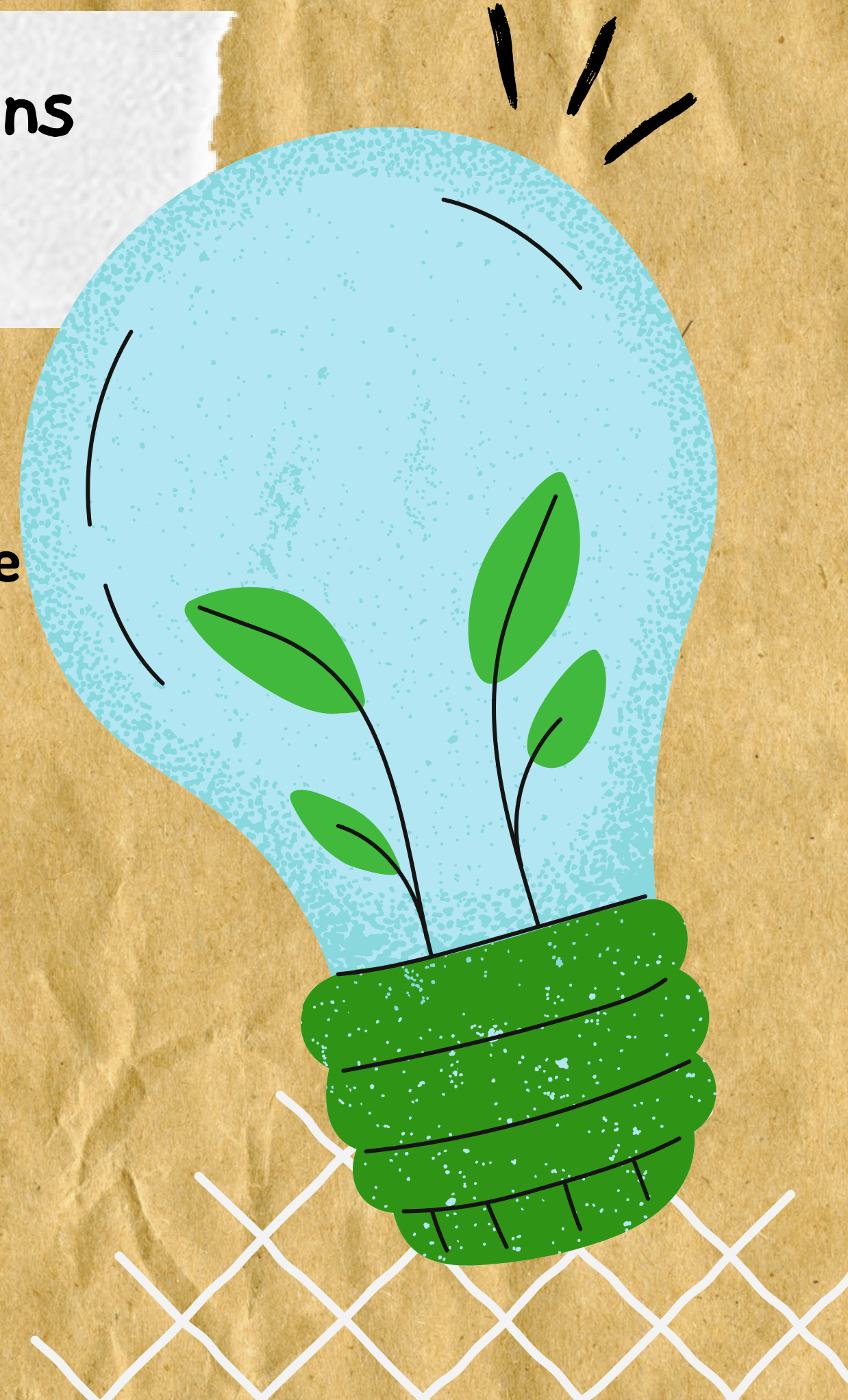


Scenario Analysis & Future Climate Projections


Introduction

Scenario analysis in the context of climate change involves the systematic exploration and examination of various logical future pathways. The world might take regarding greenhouse gas emissions, socioeconomic developments, and their impacts on the climate system are analyzing for this purpose.

It involves creating different hypothetical scenarios or storylines that depict different potential futures based on specific assumptions about how society, economies, technologies, and policies might evolve.



key aspects of analyzing



Understanding Future Possibilities:

Emission scenarios outline potential future outcomes based on different economic, technological, social, and policy assumptions. They help explore how different choices and pathways may affect greenhouse gas emissions.

Policy Planning and Decision-Making:


Examining different emission scenarios can help policymakers and stakeholders evaluate the effects of various policy choices on future emissions, which can inform the creation of effective climate change mitigation and adaptation policies and strategies.

Assessing Climate Impacts:

Emission scenarios serve as inputs for climate models to predict future climate conditions and assess the impacts of various emission trajectories on temperature changes, sea level rise, extreme weather events, and ecosystems.

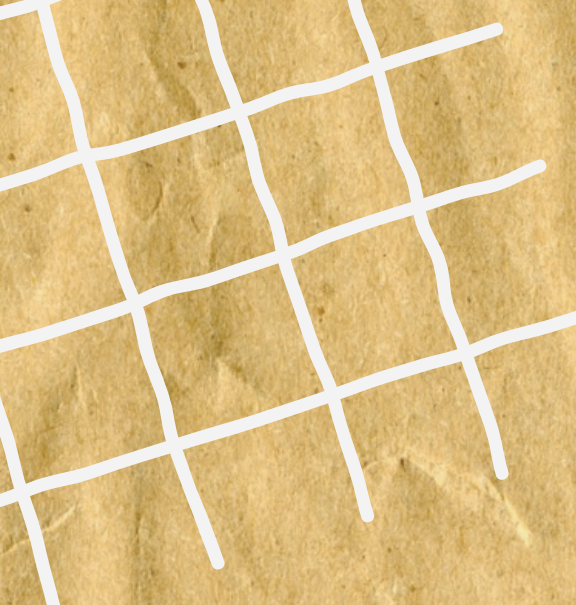
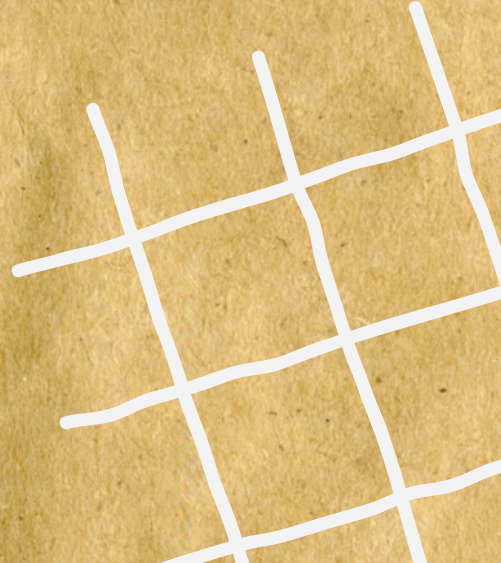
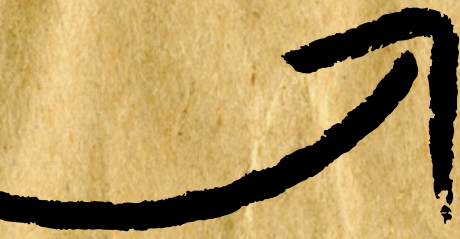
Risk Assessment and Management

Studying emission scenarios can evaluate risks related to different levels of greenhouse gas emissions, assist in creating adaptation strategies, and support plans to manage potential impacts of climate change.





The Shared Socioeconomic Pathways (SSPs)

- The Shared Socioeconomic Pathways (SSPs) are a set of scenarios used by the climate science community to explore different plausible future trajectories of socioeconomic development and their associated greenhouse gas emissions.
 - These pathways were developed to provide a framework for integrated assessment models and climate models to analyze and project future changes in the Earth system, particularly related to climate change impacts and mitigation strategies.
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The IPCC Sixth Assessment Report analyzes five scenarios based on the SSPs framework to project temperature outcomes. The scenarios are named SSPx-y.z, where x is the SSP and y.z is the expected level of radiative forcing in 2100.

SSP	Scenario	Estimated warming(2041–2060)	Estimated warming(2081–2100)	Very likely range in °C(2081–2100) /
SSP1-1.9	very low GHG emissions:CO2 emissions cut to net zero around 2050	1.6 °C	1.4 °C	1.0 – 1.8
SSP1-2.6	low GHG emissions:CO2 emissions cut to net zero around 2075	1.7 °C	1.8 °C	1.3 – 2.4
SSP2-4.5	intermediate GHG emissions:CO2 emissions around current levels until 2050, then falling but not reaching net zero by 2100	2.0 °C	2.7 °C	2.1 – 3.5
SSP3-7.0	high GHG emissions:CO2 emissions double by 2100	2.1 °C	3.6 °C	2.8 – 4.6
SSP5-8.5	very high GHG emissions:CO2 emissions triple by 2075	2.4 °C	4.4 °C	3.3 – 5.7

The IPCC Sixth report did not estimate the likelihoods of the scenarios but a 2020 commentary described SSP5–8.5 as highly unlikely, SSP3–7.0 as unlikely, and SSP2–4.5 as likely.

Implications of Different Scenarios

Sea Level Changes:

- **SSP3 (Regional Rivalry) and SSP4 (Inequality):**

Limited global cooperation and environmental focus may result in increased sea level rise due to unchecked emissions and lack of adaptation measures.

- **SSP1 (Sustainability):**

Efforts toward sustainability might mitigate some sea level rise impacts through climate adaptation and mitigation strategies.

Global temperature rise

- **SSP1 (Sustainability):**

If successful, it could lead to relatively low temperature increases compared to other scenarios due to significant mitigation efforts.

- **SSP5 (Fossil-Fueled Development):**

Likely to result in the highest temperature rise due to continued heavy reliance on fossil fuels and high emissions.

Future Climate Projections ✖

Climate models are complex mathematical representations of the Earth's climate system, used to simulate and project future climate conditions based on various inputs, including atmospheric conditions, ocean currents, land surface processes, and human influences such as greenhouse gas emissions.

Climate models consider greenhouse gas emissions, solar radiation, land use changes, clouds and aerosols, and ocean circulation and ice dynamics when projecting future climate patterns. These factors influence temperature, precipitation, and sea level rise.





Basis of Climate Models:

- Physical Principles:

Climate models are based on fundamental physical laws governing the behavior of the atmosphere, oceans, land surface, and ice.

These models use equations derived from principles of physics, fluid dynamics, thermodynamics, and radiative transfer to simulate the interactions between different components of the Earth system.

- Numerical Methods:

Climate models discretize these physical equations into a grid system covering the Earth's surface, atmosphere, and oceans.

They solve these equations over time intervals using numerical methods to simulate the complex interactions and feedbacks among various components, accounting for spatial and temporal variations.



Basis of Climate Models:



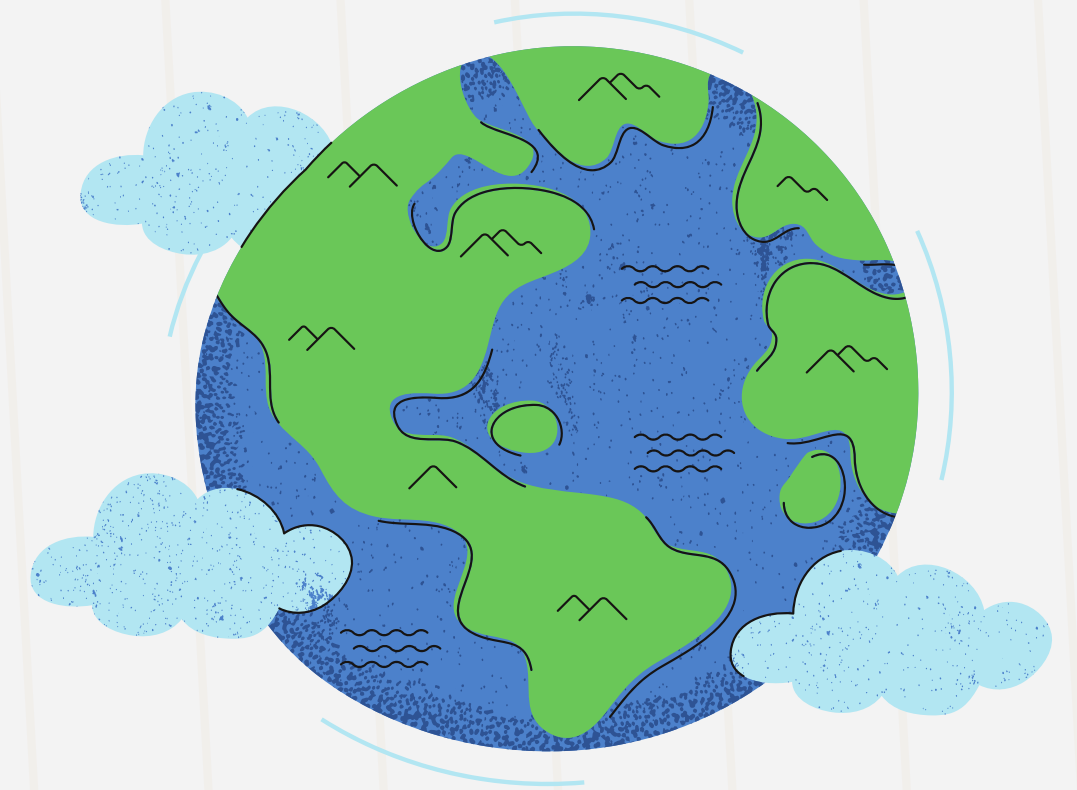
- Representation of Processes:

Models include representations of various processes such as cloud formation, precipitation, evaporation, ice melting, carbon cycle dynamics, and interactions between the atmosphere and oceans, among others.

These processes are parameterized to simulate their effects on the climate system within the computational constraints.

Climate models Role in Predicting Future Climate:

Climate models serve as invaluable tools for projecting future climate conditions by considering different scenarios of greenhouse gas emissions, land-use changes, aerosol concentrations, and other factors influencing the Earth's energy balance.



Model Uncertainty

Certainly, addressing model uncertainty in climate projections is crucial for understanding the limitations, communicating effectively, and making informed decisions regarding climate-related policies and strategies.

Sources of Uncertainty:

Data Limitations: Incomplete or limited historical data, especially from remote regions or historical periods, can introduce uncertainties in climate models.

Complexities in Processes: Incomplete understanding or inaccuracies in modeling physical processes lead to uncertainties in projections.

Emission Scenarios: Different assumptions about future socioeconomic conditions and policy decisions result in multiple emission scenarios, leading to uncertainty in predicting future emissions and their impacts on the climate.