

Group meeting

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Outline

- **Paper Draft** <https://www.overleaf.com/1225397724nhhpgfjszczg#a93b66>
 - Introduction
 - Background
 - Method
 - Experiment level1 (Simple Q&A)
 - Experiment level2
 - Experiment level3 (General Q&A)
 - Discussion
 - Conclusion
- **Demo app**

Level1 (Simple Q&A)

- Type 1: "What is the World Surface Air Temperature Change under ssp585 in 23 years?"

```
from IPython.display import Markdown, display  
  
display(Markdown(second_response.choices[0].message.  
content))
```

✓ 0.0s

Python

Under the SSP5-8.5 scenario, the World Surface Air Temperature Change in the year 2046 (which is 23 years from now) is as follows:

- The median value of the temperature change is approximately 2.204 K.
- The temperature change at the 2.5th percentile is approximately 1.953 K.
- The temperature change at the 97.5th percentile is approximately 2.434 K.

These values provide a range of projected surface air temperature changes due to varying levels of uncertainty and model outputs.

Level1 (Simple Q&A)

- Type 2: "When the world surface air temperature will change +2 degree?"

```
from IPython.display import Markdown, display  
  
display(Markdown(second_response.choices[0].message.content))
```

✓ 0.0s

Python

Under the SSP2-4.5 scenario, it is projected that the world surface air temperature could reach a +2°C change around the year 2056. This scenario represents a moderate "middle-of-the-road" future pathway where societal, economic, and technological trends do not shift markedly from historical patterns.

Level1 (Simple Q&A)

- Type 3: "What is the World Sea level Change in 50 years?"

```
from IPython.display import Markdown, display
```

```
display(Markdown(second_response.choices[0].message.content))
```

✓ 0.0s

The projected global sea level changes by the year 2073, in millimeters (mm), are as follows for various scenarios and models:

1. No Restriction Scenario (Median 50%)

- Median: 414.36 mm
- 97.5th percentile: 456.07 mm
- 2.5th percentile: 372.64 mm
- 99.5th percentile: 469.18 mm
- 5th percentile: 359.54 mm

2. COP26 Commitment Scenario

- Median: 359.49 mm
- 97.5th percentile: 399.03 mm
- 2.5th percentile: 319.95 mm
- 99.5th percentile: 411.46 mm
- 5th percentile: 307.52 mm

3. Shared Socioeconomic Pathways (SSP) Scenarios

- SSP1-1.9: 327.62 mm
- SSP1-2.6: 365.46 mm
- SSP2-4.5: 437.67 mm
- SSP3-7.0: 508.54 mm
- SSP4-6.0: 469.47 mm
- SSP5-8.5: 549.09 mm

These values provide a range of projected sea level changes under different assumptions about future greenhouse gas emissions and socio-economic developments.

Level1 (Simple Q&A)

- Type 4: "When the world mean sea level will increase 500mm?"

```
from IPython.display import Markdown, display

display(Markdown(second_response.choices[0].message.content))
```

✓ 0.0s Python

Based on the calculations provided for various scenarios, the year by which the world mean sea level will increase by 500mm varies depending on the climate change scenario:

1. **No Restriction Scenario:** The sea level will increase by 500mm around the year **2083**.
2. **COP26:** The sea level will increase by 500mm around the year **2093**.
3. **SSP1-1.9** (Stringent Emissions Mitigation): The sea level is projected to be around 478 mm by **2100**, and might not reach the 500mm point within this century.
4. **SSP1-2.6:** The sea level will increase by 500mm around the year **2093**.
5. **SSP2-4.5** (Intermediate Scenario): The sea level is projected to increase by 500mm around the year **2085**.
6. **SSP3-7.0:** The sea level is projected to increase by 500mm around the year **2076**.
7. **SSP4-6.0:** The sea level is projected to increase by 500mm around the year **2080**.
8. **SSP5-8.5:** The sea level is projected to increase by 500mm around the year **2074**.

These projections are based on different assumptions about future greenhouse gas emissions and socio-economic development pathways. The "No Restriction" case usually represents scenarios with unchecked emissions, whereas the SSP (Shared Socioeconomic Pathways) scenarios cover a range of possible futures based on varying levels of climate action and mitigation efforts.

Level 3(General Q&A)

7 questions:

- 1. What is the best estimate of the equilibrium climate sensitivity?
- 2. Is it possible the Arctic will become ice free at some points before 2050?
- 3. How likely will the world see runaway ice loss from the Antarctic ice sheets by 2100?
- 4. To what extent has climate change impacted ice sheets in both polar regions?
- 5. Will coastal New York see the impact of Greenland ice sheet melting by 2100?
- 6. What will be the likely changes to weather and climate extremes in coastal New York around 2050 if the world take no action to reduce greenhouse gas emissions?
- 7. What are the primary evidence and how robust is it that human activities caused the observed global warming since the pre-industrial period?

Level 3(General Q&A)

Result:

Questions	tool_calls	IAMs
Q1	No	
Q2	No	
Q3	No	
Q4	No	
Q5	No	
Q6	Yes	{"variable":"Surface Air Temperature Change","year":"2050","scenario":"ssp585"}
Q7	No	

Level 3(General Q&A)

- Q6:What will be the likely changes to weather and climate extremes in coastal New York around 2050 if the world take no action to reduce greenhouse gas emissions?
- IAMs :

	model	quantile	variable	unit	scenario	2050
99	REMIND-MAGPIE	0.005	Surface Air Temperature Change	K	ssp585	2.09478
199	REMIND-MAGPIE	0.025	Surface Air Temperature Change	K	ssp585	2.11271
299	REMIND-MAGPIE	0.5	Surface Air Temperature Change	K	ssp585	2.38907
399	REMIND-MAGPIE	0.975	Surface Air Temperature Change	K	ssp585	2.64485
499	REMIND-MAGPIE	0.995	Surface Air Temperature Change	K	ssp585	2.66145

Level 3(General Q&A)

- Q6 answers:

```
Initialize Reactive Jupyter | Sync all Stale code
display(Markdown(get_chatians(Q6)))
✓ 10.4s Python
```

```
[{'role': 'user', 'content': 'What will be the likely changes to weather and climate extremes in coastal New York around 2050 under these conditions:
[{'role': 'user', 'content': 'What will be the likely changes to weather and climate extremes in coastal New York around 2050 under these conditions:
```

If no action is taken to reduce greenhouse gas emissions, the climate model projections under the high-emission scenario SSP5-8.5 suggest significant increases in surface air temperatures for coastal New York by around 2050. The median estimate indicates an increase of approximately 2.39°C above the baseline temperature levels.

Here are some likely changes to weather and climate extremes in coastal New York around 2050 under these conditions:

1. Increased Temperature Extremes:

- More frequent and intense heatwaves, with higher maximum temperatures.
- Warmer night-time temperatures, reducing the occurrence of cool nights.

2. Sea-Level Rise:

- Rising sea levels will contribute to more frequent and severe coastal flooding, especially during high tides and storm surges.
- Increased risk of coastal erosion and loss of land due to higher sea levels coupled with storm events.

3. More Intense Storms:

- Potential for more intense tropical cyclones (hurricanes) with higher wind speeds and more heavy rainfall, although the frequency of these storms can vary.
- Greater likelihood of damaging storm surges due to a combination of sea-level rise and intense storm activity.

4. Increased Precipitation Extremes:

- More frequent and severe heavy rainfall events, leading to a higher risk of flash flooding and urban flooding.
- Possible changes in seasonal precipitation patterns, potentially causing prolonged periods of both drought and intense rainfall.

5. Changes in Ocean Conditions:

- Ocean warming and acidification can impact coastal ecosystems, fisheries, and biodiversity.
- More frequent and widespread harmful algal blooms, affecting water quality and marine life.

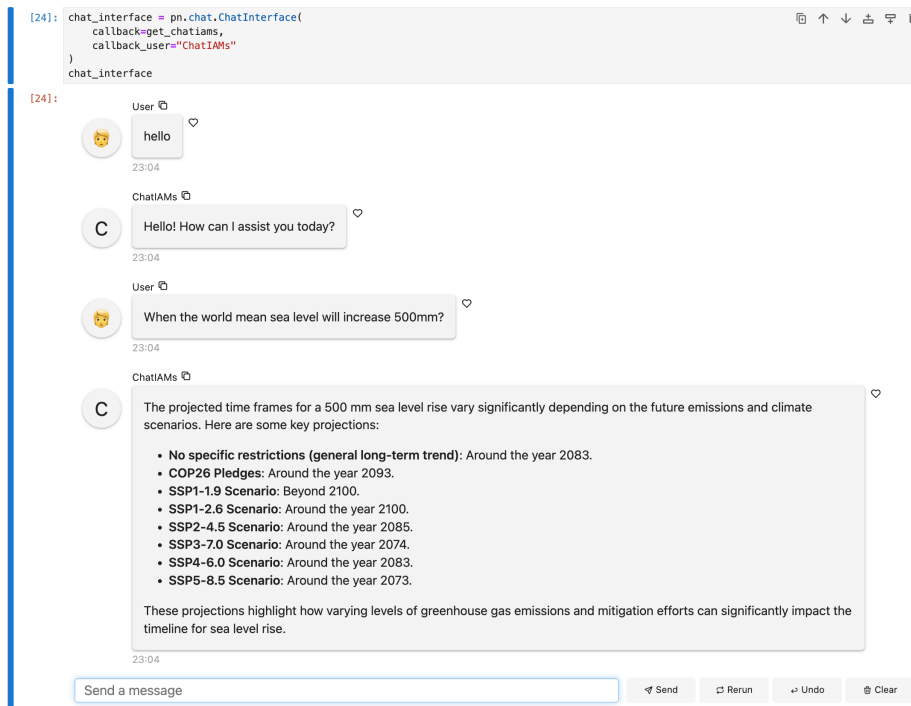
Adapting to these changes will require significant efforts in updating infrastructure, improving emergency response systems, and planning for resilient coastal development.

Possible powerful climate models

- GraphCast: <https://deepmind.google/discover/blog/graphcast-ai-model-for-faster-and-more-accurate-global-weather-forecasting/>
- Aurora: <https://www.microsoft.com/en-us/research/blog/introducing-aurora-the-first-large-scale-foundation-model-of-the-atmosphere/>
- ClimaX: <https://arxiv.org/abs/2301.10343>

Demo app

- Jupyter notebook
- https://github.com/yl1127/Academic-projects/blob/main/yl_Climate_LLM/yl_ChatIAMS_0612.ipynb



The screenshot displays a Jupyter notebook cell and a chat interface. The notebook cell, labeled [24]:, contains the following Python code:

```
chat_interface = pn.chat.ChatInterface(
    callback=get_chatians,
    callback_user="ChatIAMS"
)
chat_interface
```

Below the code cell is a chat interface with a message history. The history shows a conversation between a User and ChatIAMS. The User's messages are in light gray bubbles, and ChatIAMS's responses are in white bubbles with a 'C' icon. The chat interface includes a 'Send a message' input field at the bottom and buttons for 'Send', 'Rerun', 'Undo', and 'Clear'.

Message history:

- User: hello
- ChatIAMS: Hello! How can I assist you today?
- User: When the world mean sea level will increase 500mm?
- ChatIAMS: The projected time frames for a 500 mm sea level rise vary significantly depending on the future emissions and climate scenarios. Here are some key projections:
 - No specific restrictions (general long-term trend): Around the year 2083.
 - COP26 Pledges: Around the year 2093.
 - SSP1-1.9 Scenario: Beyond 2100.
 - SSP1-2.6 Scenario: Around the year 2100.
 - SSP2-4.5 Scenario: Around the year 2085.
 - SSP3-7.0 Scenario: Around the year 2074.
 - SSP4-6.0 Scenario: Around the year 2083.
 - SSP5-8.5 Scenario: Around the year 2073.These projections highlight how varying levels of greenhouse gas emissions and mitigation efforts can significantly impact the timeline for sea level rise.

Plan: Next week

- Paper draft
- Code
- Demo app (Docker)

Discussion