Sea level rise: model variability and community impact

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Sea Level is Projected to Increase with Climate Change

- Initial question: sea level rise and geographical / social consequences

- Other guiding questions:
  - How does the coastline shift with respect to time?
  - How does the variability of sea level rise develop with time?
  - How does the mean sea level evolve over time?
  - How much area is lost?
  - How many people have to move with respect to time?

Roadmap

- Methodology
- Preliminary results
- Problems faced
- Open questions

Methodologies - Computational tools

- CMIP6 Models
  - Zos variable (long name = Sea Surface Height Above Geoid [m])
- Intake-ESM for accessing data

```
[5]: col = intake.open_esm_datastore(
         "https://storage.googleapis.com/cmip6/pangeo-cmip6.json"
     )  # open an intake catalog containing the Pangeo CMIP cloud data
```

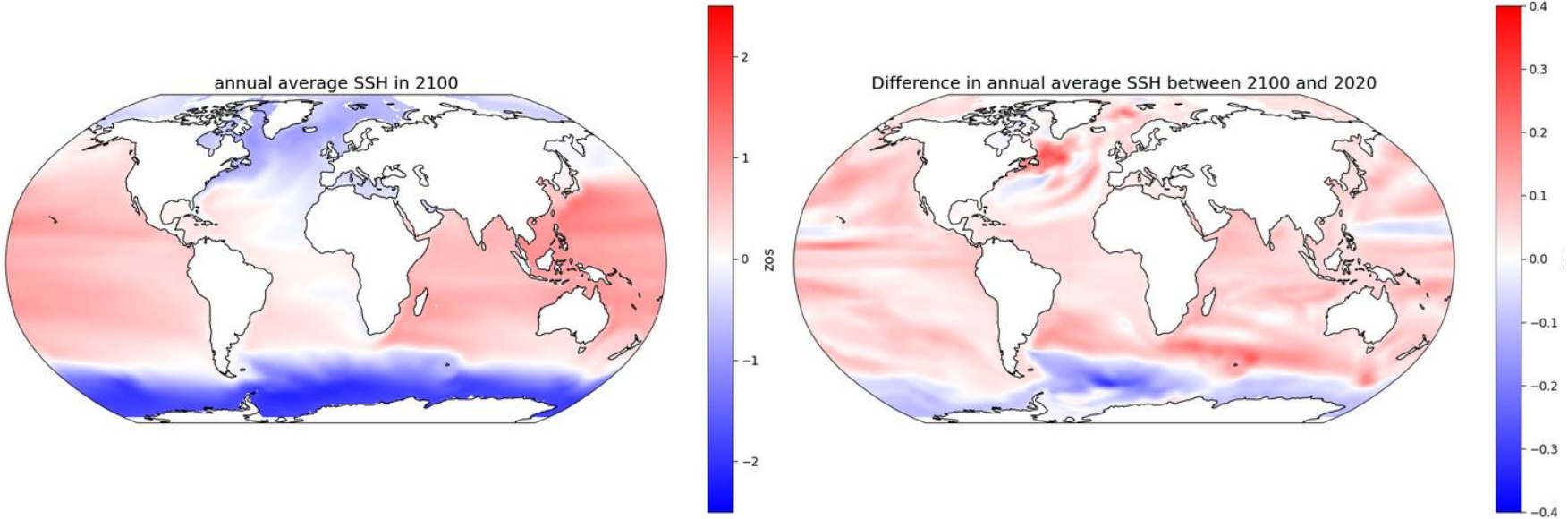
```
[6]: col
```

pangeo-cmip6 catalog with 7674 dataset(s) from 514818 asset(s):

	unique
activity_id	18
institution_id	36
source_id	88
experiment_id	170
member_id	657
table_id	37
variable_id	700
grid_label	10
zstore	514818
dcpp_init_year	60
version	736
derived_variable_id	0

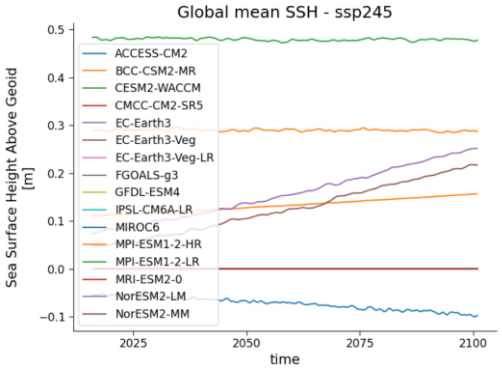
```
#create a subset using facet search
cat = col.search(
    source_id= ["ACCESS-CM2", "MPI-ESM1-2-LR",
                "NorESM2-LM","NorESM2-MM",
                "MRI-ESM2-0","BCC-CSM2-MR"],
    variable_id="zos",
    member_id="r1i1p1f1",
    table_id="Omon",
    grid_label="gn",
    experiment_id=["historical", "ssp126",
                   "ssp585","ssp245"],
    require_all_on=[
        "source_id"
    ],
)
```

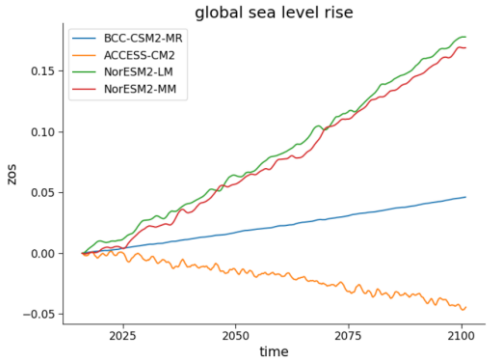
Preliminary results:
Global analysis - present/future



Projection using the BCC-CSM2-MR Model and the ssp245 scenario

Global analysis: model comparison

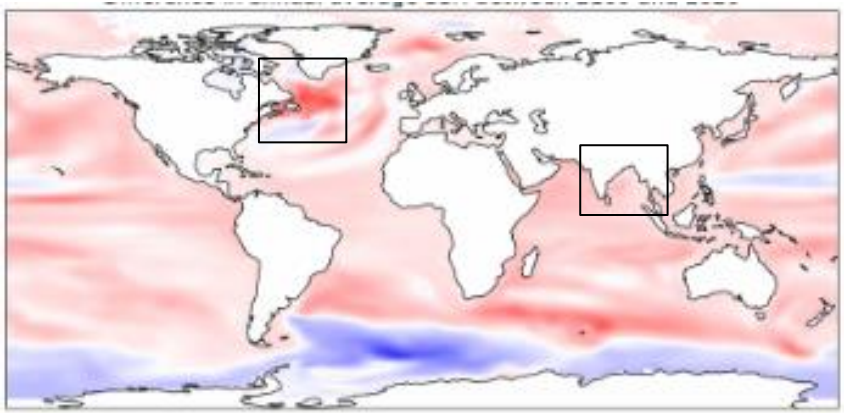


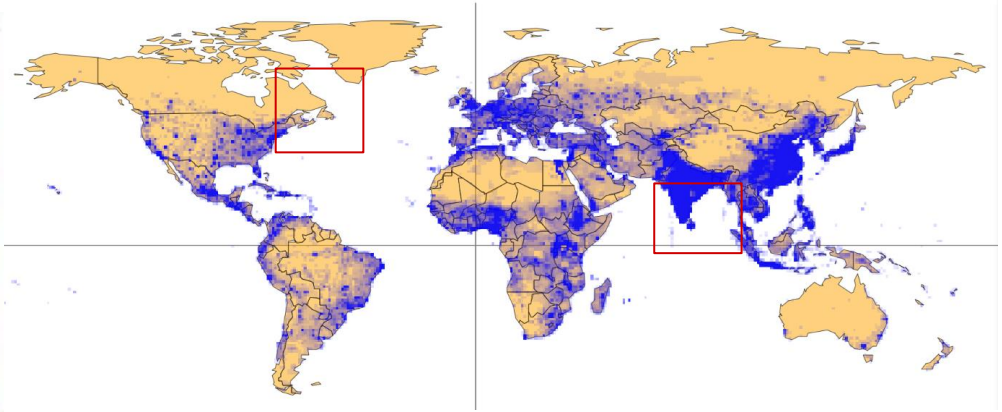


- Intermodel comparison

  Shared social pathway **ssp245**

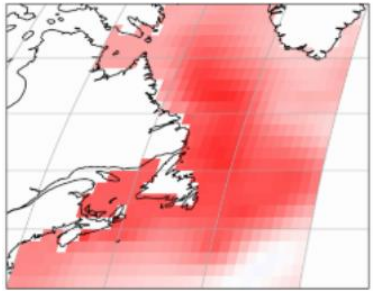
Local analysis: population vs sea level rise

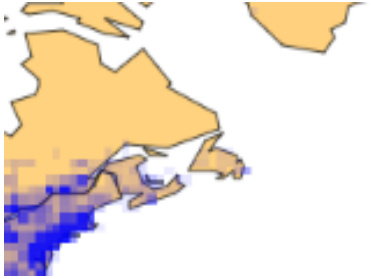


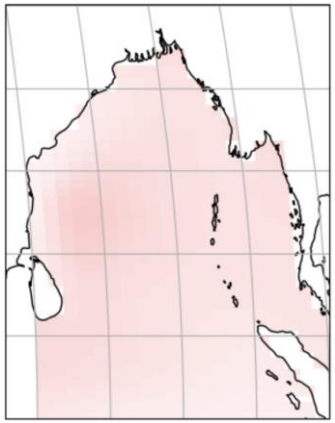


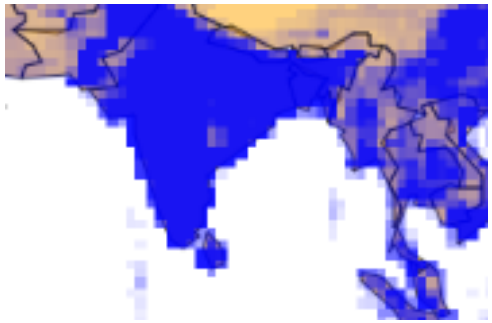
Source for the population map

Local analysis: population vs sea level rise









Canadian coastline

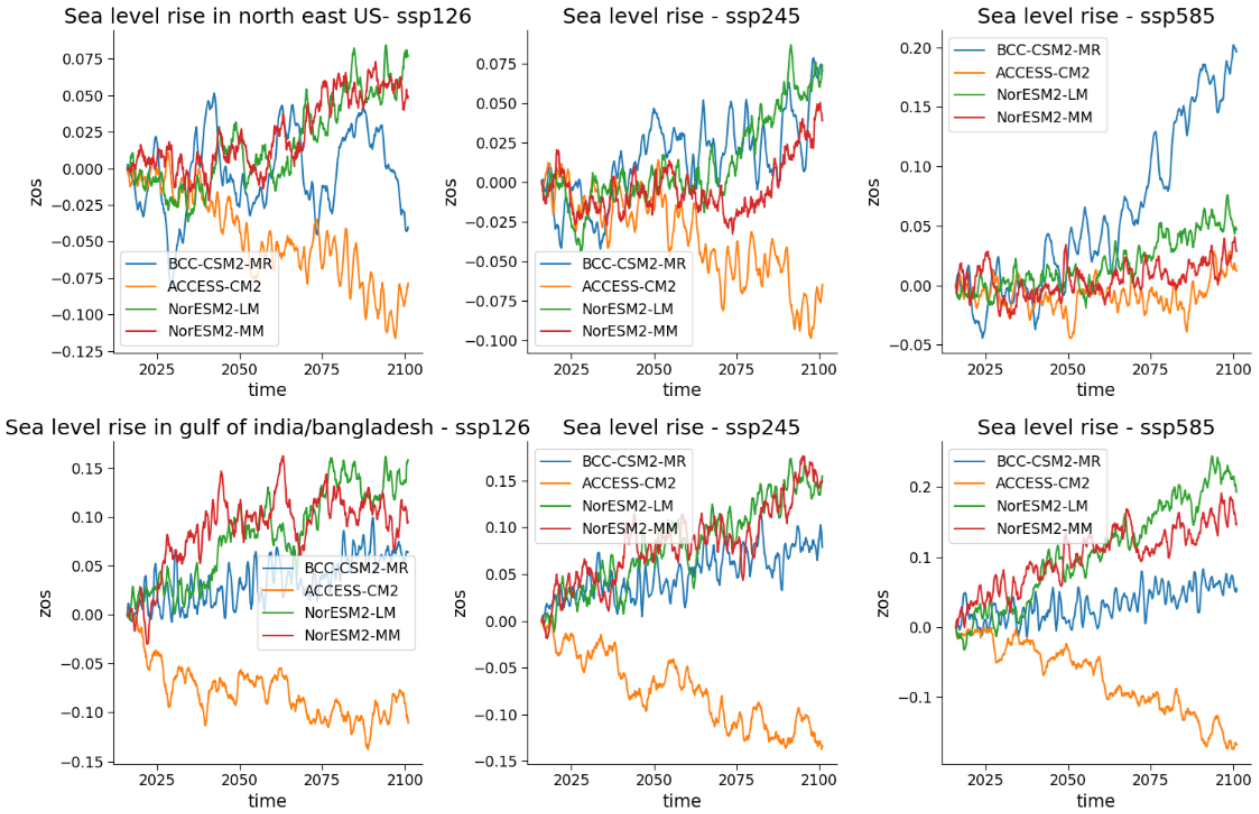
Very high predicted sea level rise
VS low population density

Bay of Bengal coastline

High predicted sea level rise
VS high population density

Source for the population map

Problems faced: different models ⇨ different results



Open questions / Summary

- Where we struggled
  - Different results based on different models
  - Finding data for future population density
- Future developments
  - Analysis on different models results
  - Socioeconomic consequences
  - Local effects on coastlines
- What could we have done differently: *any suggestions?*