

INHA UNIVERSITY
Coastal Ocean Engineering Laboratory

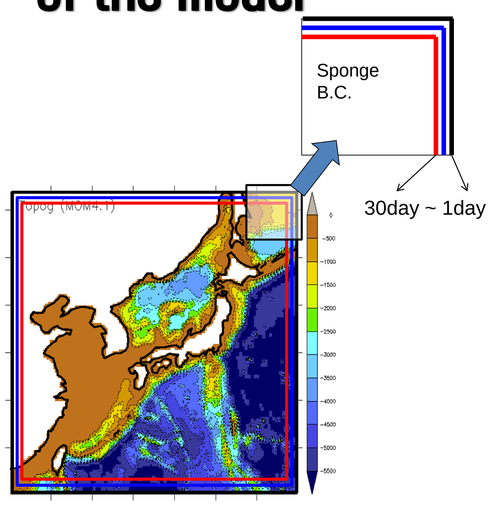
Research on Sea Level Rise and Change Transport due to Global Warming in the Northwestern Pacific Using a Non-Boussinesq Model

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Introduction

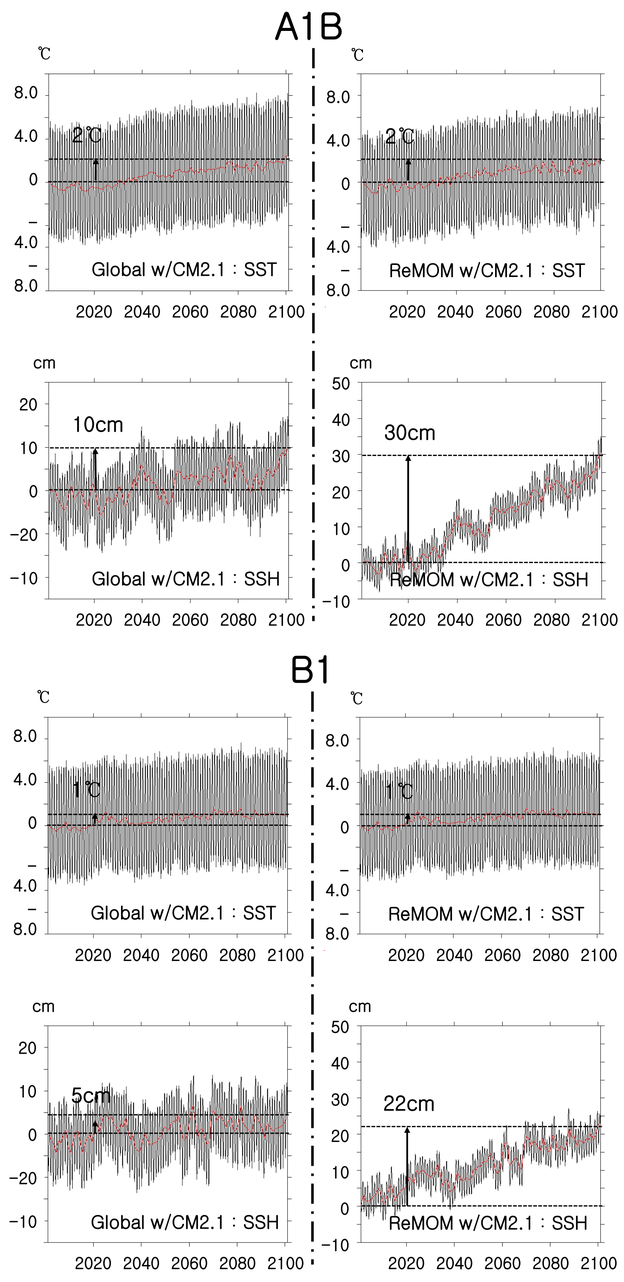
- **To study the sea water change due to global warming**
- **Use MOM4 of ocean circulation model, which does not consider the Boussinesq approximation**
- **Expressed in detail increasing the resolution**

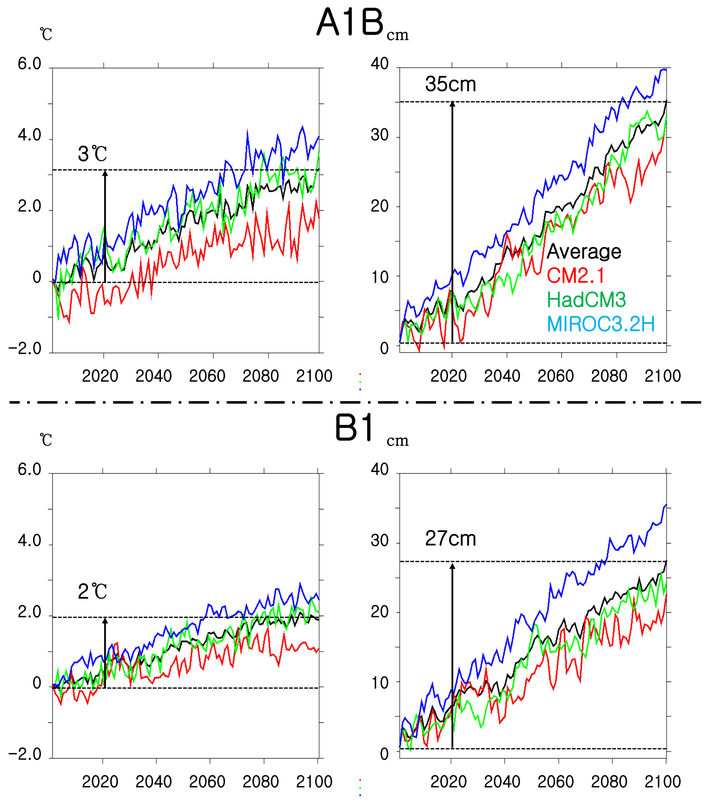
Configuration of the model



- **Study area**
  115°E~115°E, 20°N~52°N
  The Northwestern Pacific ocean region, which includes Korea
- **Resoultion**
  horizontal 0.2°, 34 layers
- **Boundary**
  Side : T,S(sponge boundary 1~30days)
  Surface : Wind stress, SST,SSS
  (damping time 1day)
- **initial condition**
  Using data made the initial field. The data which Provide by the IPCC (Intergovernmental Panel on Climate Change)
- **Developed a model names ReMOM**
- **Simulation process**
  Using ReMOM Simulated after 100 years. Result of CM2.1, Hadcm3 and MIROC3.2H was used.

Results 1 (Sea Level Rise)

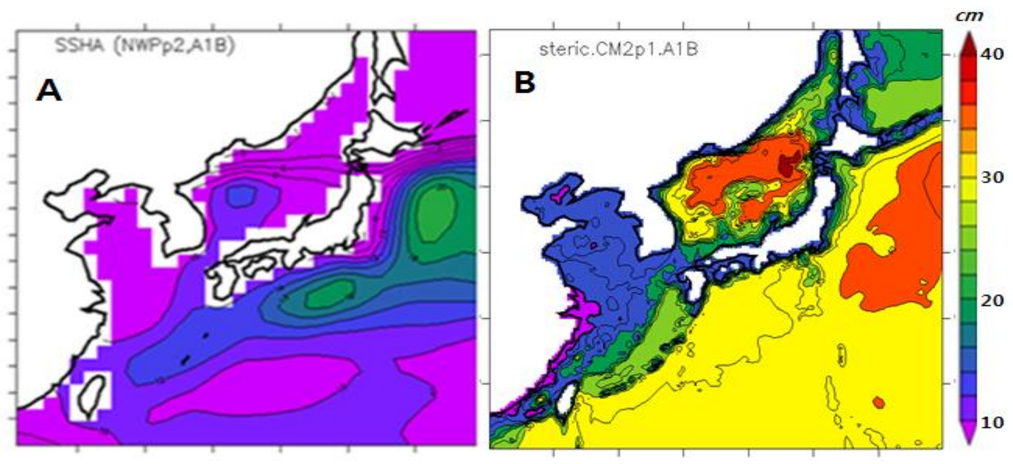




- Comparison of the boundary value (CM2.1) and sea level rise in ReMOM
- Case A1B, the temperature rose only 2℃, Conversely, differences were observed in sea level rise, with increases of 10cm for CM2.1 and 30cm for ReMOM
- Case B1, temperature rose only 1℃, Sea level rise increases 5cm/22cm for CM2.1/ReMOM

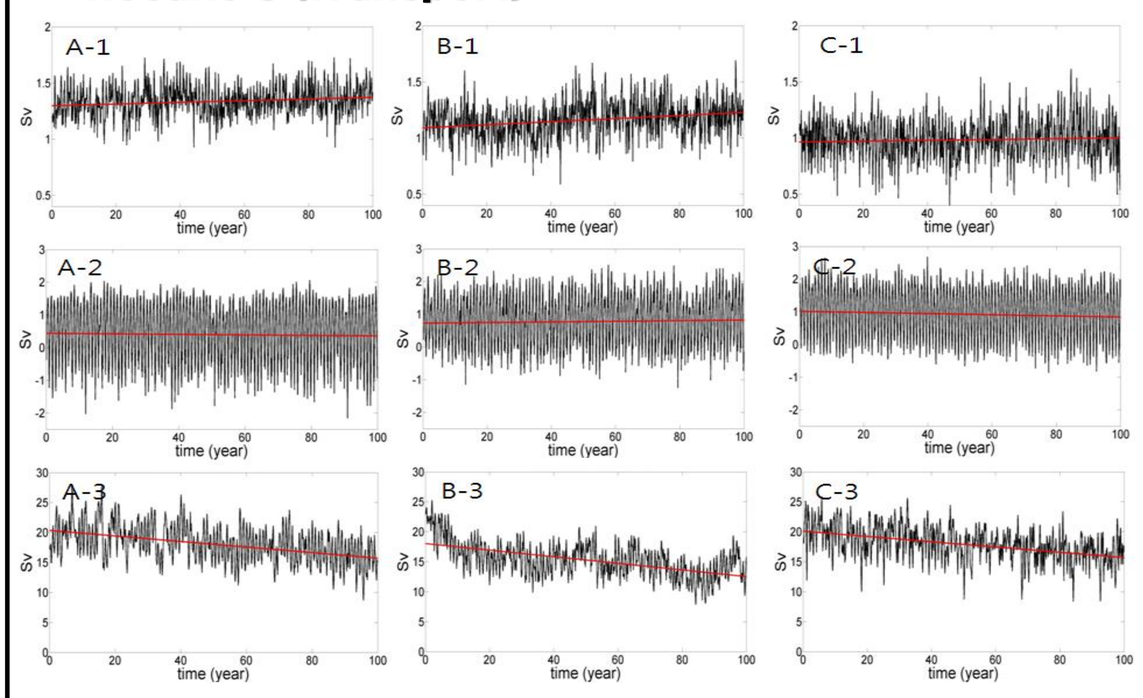
- Time series data for the models and their (CM2.1, HadCM3, MIROC3.2H) average
- Sea levels in A1B/B1 rose by 30/22cm for CM2.1, 33/25cm for HADCM3 and 40/33cm for MIROC3.2H
- Average of three models, case A1B/B1 temperature rose 3℃/2℃, sea level rise increases 35cm/27cm
- Some differnce of rising values, but trend of changes in the three models are similar

Results2 (Steric)



- The steric effect, which is defined as volume change due to heat expansion, is limited in the shallow Yellow Sea but has a huge effect in the deep East Sea.
- Image B shows that most parts of the East Sea and the northwestern Pacific, which are deep, are significantly influenced by the steric effect. Steric hindrance represents density changes due to changes in volume, and the magnitude of these density changes depends on water temperature and salinity. Sufficient water depth is required to cause changes in steric hindrance. Because the East Sea and the Pacific Ocean are sufficiently deep, steric hindrance has a huge impact.

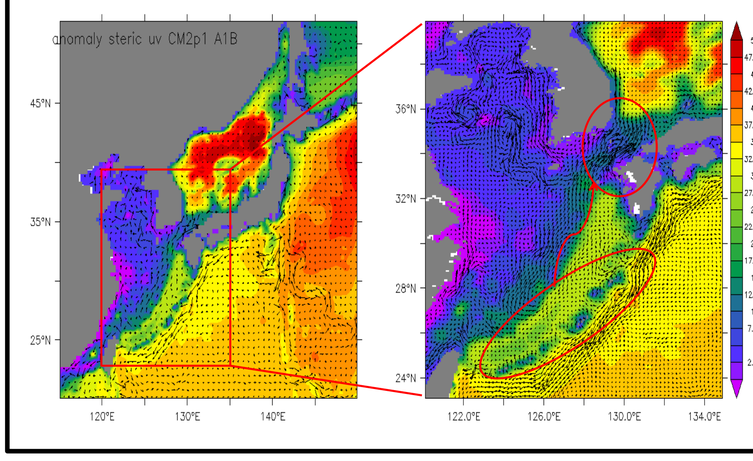
Results 3 (Transport)



- A represents CM2.1; B, HADCM3; and C, MIROC3.2H
  The number 1 represents the transport of the Tsushima Warm Current that passes through the Korea Strait; 2, the Taiwan Warm Current; and 3, the Kuroshio Current transports
- The Kuroshio current transport volume, 4~5Sv reduce all models
- The Tsushima current transport volume, 0.1~0.4Sv increased all models
- The Taiwan current did not display clear tendency

CM2.1	CM2.1	HadCM3	MIROC3.2
Tsushima	Increase	Increase	Increase
Kuroshio	Decrease	Decrease	Decrease
Taiwan	Decrease	Increase	Decrease

- Changes in transport volume of Taiwan and Tsushima, value much smaller than the change in the amount of Kuroshio transport. Changes in defect.



- Transport volume of Kuroshio whereas the decrease, why the change in cannabis turbulent transport amount is increased raw deficiencies are analyzed because the passing traffic volume of continental shelf that originated in the Kuroshio has increased

Conclusion

- Developed ReMOM by using a model that does not use the Boussinesq approximation, and study area of northwestern Pacific Ocean
- Result of ReMOM is show a greater rise in sea level value than the value of the model results to be considered indirectly Steric effect (CM2.1)
  Sea level rise, case A1B 10cm/30cm, case B1 5cm/22cm
- The steric effect, which is defined as volume change due to heat expansion, is limited in the shallow Yellow Sea but has a huge effect in the deep East Sea
- For A1B, 3 ℃ water temperature, sea level 35cm on average results of three models. For B1, 2 ℃ water temperature, sea level rise 27cm. Changing trend of the three models is similar to that.
- Transport volume of Kuroshio 4 ~ 5Sv reduction, transportation amount of cannabis turbulence 0.1 ~ 0.4Sv increase