Generation of Type A and Type B Internal Waves in the South China Sea Studied with Satellite SAR Images

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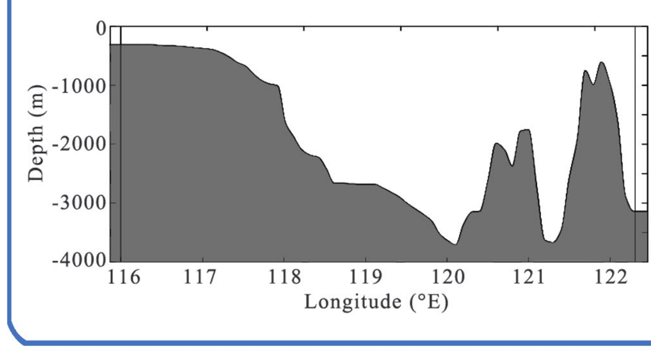
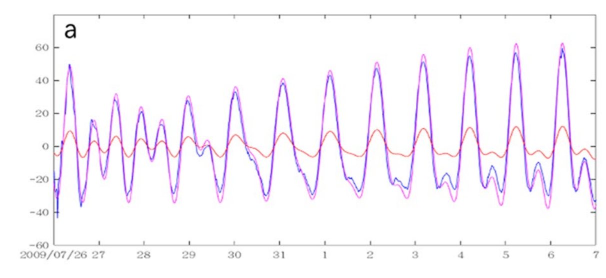
INTRODUCTION

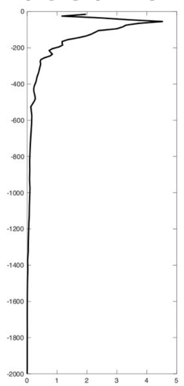
An interesting feature of internal waves in the South China Sea is the characteristics of type-A and type-B waves, which were first proposed by Ramp et al. in 2004, they divided the observed internal solitary waves into two types, namely type-A wave that appears as multiple waves and arrive per 24 hours, and type-B wave that sometimes appears as a single wave and arrives per 25 hours.Scholars have different views on the generation time and location of type-A wave and type-B wave. In order to take the research further, a series of numerical simulation experiments and analysis of in-situ measurements and SAR data were conducted.

DATA&MATHODS

This paper uses the Massachusetts Institute of Technology's atmospheric circulation model (MITgcm) to simulate the generation of internal waves in the South China Sea and the analysis of the generation mechanism of type-A and type-B waves. Terrain conditions are derived from GEBCO data, model boundary conditions are from TPXO dataset, and WOA13 data are used for stratification conditions.

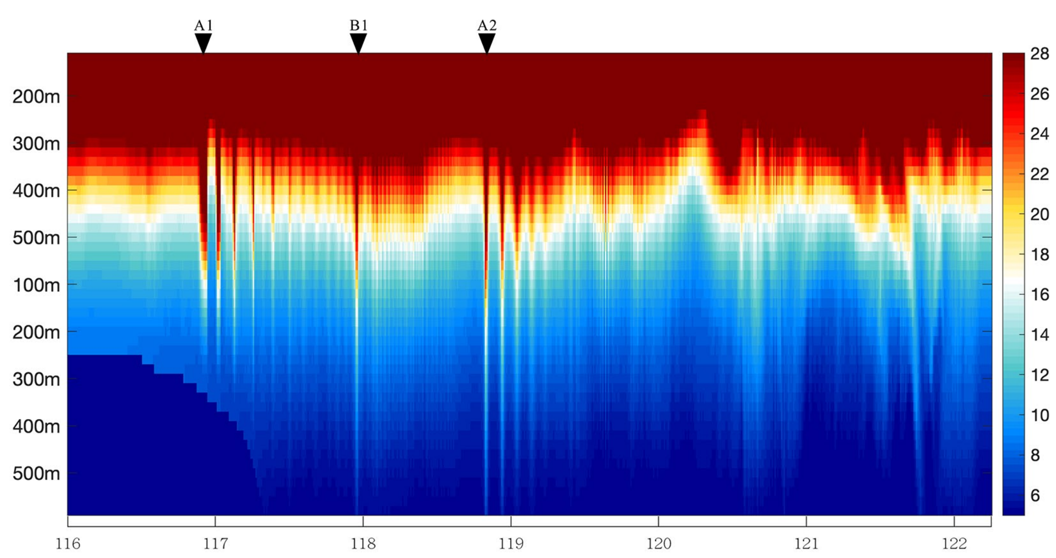


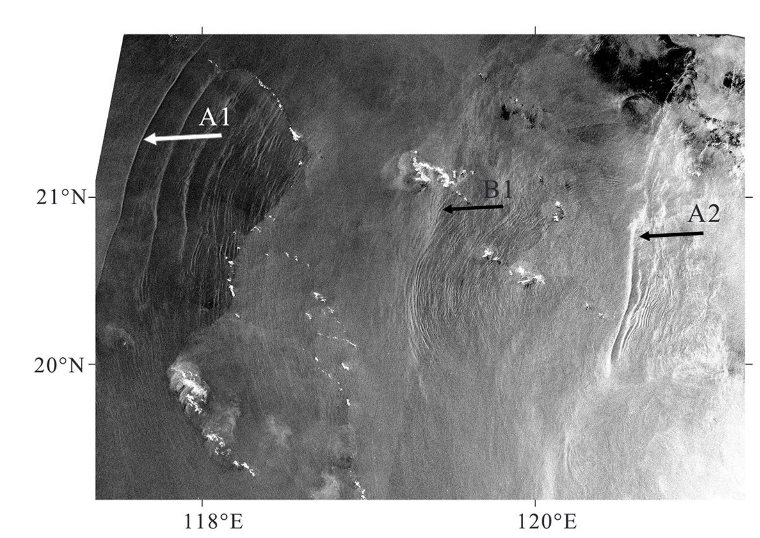




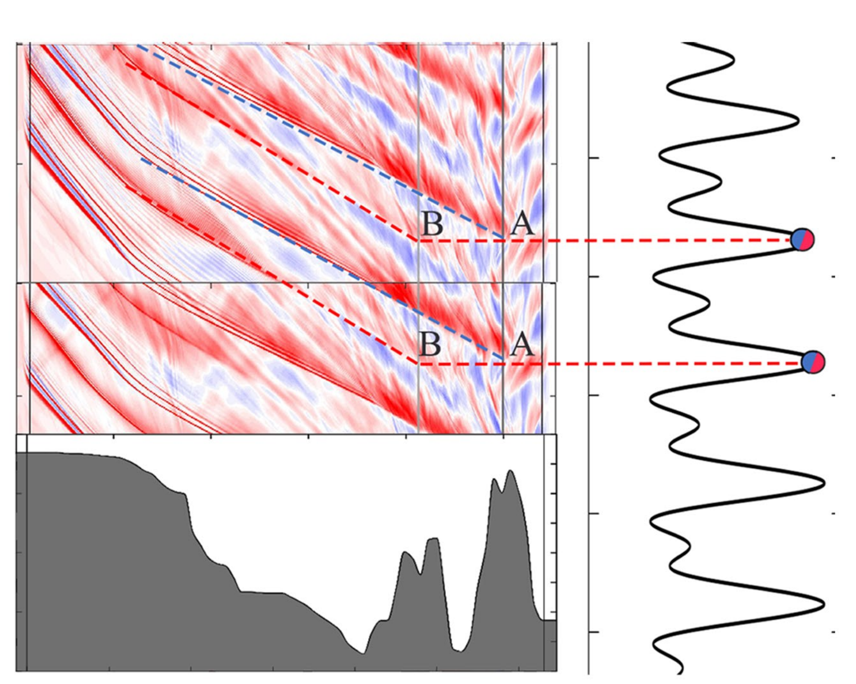
RESULTS

The figure below shows the results of the experiment on the selected Radarsat-2 image. At this moment, the spatial position of the internal wave in the SAR image coincides with the position of the internal wave in the temperature field diagram of the model result.

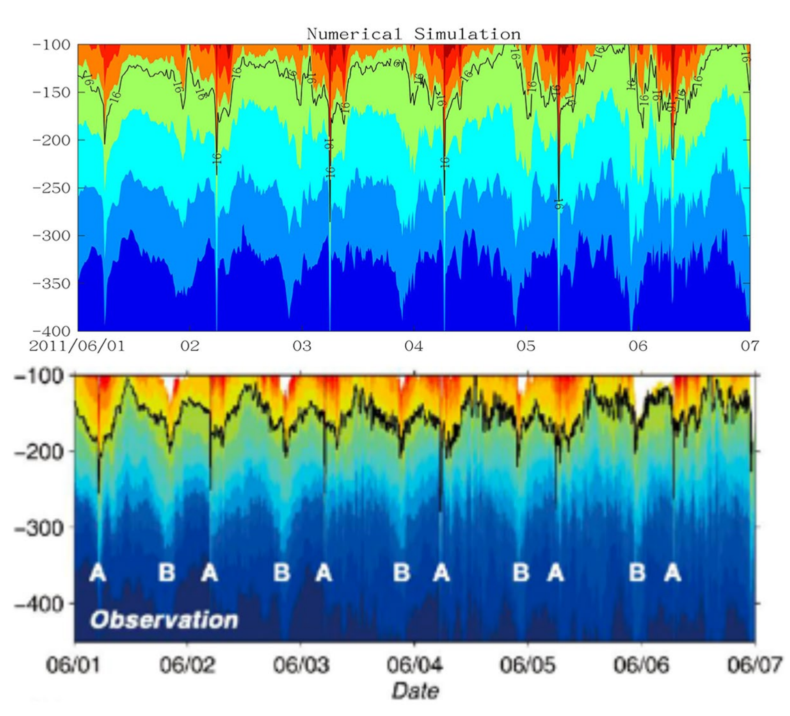




The generation time of internal waves can be traced back using Hovmöller diagrams. It can be observed that type-A wave, at the moment of maximum eastward tidal flow, is generated over the eastern ridge of the double-ridge structure. When both the diurnal and semi-diurnal tidal components are relatively strong, type-B wave, during the time of maximum eastward tidal flow, is generated over the western ridge of the double-ridge structure.

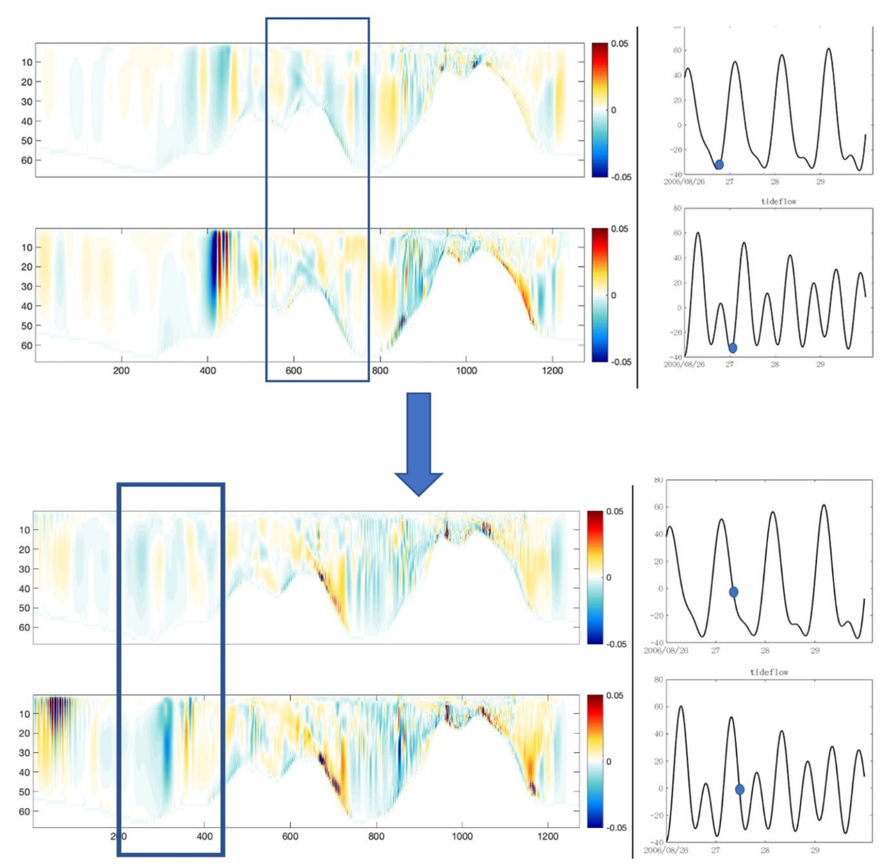


The figure below shows the comparison between the model results and the in-situ measurement data measured by the internal wave submarine buoy observation network in June 2011.



RESULTS

Disturbances originating from the eastern ridge converge at the western ridge, resulting in the generation of type-B wave during the next maximum eastward tidal flow.



CONCLUSION

A study employs MITgcm to simulate the generation of internal waves in the SCS and analyze the mechanisms underlying the formation of type-A and type-B wave. By comparing with Radarsat-2 remote sensing imagery and in-situ measurement data, it is evident that this model effectively replicates the generation and propagation of internal waves in the SCS. Type-A wave is generated at the moment of maximum eastward tidal flow over the eastern ridge of the double-ridge structure, while type-B wave is generated during the time of maximum eastward tidal flow over the western ridge. The formation of type-B wave in this scenario is associated with listurbances originating from the eastern ridge.

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