SD3668
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(FY2020)
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Date（日付）
1/12/2020 （Date/Month/Year：日/月/年）

Activity Report -Science Dialogue Program-
（サイエンス・ダイアログ事業 実施報告書）

- Fellow's name（講師氏名）: Tungcheng Ho （ID No. P19355 ）

- Name and title of the accompanying person（講義補助者の職・氏名）
Takuya Miyashita, Assistant Professor

- Participating school（学校名）: Akashikita Senior High School

- Date （実施日時）: 20/11/2020 （Date/Month/Year:日/月/年）

- Lecture title（講義題目）:
What We Have Learned from the 2011 Tohoku Tsunami and Unpuzzled 1960 Chile Earthquake

- Lecture format（講義形式）:
◆Lecture time（講義時間） 90 min（分）, Q&A time（質疑応答時間） 10 min（分）
◆Lecture style（ex.: used projector, conducted experiments）
（講義方法（例：プロジェクター使用による講義、実験・実習の有無など））
Used PPT Slides via the web meeting program Zoom, used projector on high school

- Lecture summary（講義概要）: Please summarize your lecture within 200-500 words.

Observed tsunami travel time slower than the prediction has been reported since the 1960 Chile earthquake. After the 2011 Tohoku earthquake, dozens of high-quality ocean bottom pressure gauges in the Pacific Ocean recorded the tsunami waves. The recorded tsunami waves are late to the prediction, and the delays are larger in more distant gauges. Up to 15 min travel time delay is observed when tsunami propagates over 20 hours.

The tsunami delay was first explained by the tsunami speed reduction caused by the elasticity of the Earth, water compressibility, and gravitational potential change associated with tsunami motion. We demonstrated that the ocean density stratification, actual raypath, and actual bathymetry also contribute to the tsunami speed reduction. To account for those factors in simulation, we applied the phase-correction method to the computed waveforms. The computed tsunami waveforms can well fit the observed ones after we performed the phase correction. After we performed the phase correction, the observed tsunami waveforms can be reproduced by the computed waveforms.

The 1960 Chile earthquake is known as the greatest instrumentally recorded earthquake. At that time, there are limited seismic stations. The limited observation data lead to a board

uncertainty of earthquake magnitude and source model. On the other hand, the earthquake induced a significant tsunami, which was observed by numerous tide gauges on the eastern to the western Pacific Ocean, including South and North America, Oceania, and Asia.

The tsunami inversion method, which utilizes observed tsunami waveforms to reconstruct the source of the tsunami or earthquake, is a useful method to reconstruct the tsunami and earthquake source. Because of the tsunami travel time delay problem, only near-field (travel time < 3 hours) data were used in inversions. The tsunami inversion has been suffered from data deficiency from time to time. Since we have solved the tsunami delay problem, we can apply far-field tsunami waveforms to retrieve the tsunami source.

We applied our phase-correction method to the computed waveform and performed the tsunami inversion method to retrieve the source of the1960 Chile earthquake. Our retrieved source model well reproduced the tsunami waveforms. The 1960 Chile earthquake consists of three asperities, including the north, central, and south asperity. Our analysis indicated that the north asperity generated noticeable tsunamis in North America and the central and south asperities caused large waves at Hawaii and other Pacific islands. The tsunamis induced by the three asperities arrived in Japan almost simultaneously and produced significant waves.

◆Other noteworthy information（その他特筆すべき事項）:
Very good experience.

- Impressions and commnets from the accompanying person（講義補助者の方から、本事業に対する意見・感想等がありましたら、お願いいたします。）:
The accompanying person Dr. Takuya Miyashita helped me translate the parts that is too professional for students to understand in English. Dr. Takuya Miyashita also supported some background knowledge in Japanese.