STEPS Students Report

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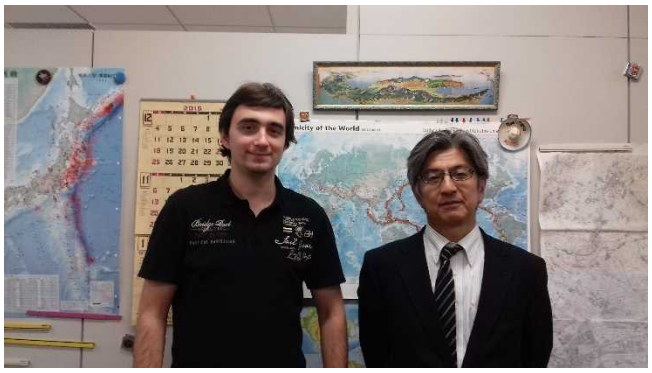
Thanks to the STEPS program I've got a great opportunity to join Prof. Satake's Lab for a three months. This time was very-very helpful for me, because all members of Prof. Satake's Lab paid a lot of attention to my research, asked dozens of questions after each one of my presentations on the Lab seminars and also gave me helpful advices. All these communications helped me to improve my results and to find the subjects for further research.



The title of our collaborative work in Prof. Satake's Lab was «Generation of free gravity waves on the ocean surface by Love and Rayleigh waves». These free gravity waves were recorded by DONET bottom observatories (near Kii Peninsula) soon after catastrophic Tohoku earthquake 2011/03/11 and more than one hour before the arrival of the leading wave of tsunami [Nosov, Sementsov, et al., 2015]. There is no direct connection between these free gravity waves and the following tsunami. But despite of this it is very important to understand physical mechanism of these free gravity waves generation, because it could provide us real-time additional information about the earthquake source and thereby help us to estimate whether the earthquake is tsunamigenic or not.

To understand physical mechanism of these free gravity waves generation firstly we made a numerical simulation of this effect. Prof. Satake recommended me a method for reconstruction of bottom dynamics using dense array of bottom seismometers. Using this method I reconstructed the dynamics of ocean bottom near Kii Peninsula during Tohoku earthquake. Based on this reconstruction the numerical simulation of the free gravity waves generation was made. The parameters of the simulated gravity waves were in good agreement with the observed values.

Then we made some numerical experiments to estimate the role of vertical and horizontal components of bottom movement in the generation of free gravity waves. After these experiments we found that horizontal movements of bottom slopes play key role in the free gravity waves generation, while the role of vertical components is not so important. All these results were presented on the seminars in Earthquake Research Institute and on the international conference "Seismological Society of Japan Fall Meeting 2016" in Nagoya (5-7 October, 2016). Questions and discussions during this conference were very helpful for our research.

After the conference we prepared a paper for Moscow University Physics Bulletin with Yifei Wu (PhD student from Prof. Satake's Lab, who also took part in STEPS program and spent 7 weeks in Moscow State University in February-March 2016): K.A. Sementsov, M.A. Nosov, S.V. Kolesov, Y. Wu, «Numerical simulation of the gravity waves, excited in the ocean by low-frequency surface seismic waves, based on the GPS-stations recordings». This paper was accepted and will be published in 2017. In the second half of November my scientific adviser from Moscow State University Prof. Nosov and our colleague Dr. Kolesov visited Earthquake Research Institute. They had presentations on Prof. Satake Lab seminar and discussion about future plans of joint research.

I would like to thank STEPS program and the University of Tokyo once again for such a great opportunity to have the experience of three months collaborative research in Prof. Satake's Lab.