IAG President Beutler, Ladies and Gentlemen:

It is a great honour to receive the 2007 Guy Bomford Prize. I express my sincere gratitude to the Central Bureau of IAG, Shuzo Takemoto, John Wahr, and all others not only in Japan but also in the world who took the time to present this prize to me. My research has been focused on the geodetic measurements of geodynamic phenomena and their geophysical interpretations. I was really fortunate to have been in the right place at the right time to take advantage of both ground-based and space-borne modern geodetic techniques. Nonetheless, it is only the numerous suggestions, criticisms, and the inspirations, I received from my mentors and colleagues along with dedicated efforts, that have enabled me to conduct exciting research and to be worthy of this prestigious prize today.

I understand that this prize has been awarded in recognition of my contributions during the previous four years. But I think I should begin with mentioning my days as a graduate student. I enrolled in geodesy, owing to my interests in the variations in the Earth’s rotation. This interest was sparked by a hypothesis proposed by Yozo Hamano, my mentor at the Department of Geophysics, University of Tokyo, in early 90s. According to his hypothesis, the length-of-day changes resulting from climate change could perturb the fluid motion in the outer core, and thereby alter the geomagnetic field. Although this idea was in contrast with what had been generally believed, I was very much impressed with the theory, and the interdisciplinary nature of the Earth’s rotation. Although Prof. Hamano is known to be a specialist for paleomagnetism, I am aware of his dislike of such a reference to himself, and instead of pushing me toward geomagnetism, he generously introduced me to Isao Naito, another empathetic teacher at the National Astronomical Observatory, Mizusawa. I was even more fortunate to meet and collaborate with Ben Chao at NASA/Goddard (now at National Central University, Taiwan), which was a fantastic experience for me. Both Prof. Hamano and Prof. Naito have been constantly insisting on the Earth system science, that does not belong to any traditional disciplines but instead should be tackled from a broader perspective. I am sympathetic to this philosophy. I believe that modern geodesy has been increasingly extending the spatial and temporal scope of its application, thereby enlarging our perspectives on the state and evolution of the Earth system.

In 1999, I was appointed as a member of Shuhei Okubo’s group at the Earthquake Research Institute, University of Tokyo. I have been expected to perform InSAR as well as some ground-based gravity measurements for earthquake and volcano studies. Due to the generous supports of Prof. Okubo, I was soon able to generate interferograms. However, a pivotal event in my career took place in 2000 – the caldera collapse and associated eruptions and earthquakes on and around the Miyakejima volcano island. Due to the persistent efforts and leadership of Prof. Okubo and the participation of Wenke Sun, we were able to exploit both the FG5 absolute gravimeter and LaCoste & Romberg G-type gravimeters, and detect spatial-temporal gravity changes associated with the magma movement. The gravity change data provided compelling evidence of significant density changes associated with the caldera collapse. Although we were unable to apply InSAR during the eruption event due to problems related to vegetation, the Geographical Survey Institute in Tsukuba – which operates nationwide GPS network – had four of them working at Miyakejima at the time. GSI also extensively carried out airborne photogrammetry to monitor the rapid changes in topography. We are greatly indebted to those data in our geophysical modeling.
Another turning point was my two years’ stay at the University of Colorado at Boulder. In parallel with InSAR data analysis and the modeling of volcano deformation, I collaborated with John Wahr, Karl Mueller, Roger Bilham and another visitor – Sripati Satyabala – who was from India. John and his collaborators have been conducting GPS and gravity measurement in Greenland, but there were only a couple of continuous GPS receivers. Although both John and I understood that it would be challenging to detect a long-wavelength signal using InSAR, which was indeed the case, a lucky chance helped us to find unloading ground deformation due to an ice-burst flood episode at one lake. Karl is an expert in structural geology, and Karl and John suggested that I apply InSAR to Canyonlands National Park, Utah, where no continuous GPS measurements are conducted. Fortunately we were able to detect the active salt tectonic motion in the park, although its amplitude is only a couple of millimetres per year. Nevertheless, we confirmed that the precision of the InSAR measurements would be in sub-millimetre per year, depending on the prevailing conditions.

Roger and Satyabala have been researching crustal deformation in central Asia for years, and a chance meeting with them opened my eyes to the possibilities in that area. The interdisciplinary collaboration definitely helped me to further expand my perspectives regarding the Earth system. I would like to thank my collaborators at CU Boulder for providing me with excellent opportunities and making my years in the US fabulous and productive.

The Earth system is not as simple as a so-called “complex system” that is tackled by some modern physicists. It has infinite degrees’ of freedom with multiple phases and chemical components, and is appallingly complicated. In order to better understand the state of the Earth system, we should not remain confined to any specific phenomenon and/or techniques. However, it appears to be impossible for one individual to carry out such studies. Therefore, interdisciplinary collaborative efforts will be crucial for the advancement of Earth system science, and in this regard modern geodesy will undoubtedly play an indispensable role owing to its multidisciplinary nature. There still remains plenty of scope for improvement in modern geodesy, not only in terms of measurement techniques but also in terms of modeling the data produced by these techniques. However, I am certain that geodesy will continue to provide us with breakthroughs and discoveries for many years to come.

In addition to the people I mentioned earlier, I would like to thank Taizo Yoshino, Tetsuro Kondo, and friends at the former Communications Research Lab; Urs Wegmuller and Charles Werner at Gamma Remote Sensing; Tim Niebauer and colleagues at Micro-G-LaCoste. I also thank ESA, CSA, and JAXA for their acquisition of excellent SAR data, and I appreciate NASA/JPL for making the excellent digital elevation model publicly available. I have acknowledged all of those I wish to share credit with. Last but not least, I would like to thank my family.

Thank you very much.