Automation of data analysis for satellite-ground beacon experiment

*山本 衛[1]、坂本 悠記[1]
*Mamoru Yamamoto[1], Yuki Sakamoto[1]

1. 京都大学生存圏研究所
1. Research Institute for Sustainable Humanosphere, Kyoto University

We have been studying ionospheric structures by the satellite-ground beacon experiment. The main observation region is southeast Asia. For example, meridional chain of five beacon receivers along 100E meridian showed meridional distribution of total-electron content (TEC) of the ionosphere, and we revealed time and spatial variabilities of equatorial anomaly. The data analysis was, however, not easy mainly because of difficulty in estimating bias of the measurement. In this paper, we try to automate the bias estimation and lower the barrier for data analysis. The automatic bias estimation is divided in two stages. In the beginning, we make a rough estimation based on a single-station data. We assume that the TEC distributes uniform in a small section of the data, and estimated many bias candidates from all sections. The final bias is then selected based on the maximum frequent appearance basis. The second approach is the multi-station estimation. The basic idea is the same as usual two-station method, but we tried to find best match between several stations. In order to reduce computation, we start from matching between two station, and then connect the data to those from the next station. After this process, we match bias from all stations by the Brute-effort way. We now find the final bias estimation in about 80 seconds of computation by a desktop PC. Applying this multi-channel approach to the 100E meridional chain of five stations, resulted absolute TEC was close to the previous analysis obtained with much more manual efforts. We also organize these data into one NetCDF format file that helps easier use of the data.

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