Data Assimilation of Side-looking Radio Occultation by Observing System Simulation Experiment

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Low earth orbit satellite (LEO) observes the signal of GPS satellite that came from the moving direction of LEO satellite, because the short shift of tangent point is required for precise estimation of tangent point profiles. If slant path data is used in the assimilation, occultation data of which the angle from the moving direction of LEO satellite (AFL) is large can be used in assimilation (Fig. 1). In general, impact of RO data is weak because the slant path data stretches for several hundred kilometers. For this reason, the total number of assimilated data should be increased by using 'side-looking' data. In this study, impact of side-looking data is investigated by OSSE.

We adopted the intense rainfall case that occurred at Kobe City as the target of OSSE (Fig. 2). Intense rainfall raised water level of Toga River, and then five people were drowned in the riverside park. In OSSE, truth data is needed to produce 'simulated slant data'. Analyzed fields of the intense rainfall case of Kobe City, which were obtained by the assimilation of ground GPS data and conventional data (Shoji et al 2009), were used as truth (Fig.3). We checked AFL distribution of occultation data (Fig. 4). Signals of data of which AFL was less than 60 degrees were received. However, profiles were not provided from the half of data of which AFL were larger than 50 degrees. Occultation data, of which AFL was larger than 60 degrees, is about 11% when satellite position data of the same day is used. Thus, total data that is expected to be received by side-flank observation becomes about 18%. There were several occultation data of which AFL were larger than 60 degrees near Alaska (Fig. 5). We used position of these occultation points that were shifted to Japan area. When the first guess and truth data was compared, path-averaged refractivity of truth below the height of 3 km is larger than that of first guess (Fig. 6). The reinforcement of rainfall is expected when this data is assimilated.

Figure 7 is the assimilation results of the simulated side-looking observation data. The intense rainfall was reproduced when the forecast was performed from the analysis field that was obtained by the assimilation of conventional data and 'simulated slant data'. Intensity and area of the rainfall became comparable to the observed one though the position was shifted westward.

Result of this study is summarized as follows: (1) when the side-looking data, of which AFL are large, are included in assimilation data, the analyzed fields is further improved, (2) however, the problems of hardware etc. are not considered. So, more experiment is needed under the more actual condition.

References

Shoji, Y., M. Kunii and K. Saito; 2009: Assimilation of Nationwide and Global GPS PWV Data for a Heavy Rain Event on 28 July 2008 in Hokuriku and Kinki, Japan, *SOLA*, **5**, 45-48.

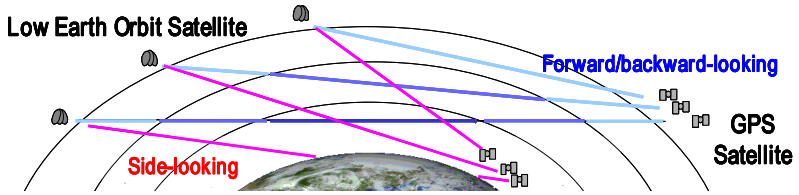

Fig1. Concept of side-looking observation

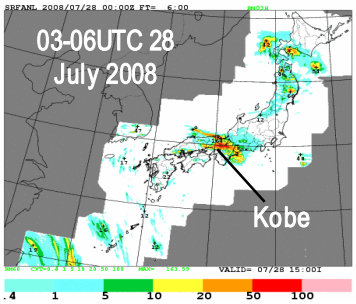

Fig.2 Target event of the observing system simulation experiment.

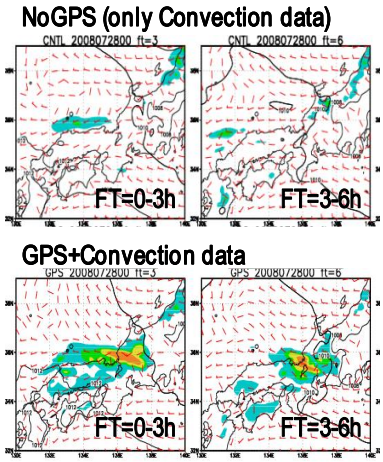

Fig. 3 Assimilation results of ground-based GPS data (After Shoji et al. 2009).

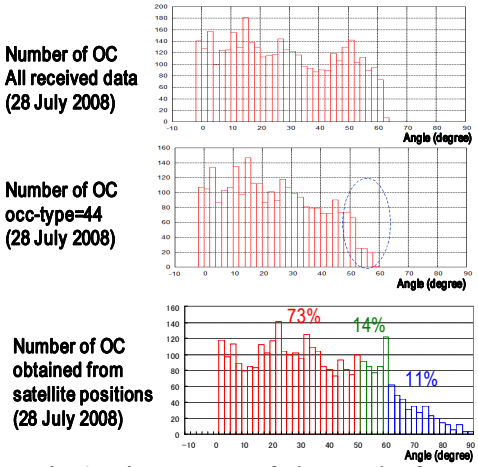

Fig.4 Histograms of the angle from moving direction of COSMIC of 28th July 2008.

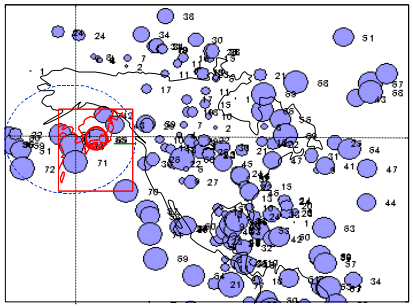

Fig. 5 Distribution of lowest tangent points during 12-15 UTC 13th September 2006.

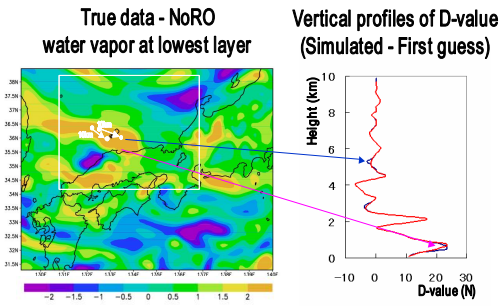

Fig. 6 (left) Difference between the true data and the assimilated fields of conventional data. (right) Vertical profile of difference of the true data and first guess data

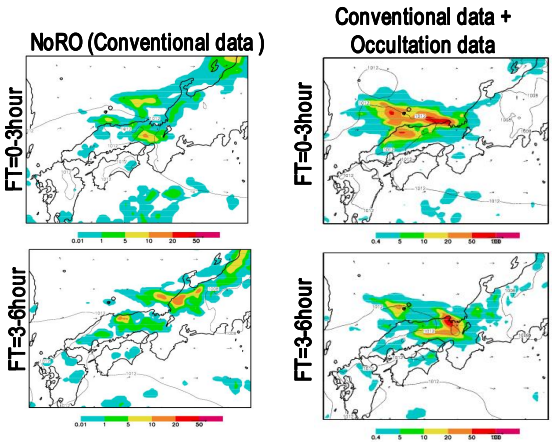

Fig. 7 Assimilation results of simulated side-looking observation data.