[A-AS23_28PM2] Hyper-dense observation network to elucidate micro-scale atmospheric phenomena

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The recent development of sub-kilometer scale hyper-dense network of meteorological instruments enables us to unveil the detailed behavior and structure of micro-scale meteorological phenomena. The potential of the hyper-dense network widely include the research of the disastrous phenomena such as windstorm or tornado and the precise forecast of active cumulus convection by monitoring near-surface converiscence lines. It is also noteworthy that the micro-scale phenomena is represented by non-hydrostatic meteorological model with very fine horizontal resolutions. In this sense, the comprehensive studies combining observation and model are keenly expected. This session widely welcomes research topics and future actions regarding micro-scale meteorological phenomena. The new design of hyper-sense network and QC method of big-data obtained from the hyper-dense network is also included in the session scope.

5:40 PM - 5:55 PM

[AAS23-P01_PG] A study on an atmospheric propagation delay estimation method using a fixed radio source

3-min talk in an oral session

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Keywords: Wind Profiling Radar, estimation of horizontal humidity distribution, non-hydrostatic forecast model, software radio, side-lobe, propagation delay

This study aims to develop a new method to observe water vapor horizontal distribution using a side-lobe emission of the 1.3 GHz-band wind profiling radar (WPR). The phase delay of the received side-lobe emission is mainly due to the refractive index fluctuation along the propagation path. In the atmospheric boundary layer, the temporal and spatial non-uniformity of water vapor determines the refractive index fluctuation. Main scope of the study is to extract humidity information from the atmospheric phase delay of side-lobe emission from a WPR. Horizontal humidity distribution can be derived by the data assimilation into numerical prediction model. The receiver system and data analysis algorithm were developed. A software radio, USRP N200 with an RX daughter board was employed to detect side-lobe emission received by an antenna. A Rubidium frequency standard and a 1 pps signal source of GPS receiver were used for accurate estimation of phase delay variation. The frequency stability of a crystal oscillator, which is generally employed for a reference frequency source of WPR, is insufficient for the accurate estimation. We proposed a new method to compensate the frequency uncertainty of WPR by using data of the additional receiver nearby the WPR site. IQ data detected by USRP B210 which is controlled by GNURadio, an open source software. By using GNURadio the system will be low cost. The
program written in IDL language extracts the temporal variation of the phase delay from the received IQ signal. In order to achieve good performance even in low SNR conditions, we developed an algorithm using STFT (Short-term Fourier transformation) aiming to remove noise in undesired frequency range. The developed system is promising to derive humidity information from side-lobe emission from various WPRs such as the operational WPR network in Japan (WINDAS (WInd profiler Network and Data Acquisition System)).