

ABSTRACTS (MASTER THESIS)

Development of a low noise RASS using a parametric array

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The frequency of unpredictable local heavy rain is increasing in the world. Various studies have been made to predict local and short-term weather phenomena. One of them is to improve the temporal and spatial resolutions of meteorological observation data. If meteorological observation data can be obtained with high resolution, understandings of meteorological phenomena will progress, and short-term weather forecasts will become more accurate, which will contribute to the safe operation of aircraft.

Radio acoustic sounding system (RASS) is a ground-based remote-sensing technique to obtain temperature profiles in the troposphere with high temporal and height resolutions by combining an atmospheric radar (or wind profiling radar) and a high-power acoustic transmitter shown in Figure 1. However, the RASS requires strong output sounds in the audible frequency, so observation sites are restricted due to a noise problem.

The purpose of this study is to develop a low noise and all-weather RASS system using a parametric array having a sharp directivity. Considering the application of parametric speakers to RASS, securing waterproofness is an important issue because of outdoor use of RASS speaker. We ensured waterproof property of a speaker by making it turn to downward and reflective type shown in Figure 2.

We carried out an observation experiment by using an LQ7 wind profiling radar and the reflective speaker. When the wind was calm, it was confirmed that RASS echoes could be obtained up to 1 km above the ground as shown in Figure 3. However, it was difficult to obtain RASS echoes when the wind was strong. In order to improve the RASS observability in the presence of wind, we considered speaker layout as *Uncapacitated Facility Location Problem* based on wind data obtained with a Doppler sodar, and we examined the optimal speaker layout.

References

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- [2] Y. Masuda, "Influence of wind and temperature on the height limit of a radio acoustic sounding system", *Radio Science*, Vol. 23, No. 4, pp. 647–654, 1988.

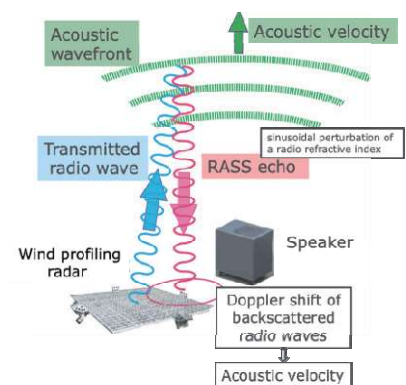


Figure 1. The principle of RASS

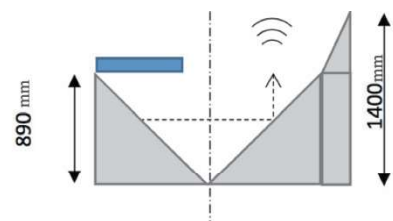


Figure 2. Reflective type of parametric speaker

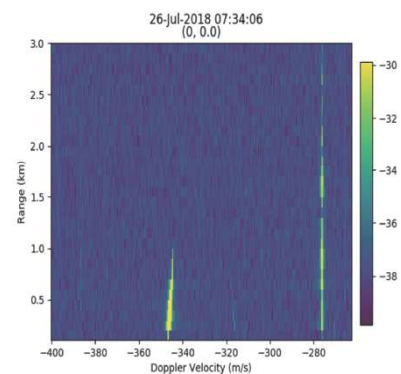


Figure 3. Example of RASS echoes observed by LQ7