P1.2 Cloud & fog observation and Fog Dissipation Experiment at Daegwallyong site

Joo-Wan Cha, Ki-Ho Chang, Jin-Yim Jeong, Ha-Young Yang, Yo-Han Cho, and Jae Cheol Nam
Meteorological Research Institute/KMA , Korea

1. Introduction

Cloud and fog are always important for weather and climate. They are a part of the hydrological cycle and are known for its impact on quality of life and public safety in transportation, tourism and outdoor activities such as open-air sports. Up to now, a lot of cloud observation have been performed to address different aspect clouds (Chandler *et al.*, 1988; Mohnen and Kadlecek, 1989). Especially, ground fog observation were performed in November 1989 in the Po Valley, near Bologna, Italy and the results of the campaign are published (1992). Fog induces to a lot of economic loss in each country. For example, on US highways, between 1981 to 1989, more than 6000 deaths were associated with such events (NCHRP, 1998).

one objective of this work is to verify new instruments for studying the cloud in mountain weather modification at new Daegwallyoung cloud observation site. The other is to investigate the potential capability of fog dissipation by seeding the recently developed hygroscopic materials (ICE Inc. U.S.A). To perform this experiment, we mainly use FSSP (Foreword Scattering Spectrometer Probe, model:FSSP-100), Microwave radiometer (model: WVR-1100), and Micro Rain Radar (model: MRR-2). For dissipating fog, two hygroscopic particle (mainly composed of $CaCl_2$) seeding experiments has been performed at the Daegwallyoung cloud observation site with 1-hour interval during about 2 hours in 16 June 2005 to dissipate the natural warm fog.

*Corresponding author address: Joo Wan Cha, Meteorological Research Institute/KMA, 460-18 Seoul 156-720 Korea; e-mail: jwcha@kma.go.kr

2. CPOS & Related Experiment

Our site name is Deagwallyoung (37°41'N, 128°45'E) Cloud Physics Observation System (CPOS) with the altitude of 842 m from mean sea level (Fig. 1). We use the CPOS data from December 2003 to September 2005.

Fig. 1 Daegwallyoung cloud observation site

1) Observation result of instruments

The precipitable water vapor data of MicroWave Radiometer (MWR) at Daegwall -

young cloud observation site is compared with that of RainSonde (RS) (Fig. 2). The correlation between the data of MWR and those of Rainsonde is better in none precipitation weather condition than in precipitation weather condition due to the MWR characteristics measuring the two channel absorbed radiance.

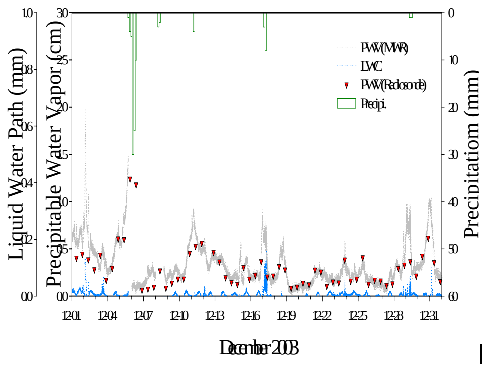

Fig. 2. Time seies of PWV_{MWR} (dash line; Precipitable Water Vapor) and LWP_{MWR} (solid line, Liquid Water Path) from MWR for 3~9 April 2004. The triangle are PWV_{RS} derived by integrating Radiosonde sounding. The Bars indicate amount of precipitable. (R^2 =0.83)

MRR is good instrument for getting the prec ipitation characteristics. In our site, we compare the MRR estimated precipitation with the AWS (Auto Weather Station) measured precipitation in Figure 3.

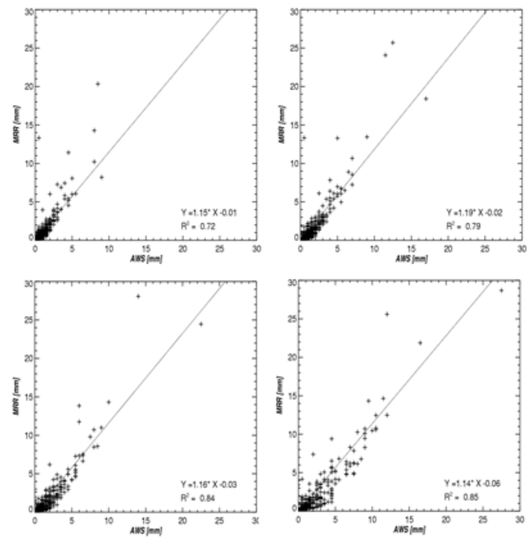

Fig. 3. Comparison of (a) 15 min, (b) 20 min, (c) 30 min and (d) 60 min cumulative rainfall from AWS and MRR. there, R^2 denote the correlation coefficients

2) Fog dissipation experiment at Daegwal -lyoung cloud observation site

Figure 4 shows the obvious change of fog-droplet concentration after seeding. The small-size (<25um) droplet decreases and large-size (>25um) increases. This suggest that the condensation of cloud(fog) is enhanced.

Under the fog conditions, the visibility V may be approximately calculated from the droplet size r_i and concentration N_i measured by the FSSP for the i-th channel (Koschmieder, 1924):

$$V = \frac{3.912}{\sum_i 2\pi N_i r_i^2} \quad . \qquad (1)$$

As visibility in fog is poor due to the presence of a high concentration of small droplets, the decrease in the number of small droplets would result in an increase in visibility. Fig. 5 shows that the calculated visibility has been improved during the 3-10 min. and 7-28 min. after the finish of seeding for the first and second experiment, respectively.

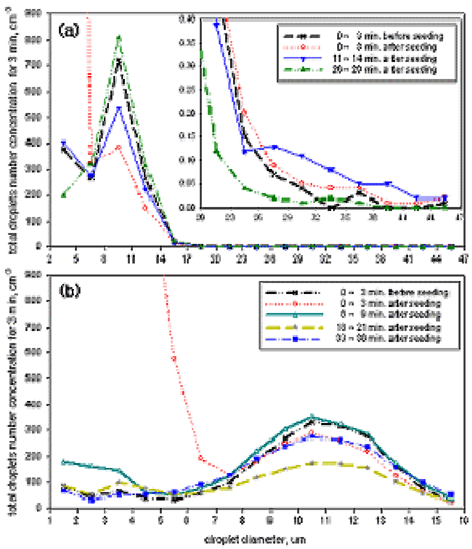

Fig. 4. Temporal variation of the fog-droplet number concentration for the (a) first and (b) second seeding experiment of $CaCl_2$.

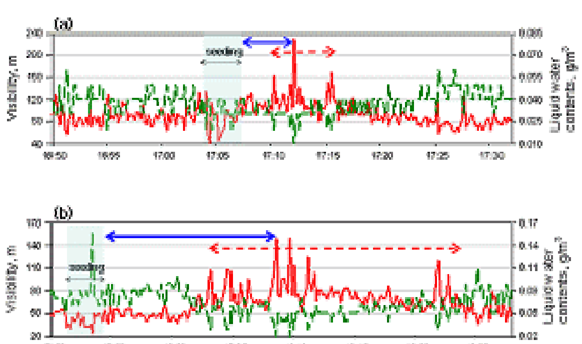

Fig. 5. Time series of the visibility and liquid water content calculated from the FSSP measurements for the (a) first and (b) second seeding of $CaCl_2$. The solid line is the visibility and the dashed line the liquid water content. The period of solid arrows denotes the impact period and that of dashed arrows the visibility improvement period.

3. Summary

We have installed the MWR, MRR, and FSSP in Daegwallyoung cloud observation site which is the first integral cloud observation site in Korea. The precipitable water vapor data MWR give good correlation with those of Radiosonde. Especially, the 30 min. and 1 hr. MRR precipitation give good agreement with those of rain gage

The results of fog dissipation experiment suggest that during the period from the start of seeding to about 6 minutes including seeding, the visibility becomes worse due to the white color of seeding particles, but during the period of 10-20 min. after the finish of seeding, the improvement of visibility has been validated by the FSSP measurements.

Acknowledgements

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