Precipitation Structure on Ground-Based Radar

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Abstract

In order to find horizontal and vertical precipitation structure in Korean peninsula, we use ground-based radar, and Automatic Weather Station (AWS) data. Radar data was selected for rain events in the Pusan and Jindo in Korea, during the spring and summer season of 2002. AWS point gauge measurements are analyzed as part of spatial structure of precipitation. TRMM/PR and ground-based radar is used vertical correlation. The results showed, as expected that the correlation decreased rapidly with distance.

1. Introduction

Previous analysis of precipitation over the Korean peninsula have shown that the trend through the years. But precipitation trend over the Korean peninsula not have shown distinctive feature.

This result prompted an analysis of precipitation to discover further information on the spatial, time and vertical variation. Use was made of the coefficient of correlation.

2. Data

2.1 Radar in KMA

We use only radar sites of Kunsan, Pusan and Jindo, which are located at the southern part of the peninsula.

Major parameters of three radar sites are shown Table 1. Reflectivity is observed every 10 minute, with spatial resolution 1km and elevation angle interval of 0.5° - 1°.

Table 1. Major parameters of radar in Kunsan, Pusan and Jindo.

	Kunsan	Pusan	Jindo
Observation Range	120,240,480	120,240,480	120,240,480
Type	C-band	C-band	S-band
Beam width	1.2	1.2	1.2
Peak Power (kW)	250	250	750
Frequency (MHz)	5340	5340	2690
PRF(Hz)	250-1180	250-1180	250-1200

2.2 Automatic Weather Station (AWS)

KMA have very good surface observation network. AWS's spatial resolution is about 19km. Temperature, precipitation, humidity, wind speed and direction are observed every minute. We use hourly AWS data of KMA during 1999-2002.

2.3 TRMM/PR

We use 2A25 product of TRMM/PR for vertical precipitation structure analysis. 18 cases of 2000 March to November rain snapshots were selected

Table 2. Major parameter of TRMM/PR.

Item	Specification
Frequency	13.796, 13.802GHz
Swath width	220km (from end to end)
Observable range	Surface to 15km altitude
Horizontal resolution	4.3km (nadir)
Vertical resolution	0.25km (nadir)
Type	128-element WG planar array
Beam width	0.71o×0.71 o
Scan angle	± 17 (cross track scan)
Peak power	500W
PRF	2776Hz

3. Spatial correlation study

The spatial variation was investigated further by use of the coefficient of correlation between individual stations. AWS data were obtained for 464 stations distributed over the Korean peninsula as shown in Fig. 1 .

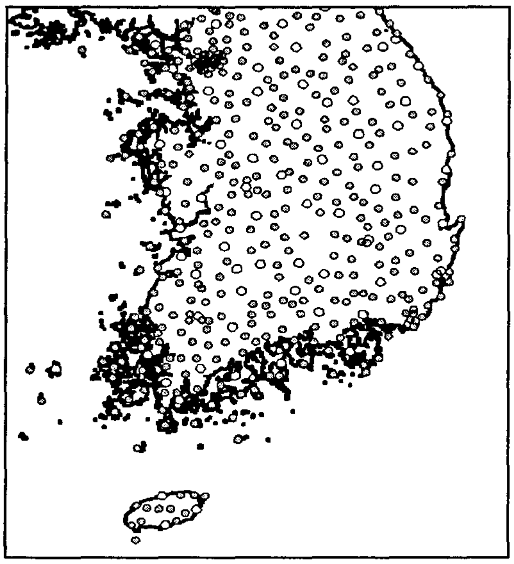


Fig. 1 AWS stations are over the Korean peninsula.

The distribution of stations were not be uniform. Correlations were made using the monthly totals for May to September only. These are the month with the greatest amounts of precipitation during these month falls as rain.

The large number of correlations obtained made it necessary to group them to obtain meaningful relationship. This was done by determining the distance and direction *AiAj* (*i,j*=1...,464). Distances were grouped by 10km intervals, and directions by 10° intervals starting from East. Because the direction from *Ai* to *Aj* is 180° different from the direction from directions from 1° to 180° only were used (Longley, 1974).

Fig. 2 is shown spatial correlation with distance in 2002. When means of the correlations were taken for distance groups, ignoring direction, the results showed the expected decrease of mean correlation with distance. E-folding distance of May is 170km, but June to August is about 70km. These results show that May have large precipitation structure, but JJA have local structure precipitation.

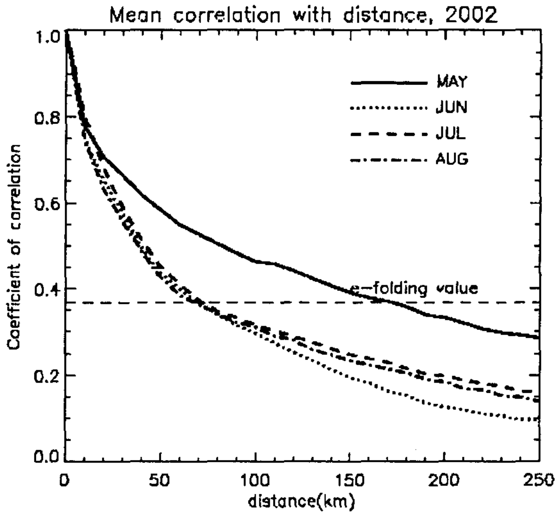
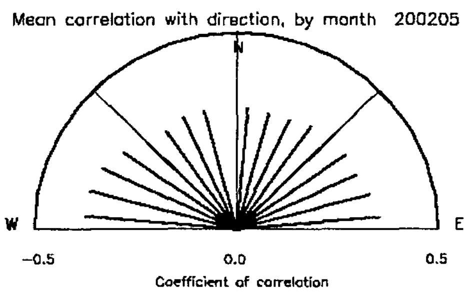


Fig. 2 Mean correlation with distance, by month , 2002.

Fig. 3 shows correlation by direction of 2002. May is isotropic structure, June and August are tilted north-east.



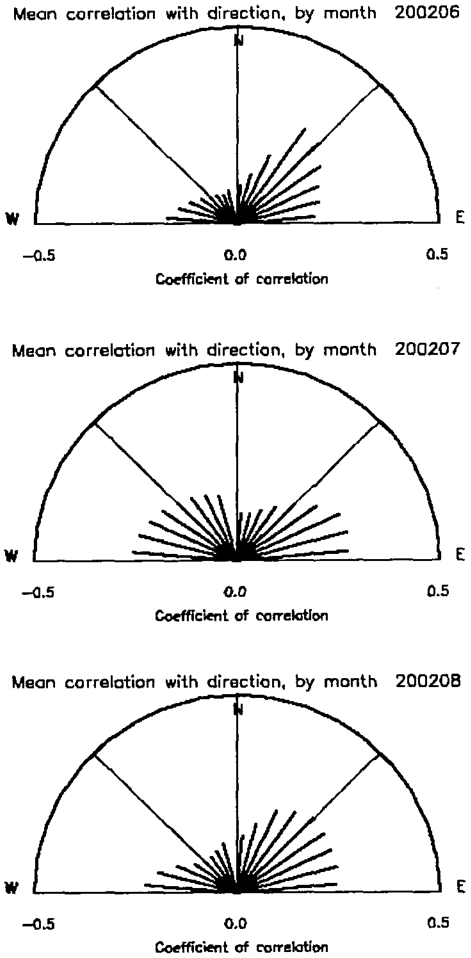


Fig. 3 Mean correlation with direction, by month , 2002.

4. Vertical correlation study

Fig. 4 shows vertical correlation from TRMM/PR in 2000.

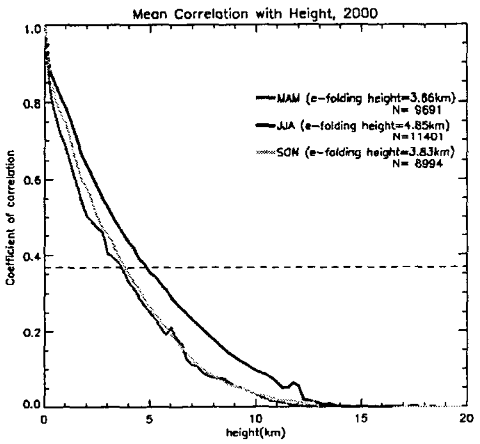


Fig. 4 Mean correlation with height, by season, 2000.

JJA have the highest e-folding height, 4.85km, because precipitation on JJA have strong vertical convection. MAM and SON are shorter than JJA. SON is slightly higher than MAM, because SON includes one typhoon event.

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Reference

Longley, R. W., 1974, Spatial variation of precipitation over the Canadian prairies. Monthly weather review, 102:307-312.