

Method for Estimating Ground Precipitation from Radar Precipitation using Correlation Analysis

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Introduction

- RTRI is developing a system for secure the safety of railway passengers from inundations caused by localized torrential rainfall in small rivers in urban areas by using radar and numerical simulation data.
- Precipitation obtained by radars has a slight difference from the ground precipitation.
- Small scale river has a narrow catchment area. Therefore, a slight difference of precipitation area and/or amount may affect results of inundation depth analysis.
- So we examined a method to more accurately estimate distribution of ground rainfall using synthetic rainfall obtained by radars.

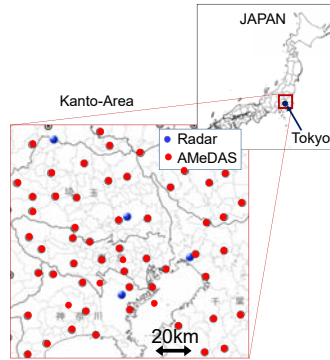
Dataset

Radar (Estimated precipitation):

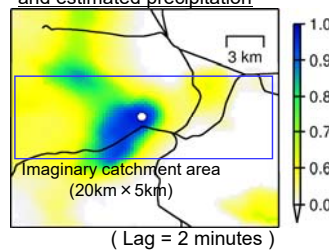
- MLIT XRAIN (eXtended RADar Information Network)
- 1/60th of the 10 minute accumulated value of synthetic rainfall obtained every minute

Ground precipitation:

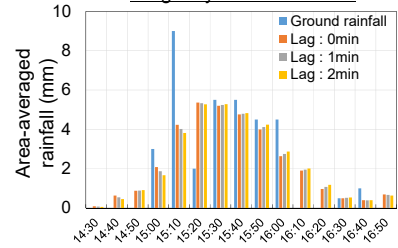
- JMA AMeDAS (Automated Meteorological Data Acquisition System)
- 10-minute rainfall amount



Cross correlation coefficient between ground precipitation and estimated precipitation



Area-averaged precipitation in imaginary catchment area



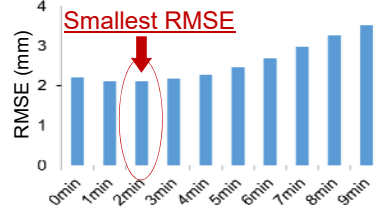
Area-averaged rainfall depends on lag.

Short-term heavy rain events analyzed

precipitation event including value of 1 hour precipitation exceeding 30mm in 2016 in Kanto-area, JAPAN

The number of events	Peak value of 1-hour Rainfall
20	30.5mm ~ 86.5mm

RMSE at each time lag (at point, 20 events)

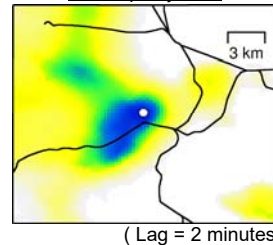


Estimated precipitation two minutes before well express ground precipitation.

Comparison of estimated precipitation and ground precipitation

- In small area, rain area are sometimes wider than catchment area.
- Estimated precipitation averaged in the catchment area, and estimated precipitation on a grid with a rain gauge are different from ground precipitation.

Considering movement of raindrops by wind

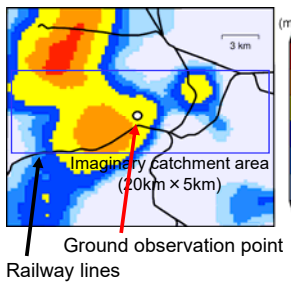


(Lag = 2 minutes)

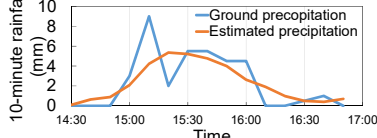
Surface Winds	RMSE
Without considering	2.11mm
With considering	2.15mm

There is little effect of raindrops moved by the wind.

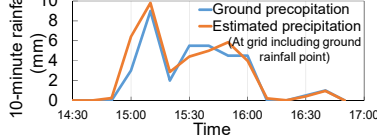
Distribution of estimated precipitation



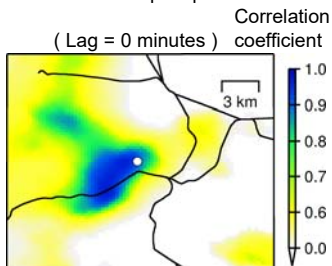
Catchment-area-averaged precipitation amount



Time series of precipitation amount



Cross correlation coefficient between ground precipitation and estimated precipitation



The correlation coefficient at the surrounding point are higher than the correlation coefficient at the point including the rain gauge.

There is a possibility that the precipitation area moves while the raindrops fall to ground.

Based on the relationship between estimated precipitation with time shift and ground precipitation, a method for estimating ground rainfall by using estimated precipitation data is performed.

Summary

We studied methods to more accurately estimate the amount of precipitation on the ground from the precipitation intensity obtained by the radar in the localized heavy rain case.

- Ground rainfall is estimated more accurately by using synthetic rainfall by radars at 2 minutes before.
- When estimating ground rainfall using radars, there is little effect of raindrops moved by the wind.

Acknowledgements

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Any questions to