

# JMA's Operational Quantitative Precipitation Estimation (QPE)

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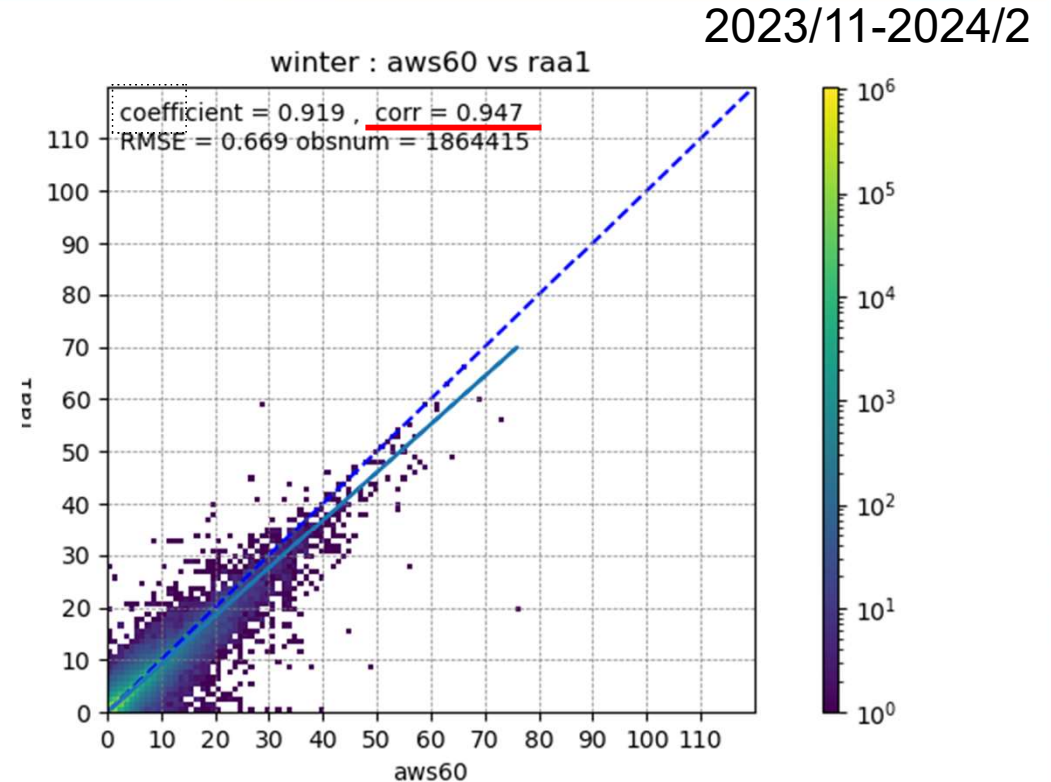
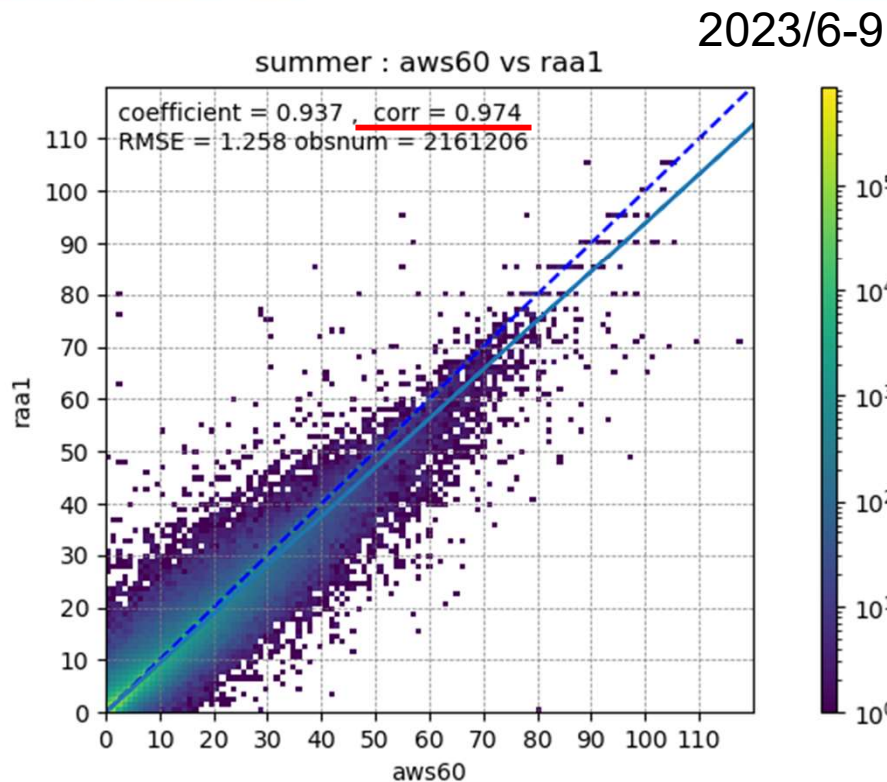
# JMA's Operational QPE product

## •Radar/rain-gauge Analyzed Precipitation (R/A)

- Estimate precipitation in one hour
- Spatial resolution: 1 km
- High accuracy
- Issued every thirty minutes
  - Immediate analysis issued every ten minutes.  
(Rain-gauge data for last 10 minutes is unavailable)

### Requirement of R/A


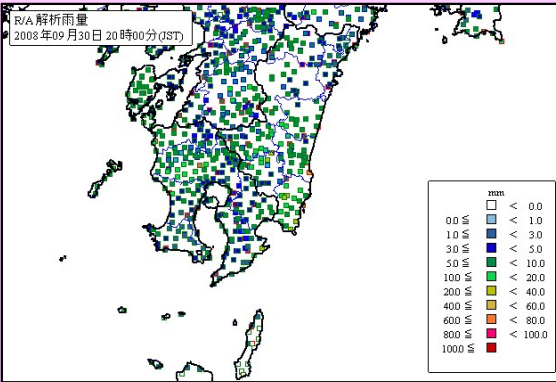

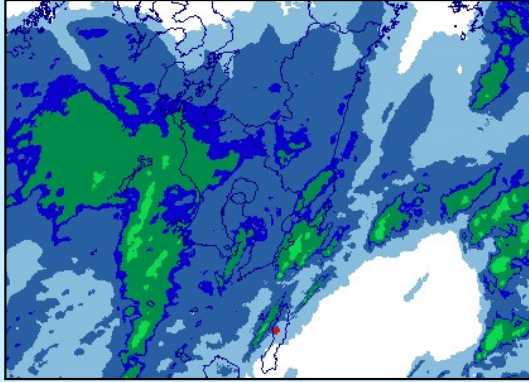
- Accurate enough to estimate disaster risk precisely
- Spatially spread to cover whole county
- Frequent enough to publish warning/advisory



# Accurate/Spatially spread Precipitation measurement

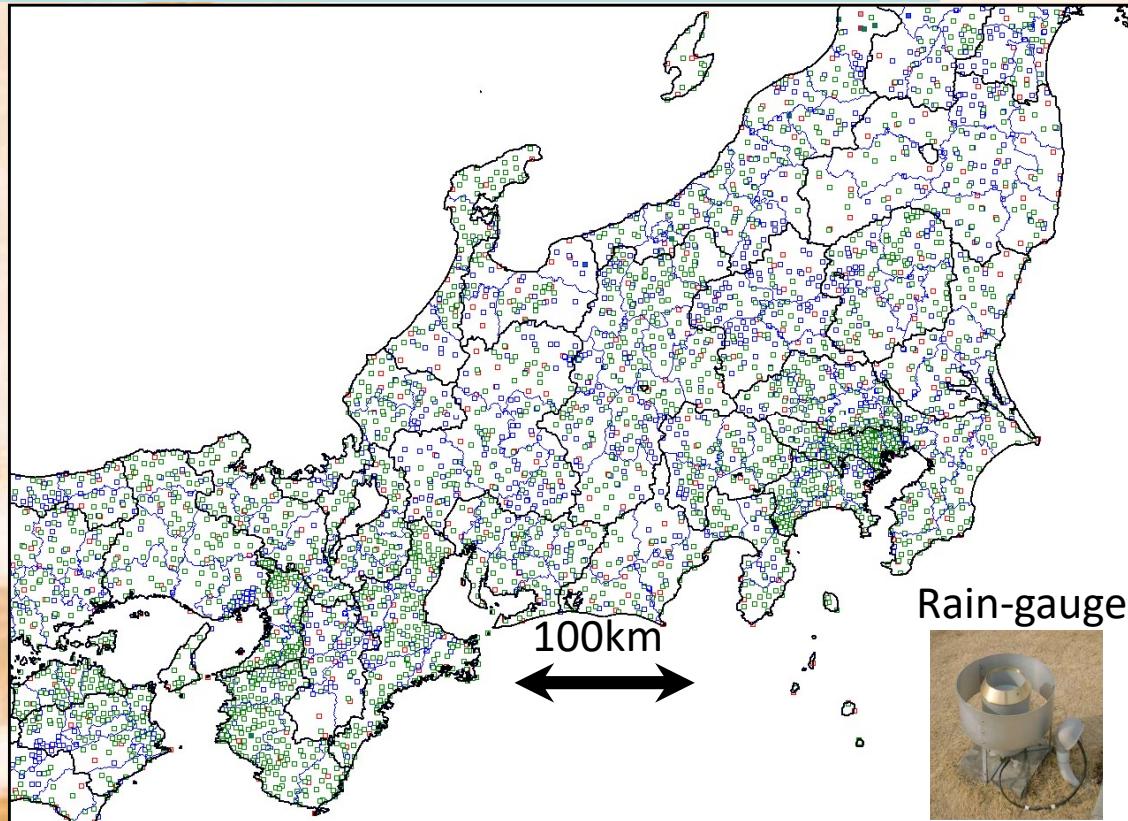
Two major instruments to observe rainfall amount are rain-gauge and radar

## Observation features of rain-gauge and radar

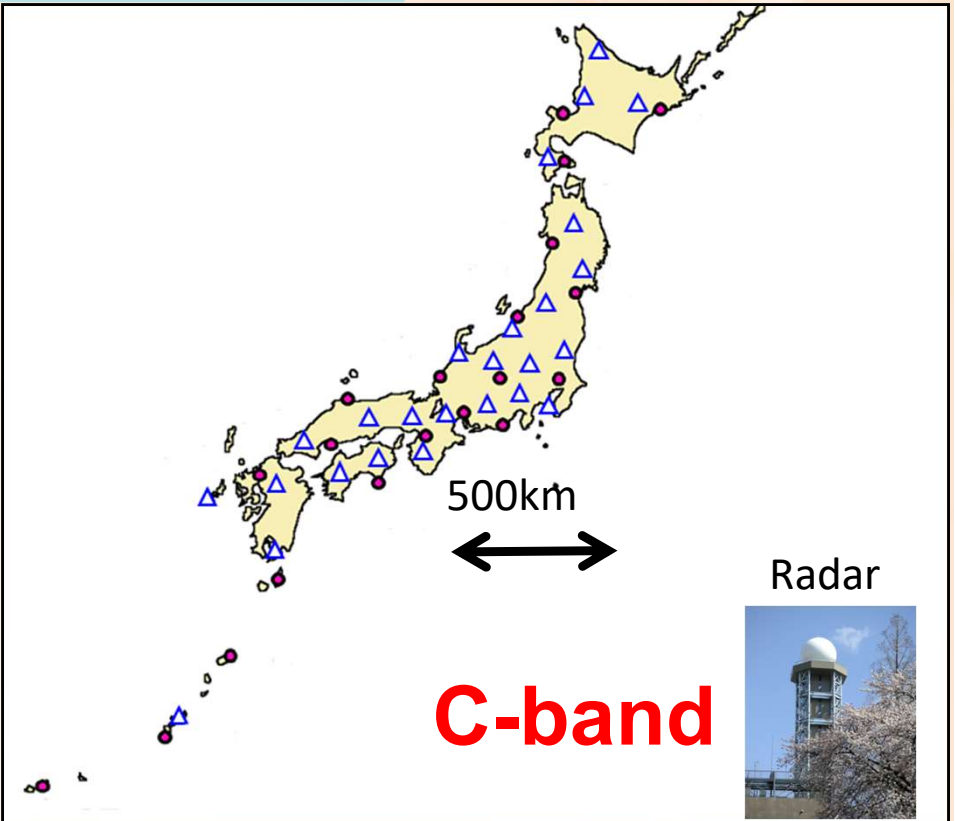
|                      | Rain-gauge   | Radar   |
|----------------------|--|---|
|                      |   |   |
| <b>Advantage</b>     | More accurate than radar.  | Spatially spread observation.   |
| <b>Dis-advantage</b> | Just a point.  | Low accuracy than rain-gauge.   |

# Rainfall Observation in JMA

## Automated Weather Station Network



## Radar Network



□ **JMA 1,300 points** Every 10minutes

□ **Ministry of Land, Infrastructure, Transport and Tourism (MLIT) 3,400 points**

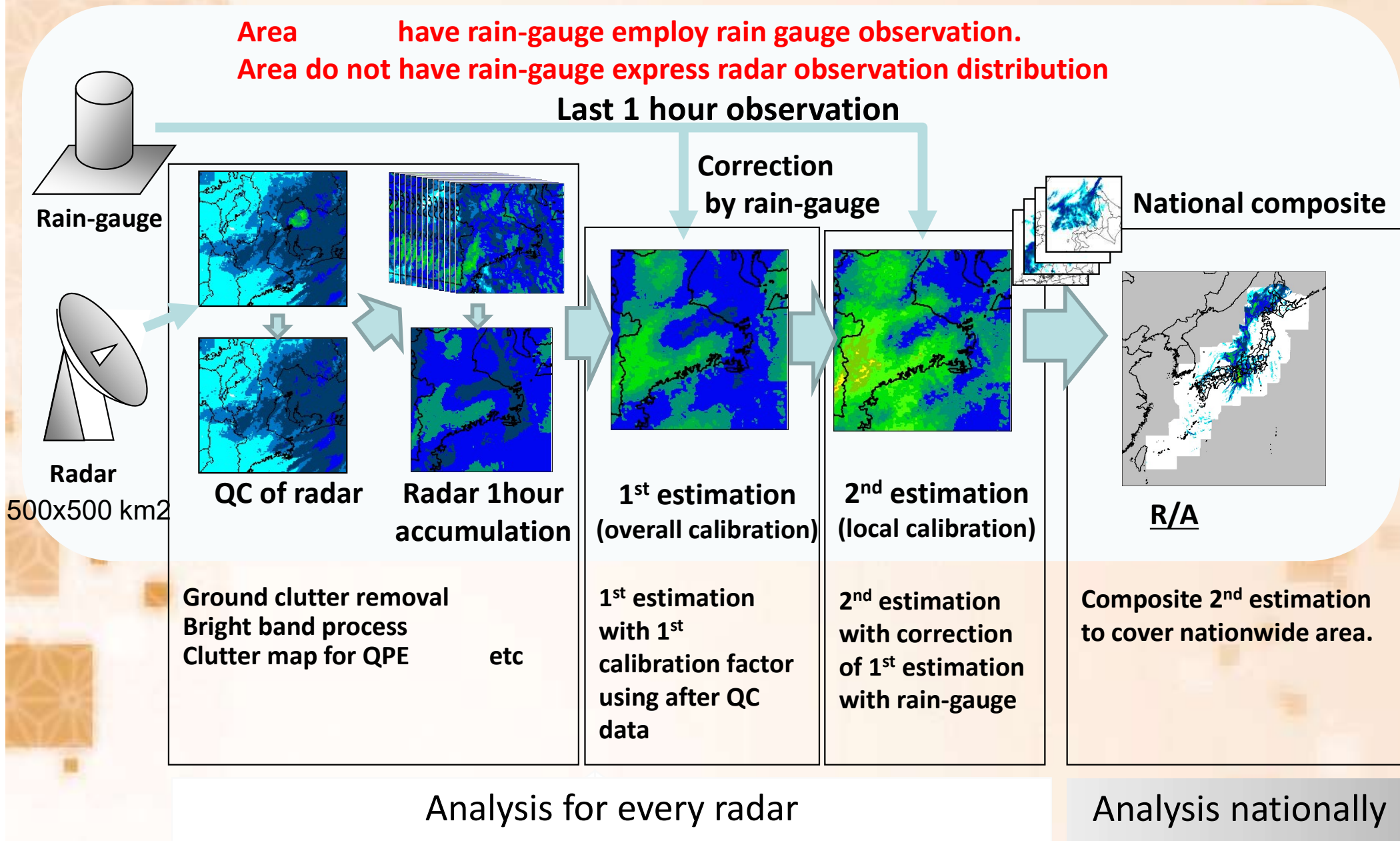
□ **Local government 5,700 points**

● **JMA 20 sites** Every 5 minutes

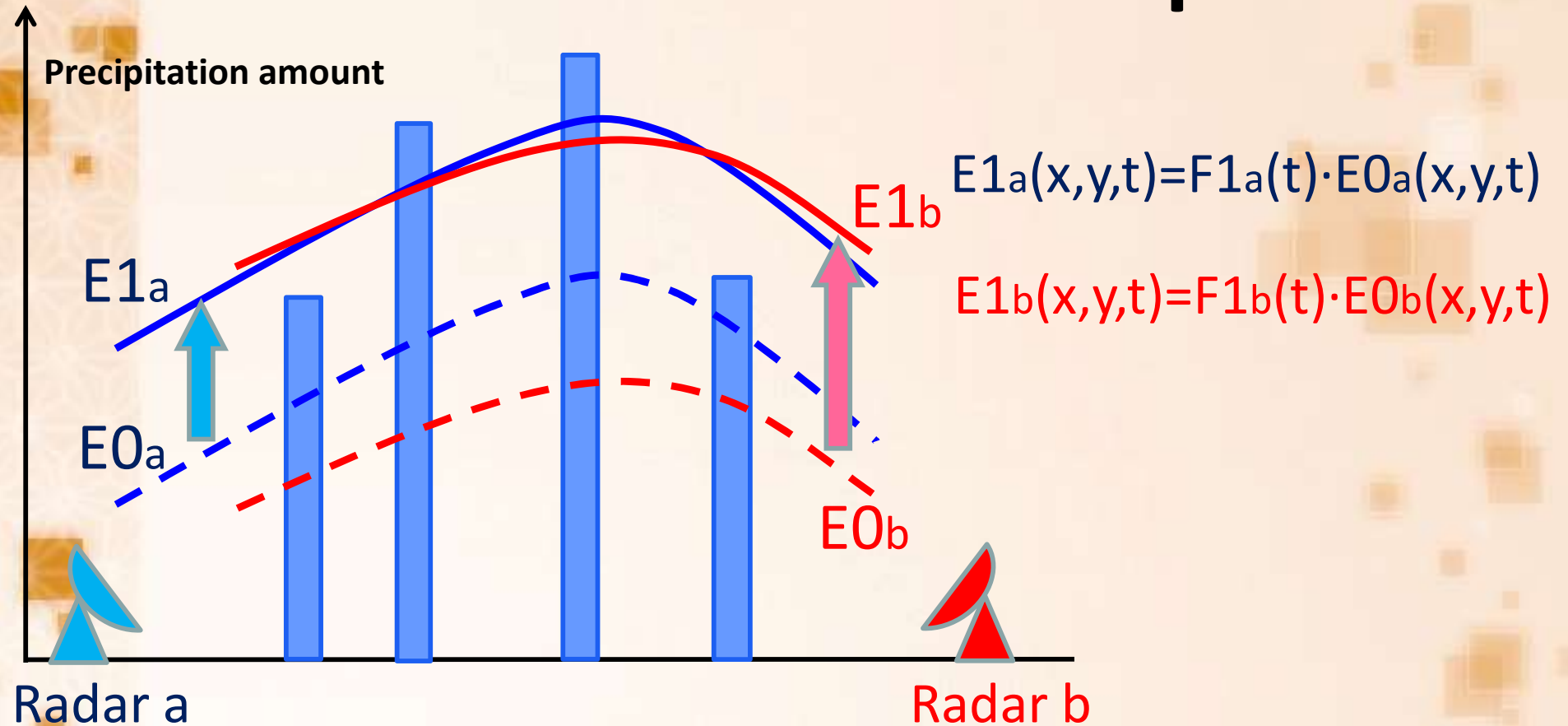
△ **MLIT 26 sites**

# JMA is an extra-ministerial bureau of the MLIT.

# R/A processing algorithm



# First Calibration of Radar Precipitation

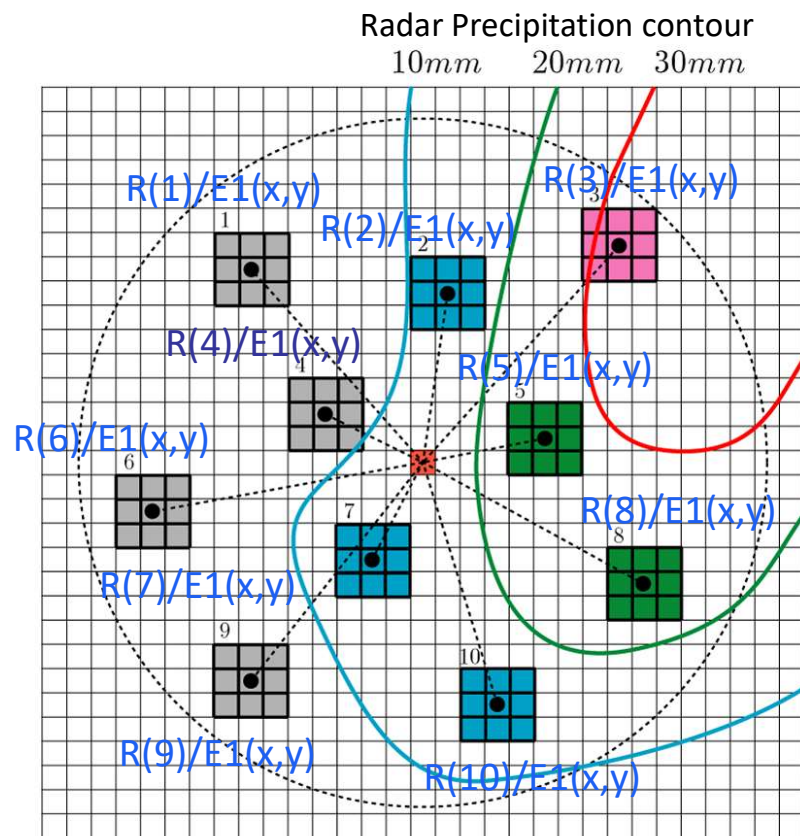


First calibration factor is made to minimize a difference between  $E1a/R$  and  $E1b/R$  in a common observation area of Radar a, b.

$$\min \left[ \sum_{\text{radar } i}^{\text{the number of radar sites}} \sum_{\text{radar } j \neq \text{radar } i}^{\text{the number of radar sites}} \sum_{\text{radar } i \cap \text{radar } j}^{\text{the number of raingauges}} \{F1_i(t) \cdot E0_i(x, y, t) - R(x, y, t)\} \right] \rightarrow F1_i$$

# Correction Factor for Second Estimation

1. Calculation of Correction Factor (C2) for rain-gauge grids
2. Calculation of Correction Factor for all the grids



• raingauge grids R(i)    ■ target grid g E1(x,y)

Correction Factor of rain-gauge grid  $i = R(i)/E1(x,y)$

■'s correction factor =

$$CC2(x,y) = \frac{\sum_{i=1} W(d) \times C2(i)}{\sum_{i=1} W(d)}$$

$$E2(x,y) = CC2(x,y) \cdot E1(x,y)$$

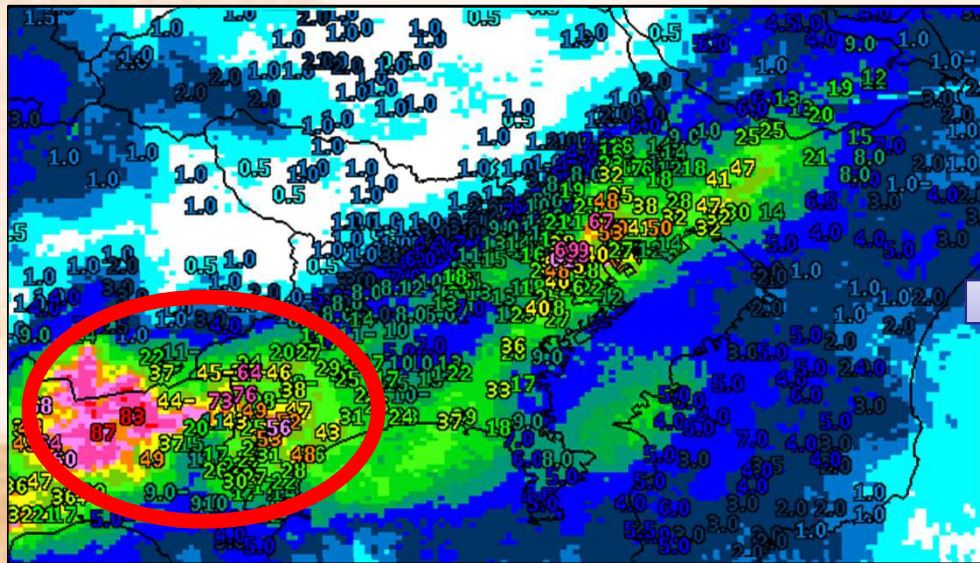
E2 (x,y) : Second Precipitation Estimation  
 C2(i) : Correction Factor at the grid of rain gauge #i  
 CC2(x,y): Correction Factor at the grid g  
 W(d) : weight of rain gauge #i to grid g  
 (x,y): grid position  
 i : rain gauge number

**\* weight W(d) \***

d = distances between the grid g and rain gauges

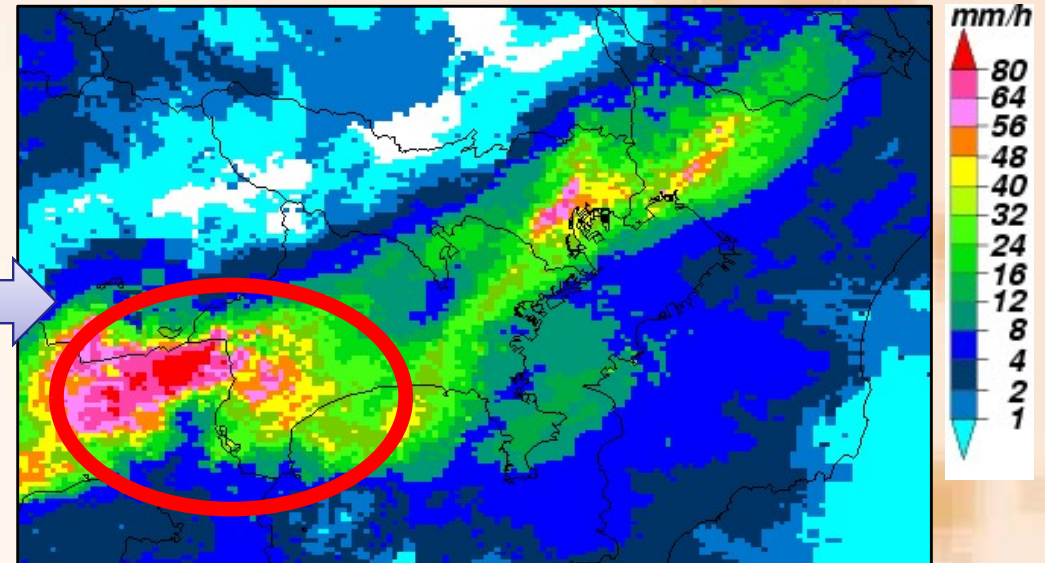
# Accurate/Spatially spread Precipitation measurement

Distribution of rainfall amount by Radar with rain-gauge



Generally, radar estimate lower than rain-gauge

R/A

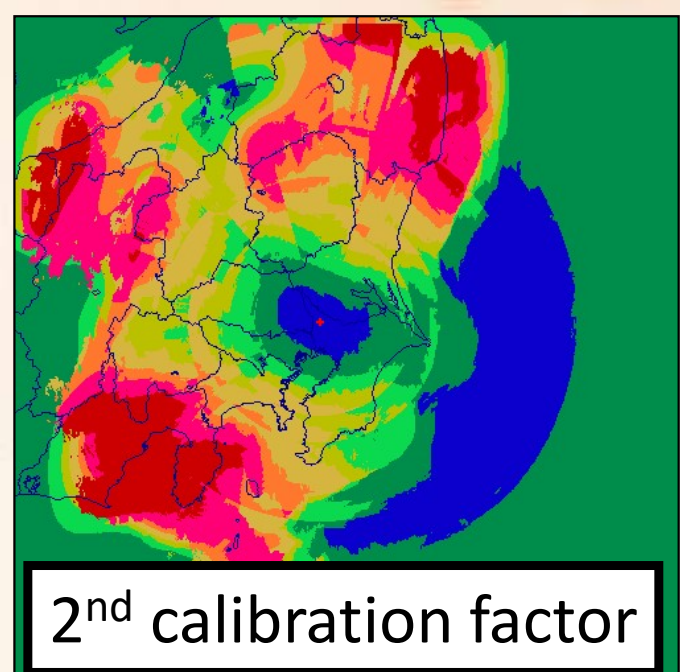
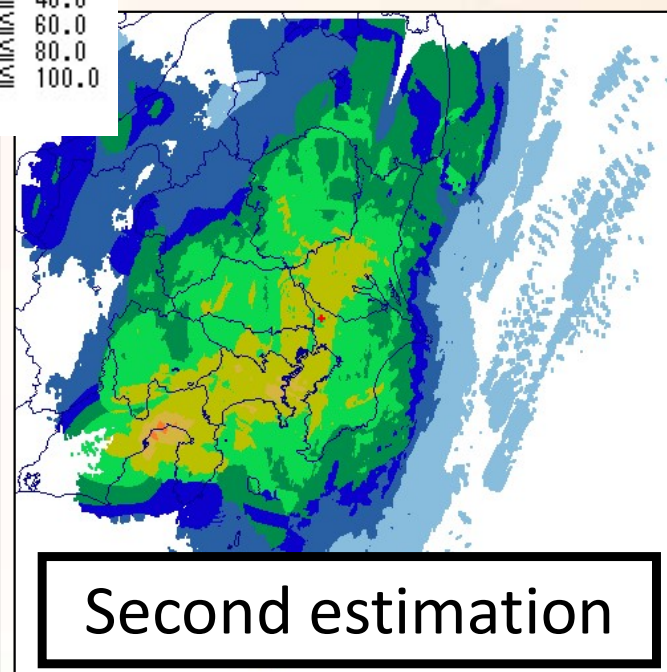
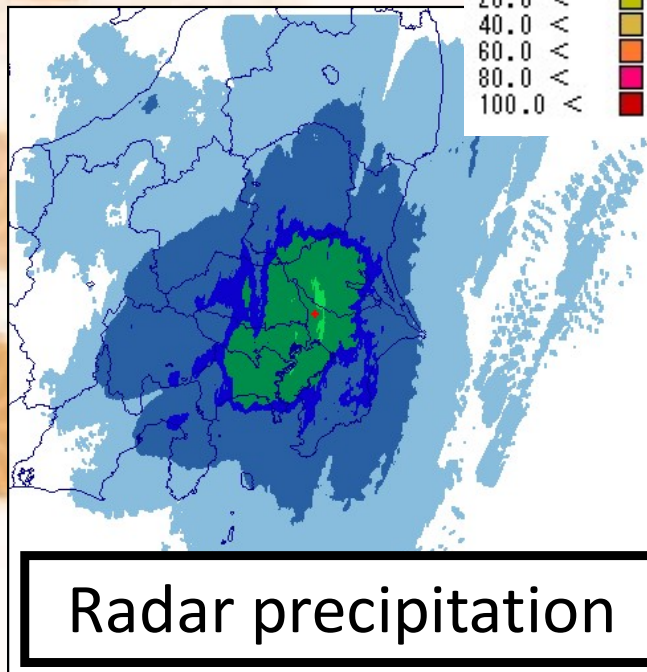
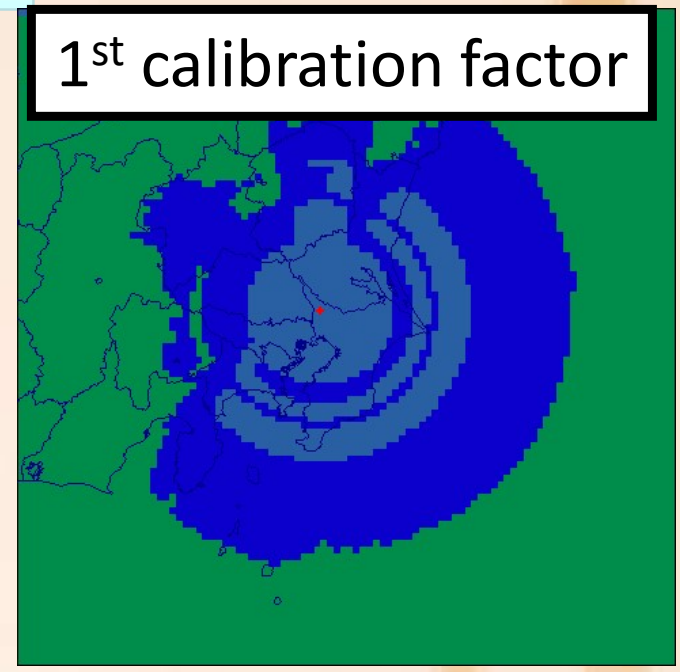
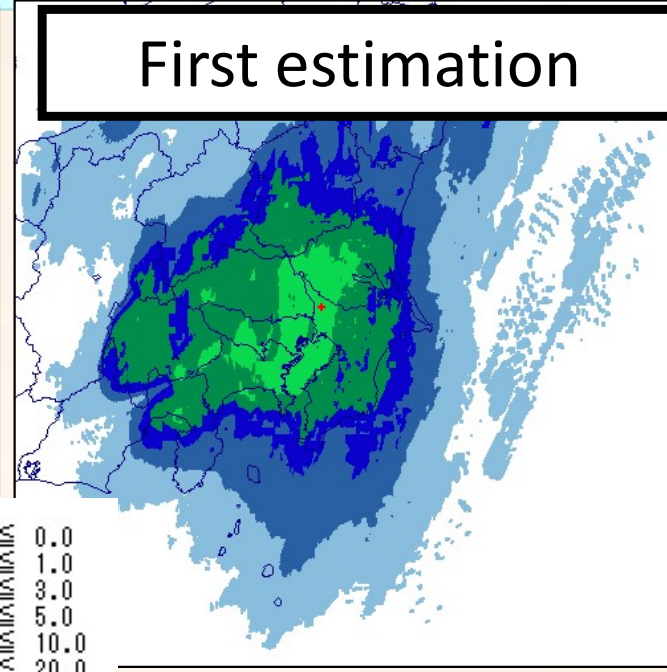
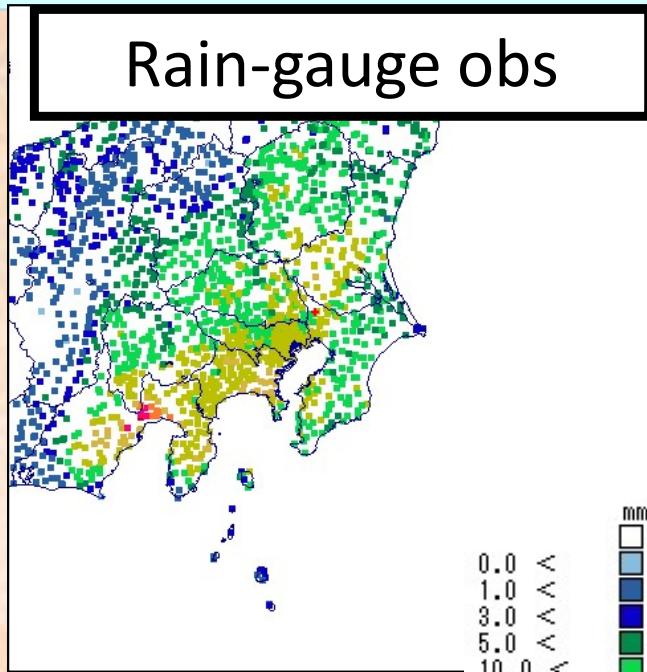


Distribution better than radar accumulation



# Comparison first and second calibration

2014/10/6 9:00(JST)



After upward correction of 1<sup>st</sup> calibration, calibrated locally by 2<sup>nd</sup> calibration. logical 9

# Summary

- QPE takes advantage on the radar and the rain-gauge observation.
- Quality Control process is vital to prevent inclusion of contaminated data.
- R/A is essential as a basic information to analyze disaster risk and to publish disaster-prevention information on JMA early warning system.