WORLD METEOROLOGICAL ORGANIZATION

CBS-CIMO Remote Sensing/ Doc. 6(3)

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ITEM: 6

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Joint Meeting of
CBS Expert Team on Surface-based Remotely-Sensed Observations
(First Session)
and
CIMO Expert Team on Remote Sensing Upper-air Technology and Techniques
(Second Session)

Geneva, Switzerland, 23-27 November 2009

DEVELOP GUIDANCE AND METHODOLOGY FOR SURFACE BASED REMOTE SENSING MONITORING

Report from Japan

(Submitted by Hakaru MIZUNO)

Summary and Purpose of Document

The document presents a brief overview of the methods used for surface-based remote sensor monitoring in Japan.

ACTION PROPOSED

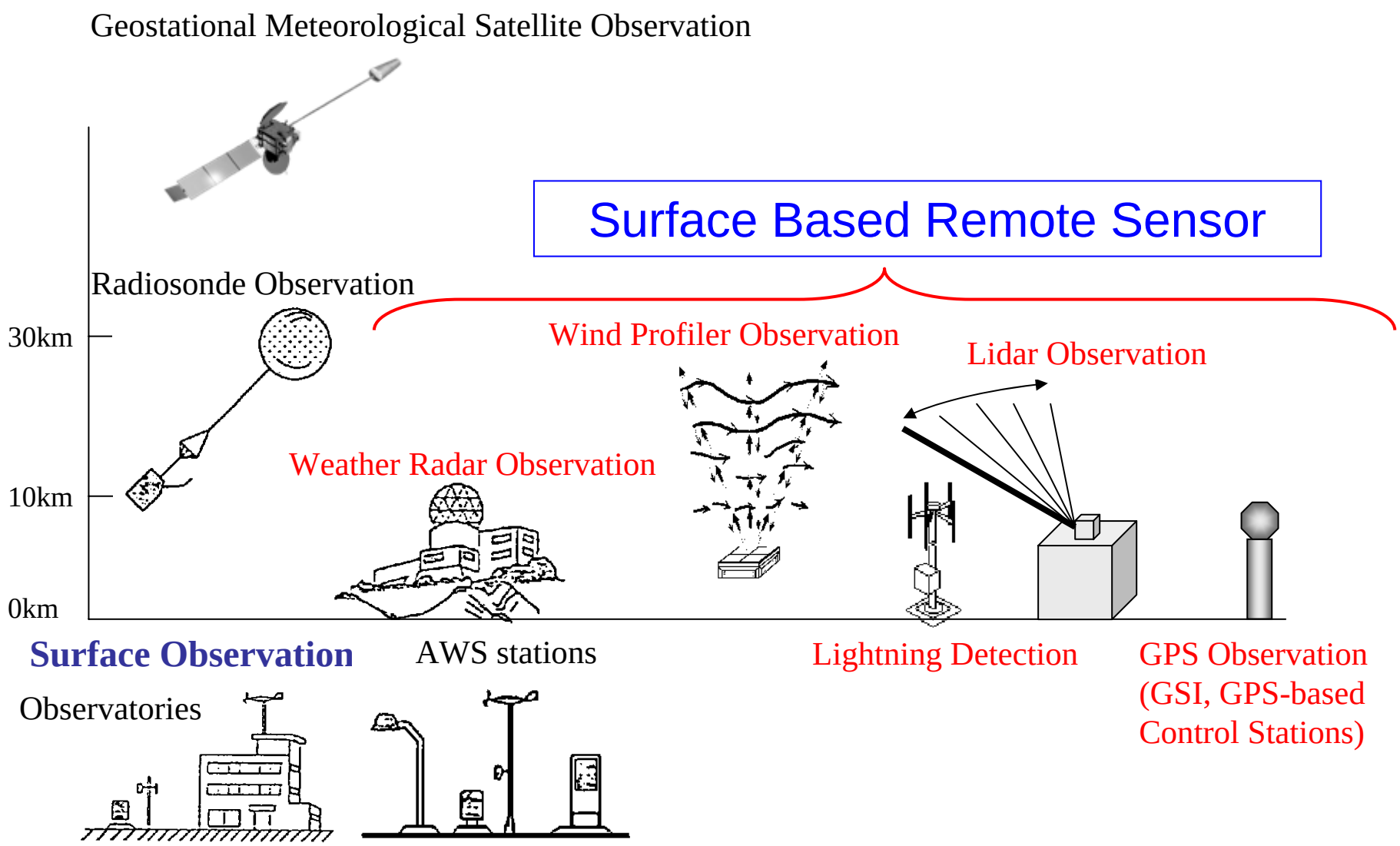
The meeting will be invited to develop the methodology and standard guidance material that can be used for the monitoring of surface-based remote sensor systems.

Surface Based Remote Sensors in the Japan Meteorological Agency

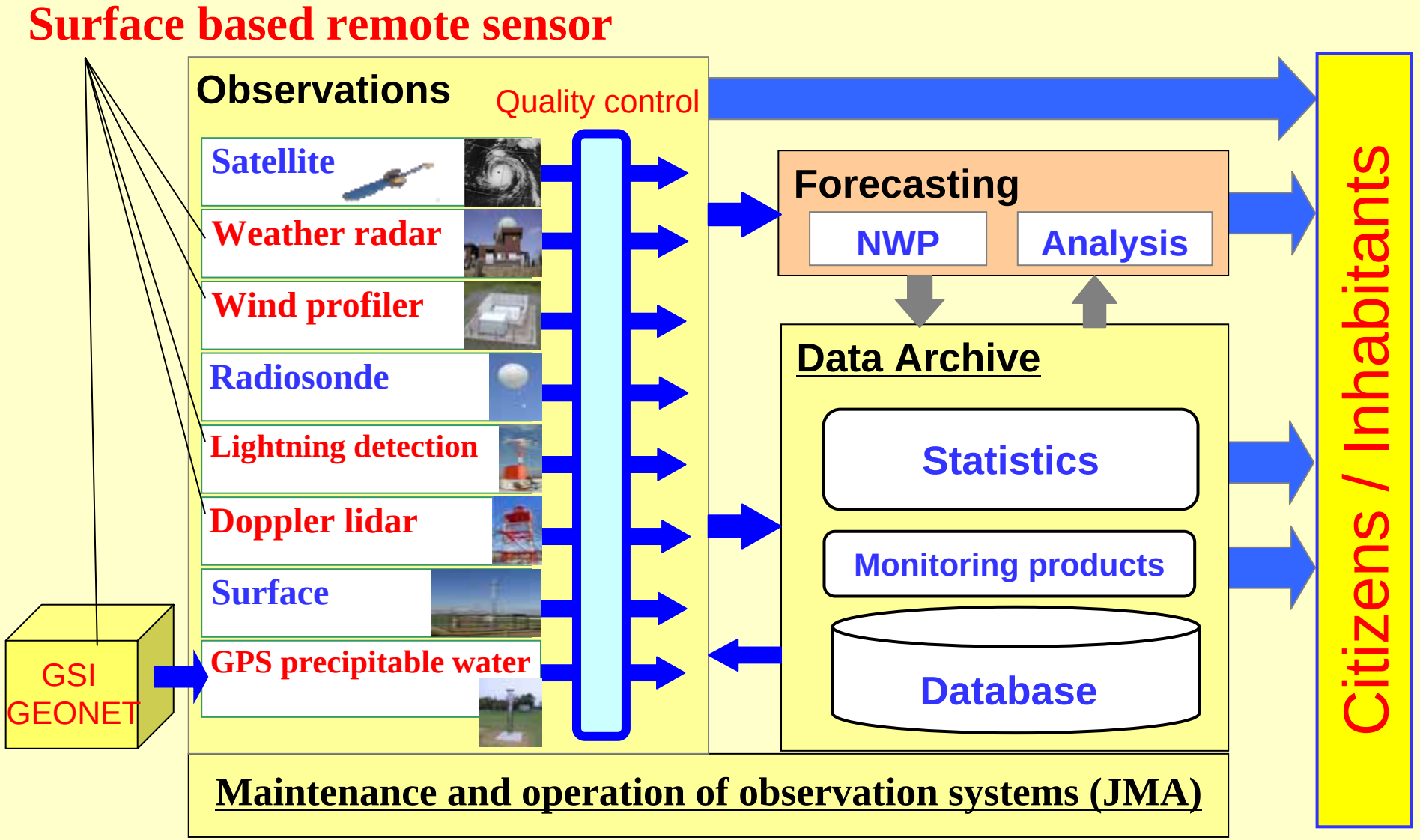
Hakaru Mizuno
(Kenji Akaeda)
Japan Meteorological Agency

WMO
Joint Meeting of the CBS Expert Team on Surface Based Remote Sensing (First Session)
and
CIMO Expert Team on Remote Sensing Upper-air Technology and Techniques (Second Session)
23-27 November 2009, Geneva (Switzerland)

Overview of the Observation Systems



Observation Data Flow



Radar Observation

Brief History

1954 Installation of the Osaka radar

1964 Installation of Mt. Fuji radar

1971 Installation of Kushiro radar
Completion of radar observation network

1982 Beginning of digitization (Nagoya, Fukui)
First-generation digitization

1994 Ishigakijima radar substitute for Miyakojima radar
Completion of first-generation digitization

1995 DRAW(Kansai Airport)

1997 Second-generation digitization
Centralization (Tokyo District)

1999 Mt. Fuji radar stopped Shizuoka radar

Nagano radar

2002 Completion of second-generation digitization

2003 Installation of 1km-mesh composite equipment (JMA headquarters)

2005 Beginning of the Radar Observation and Processing System (ROPS)(Eastern Japan)

2006 Beginning of replacement program for Doppler radar (Tokyo radar)

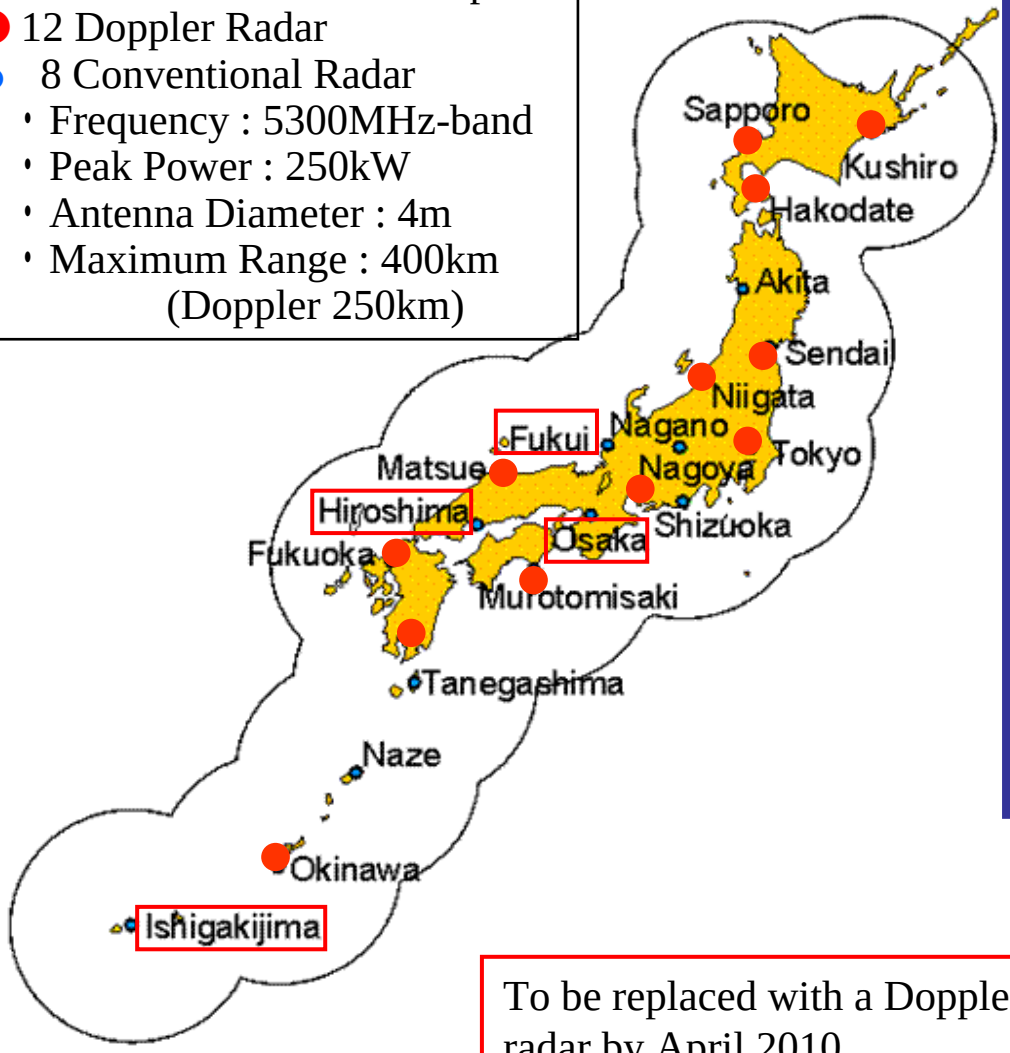
2008 Beginning of the ROPS (Western Japan)
Completion of centralization

2009 2009 Replacement of 5 sites for Doppler radar

Radar Observation Network

General Weather Radar

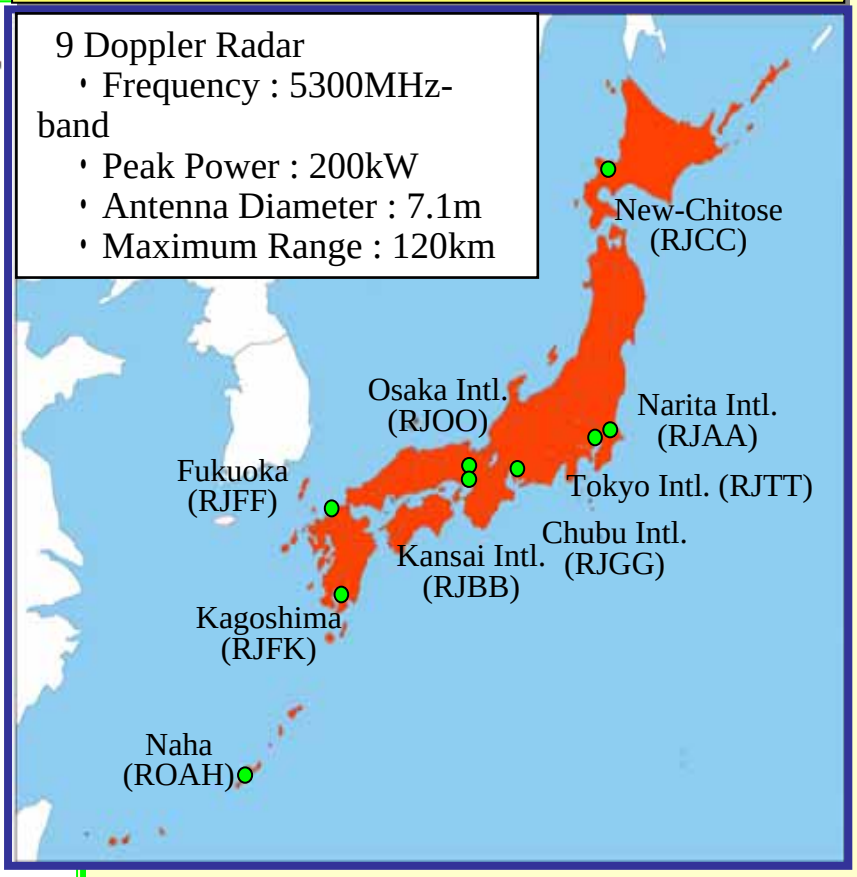
20 Radars cover almost of Japan.
- 12 Doppler Radar
- 8 Conventional Radar
  - Frequency : 5300MHz-band
  - Peak Power : 250kW
  - Antenna Diameter : 4m
  - Maximum Range : 400km (Doppler 250km)



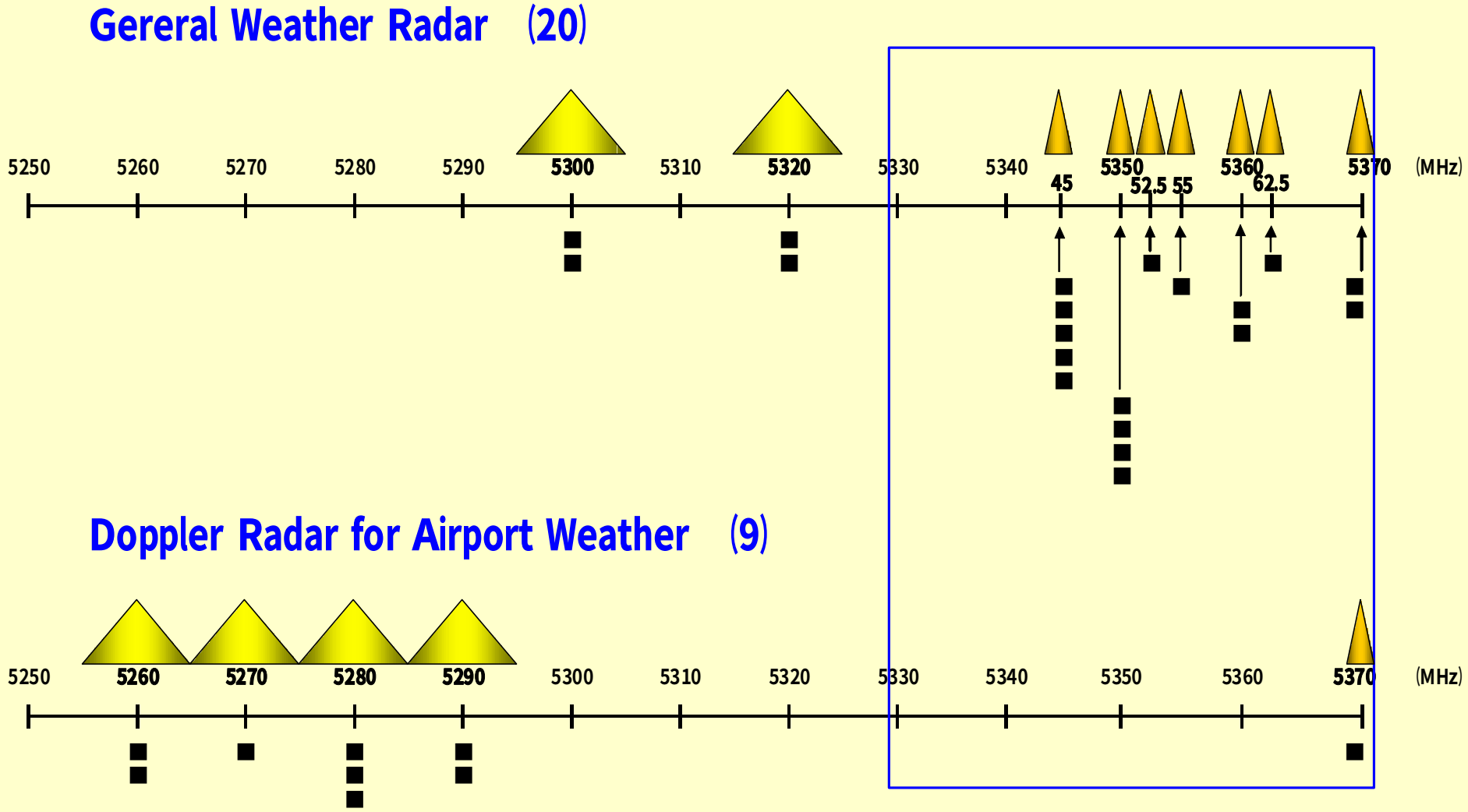
To be replaced with a Doppler radar by April 2010.

Doppler Radar for Airport Weather

9 Doppler Radar
- Frequency : 5300MHz-band
- Peak Power : 200kW
- Antenna Diameter : 7.1m
- Maximum Range : 120km



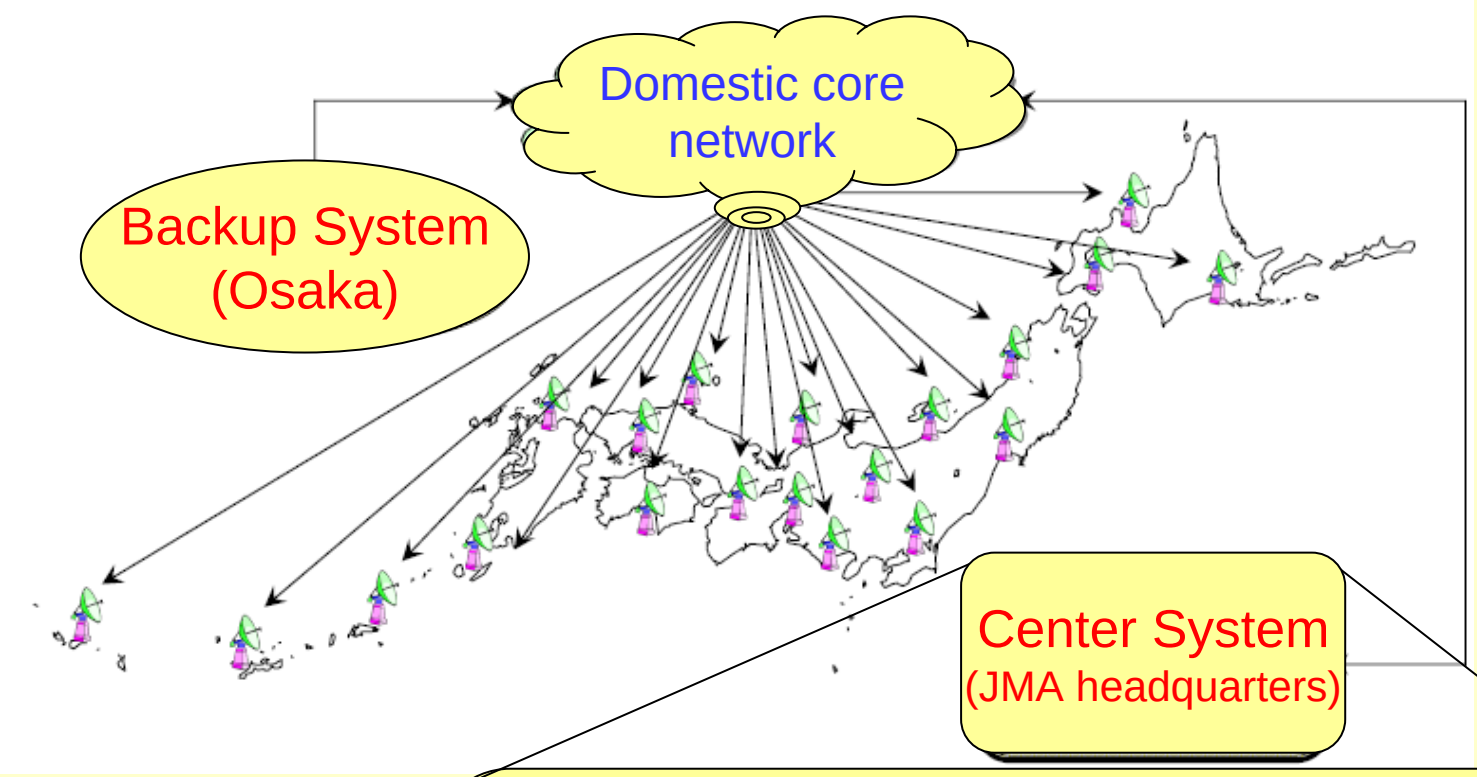
Frequency Allocations for the JMA Radar Operation



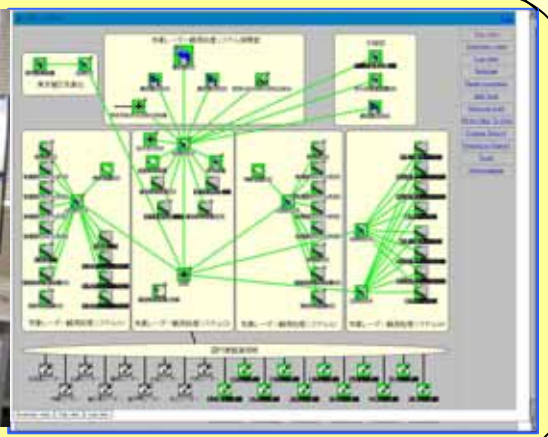
Characteristics of general weather radar

Characteristics	General Weather Radar
Frequency	5300～5370 MHz
Wavelength	5.59 ～ 5.66 cm
Peak Power	250 kW
Pulse width	2.5 ×10^{-6} s, 1.0 ×10^{-6} s
Antenna diameter	4.0 m
Beam width	1 ～ 1.2 deg
Observation range	400 km
Observation Interval	10min, 5min(2km-level intensity)
Distance resolution	250m

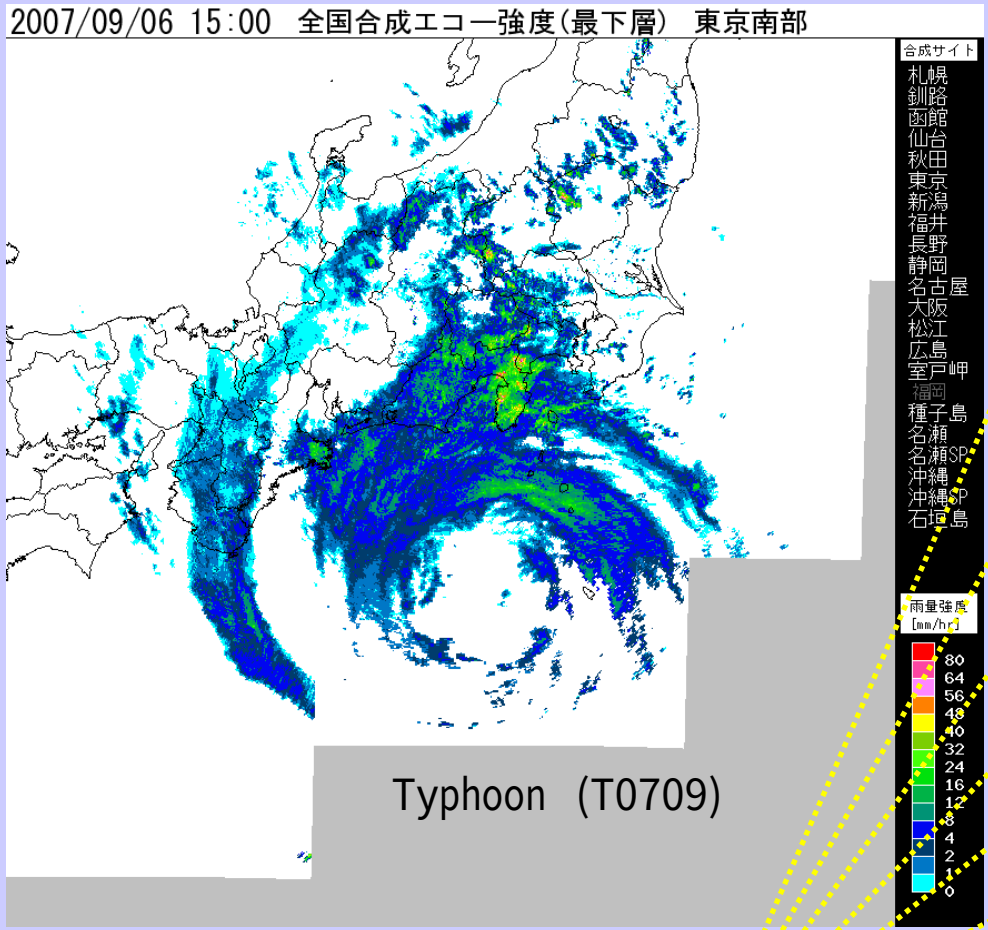
Radar Observation and Processing System

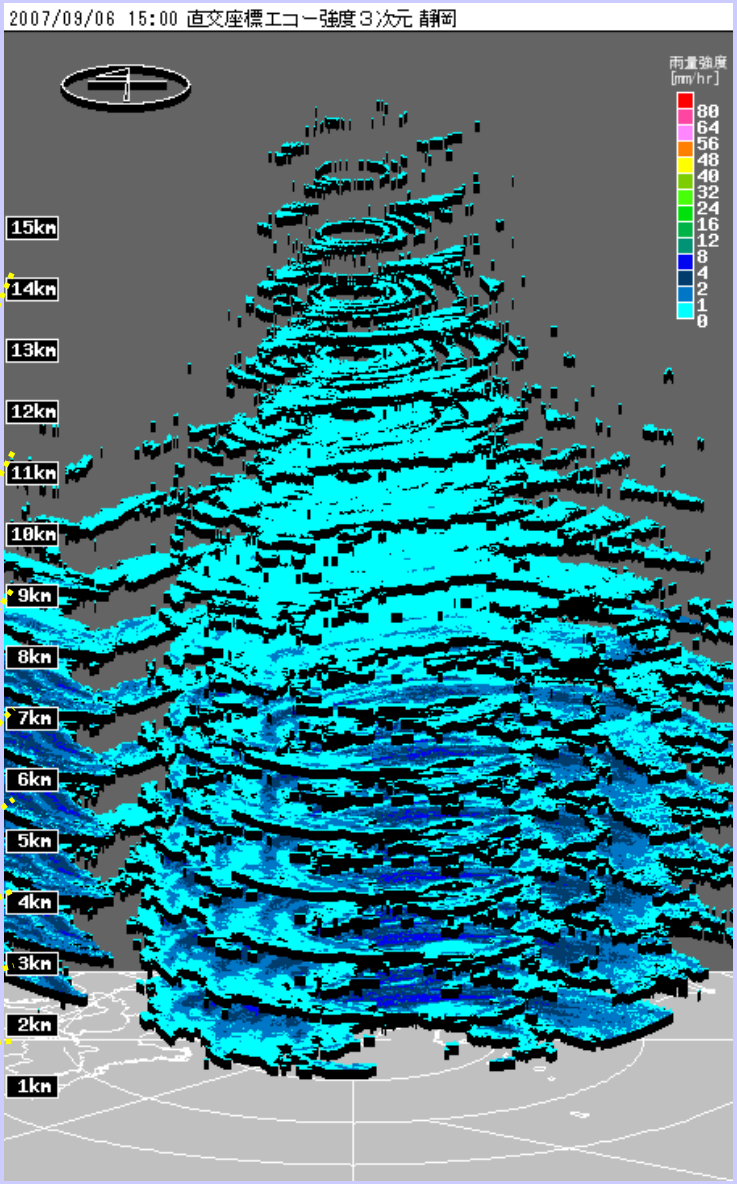


Remote control and watch
Data processing

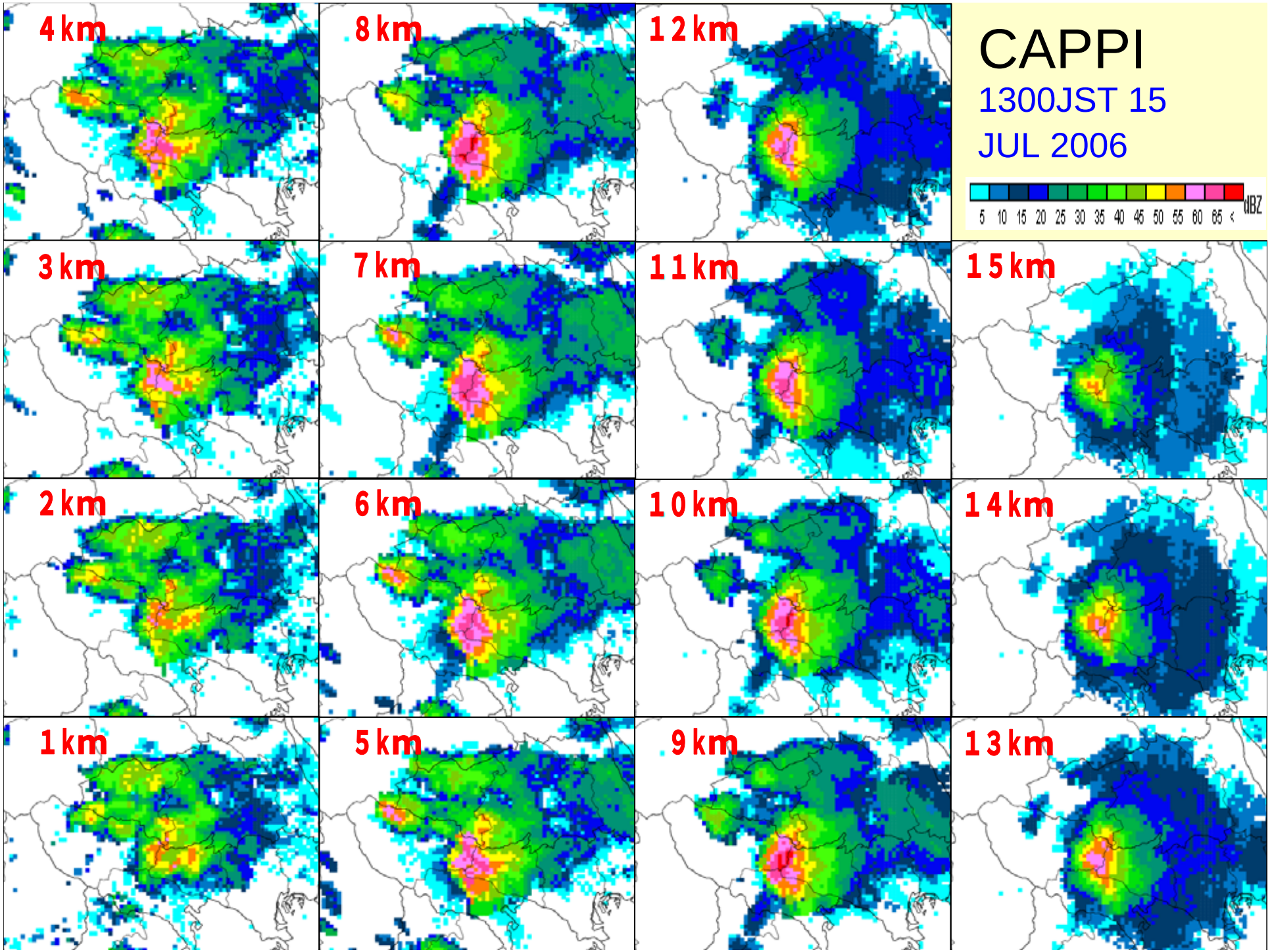


3-dimensional radar observation

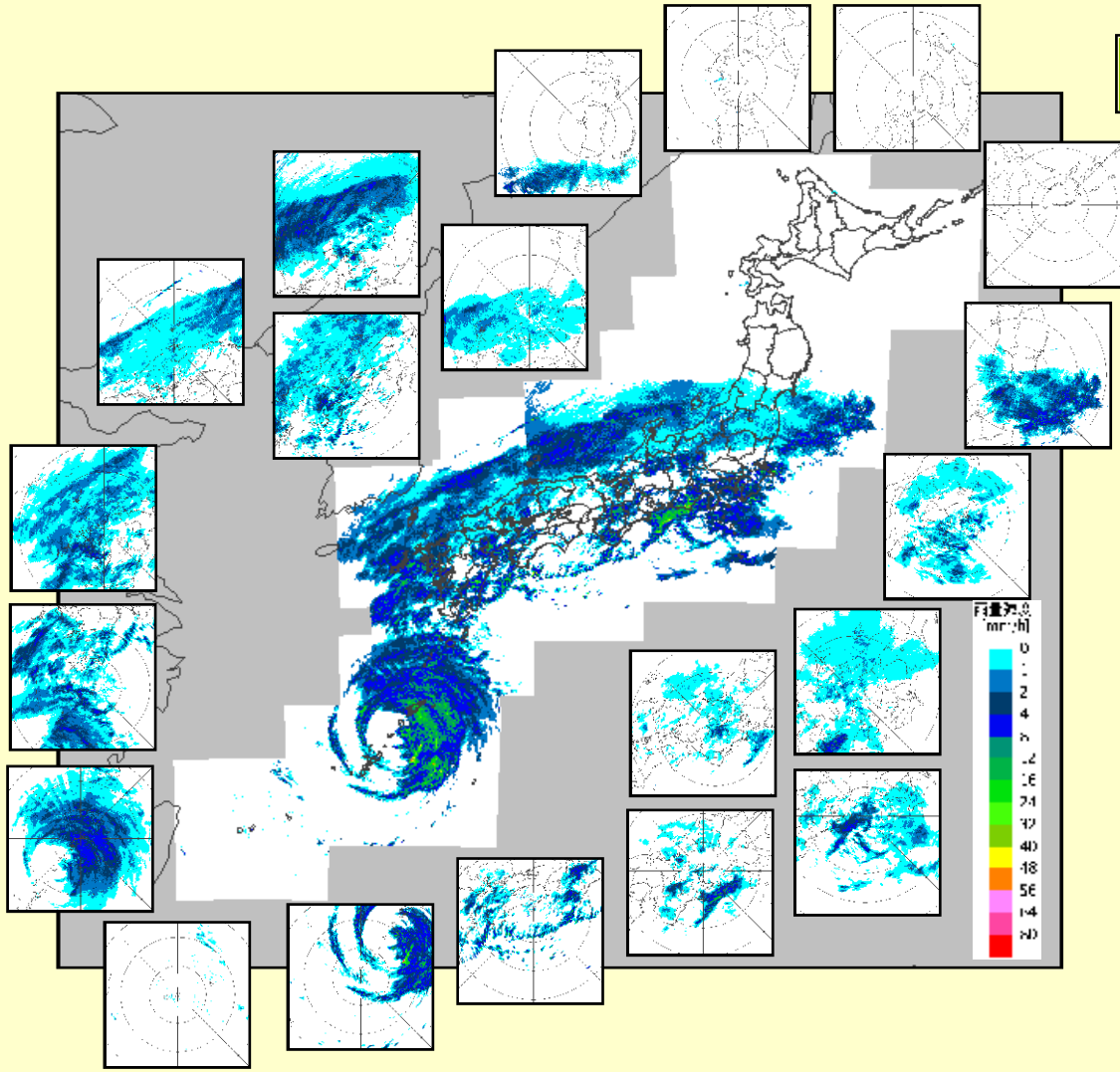


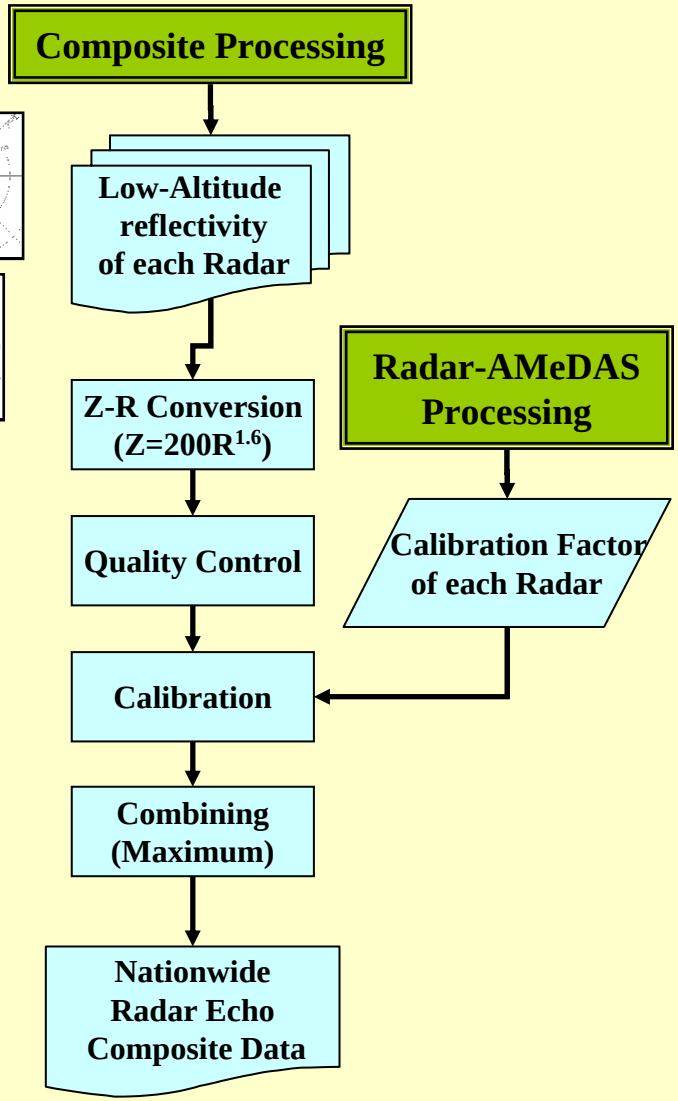


Horizontal resolution 1km ×1km
Vertical resolution 1km(0-15km)
Time resolution 10 min.
5 min.(2-km level)


4km
8km
12km
CAPPI
1300JST 15
JUL 2006
5 10 15 20 25 30 35 40 45 50 55 60 65 <
dBZ
3km
7km
11km
15km
2km
6km
10km
14km
1km
5km
9km
13km

Composite Radar Echo Intensity

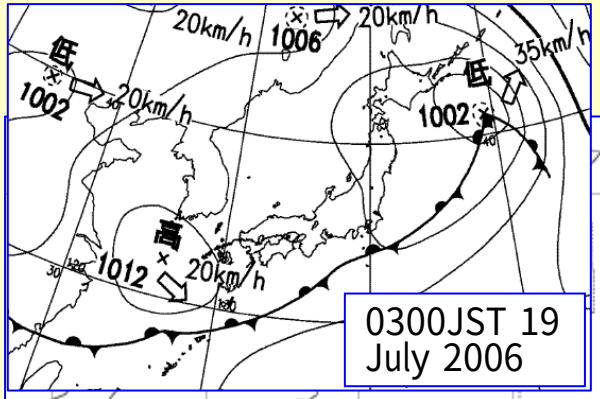




All radar echo data are collected to the center system, and nationwide composite map is made.

Monitoring heavy rainfall

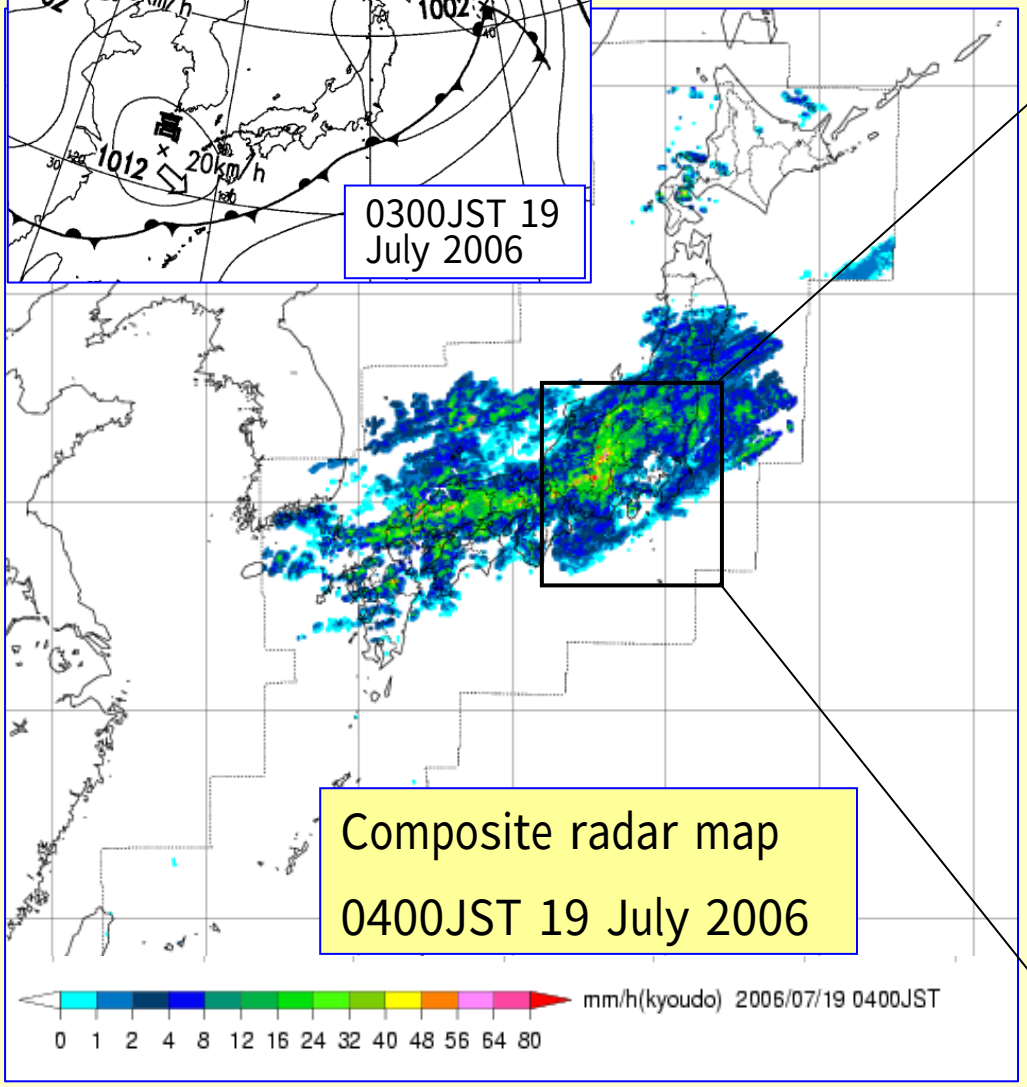
Horizontal resolution 1km ×1km
Time resolution 10 min., 5 min.(2-km level)

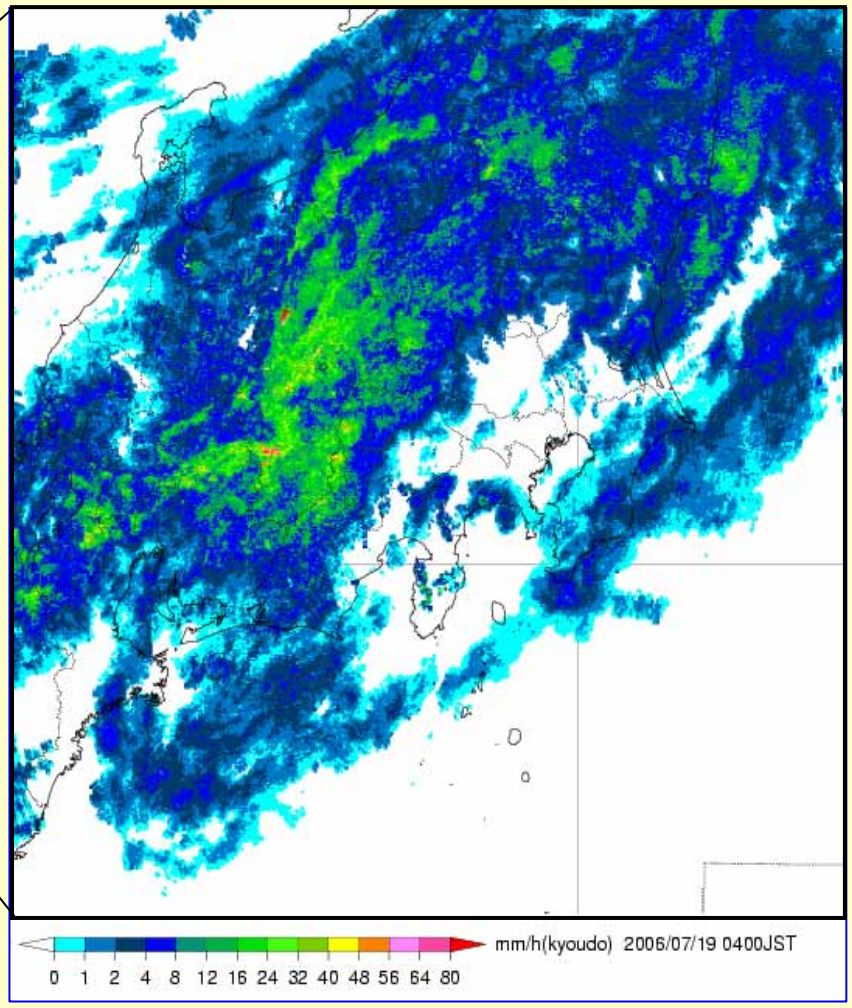


0300JST 19 July 2006

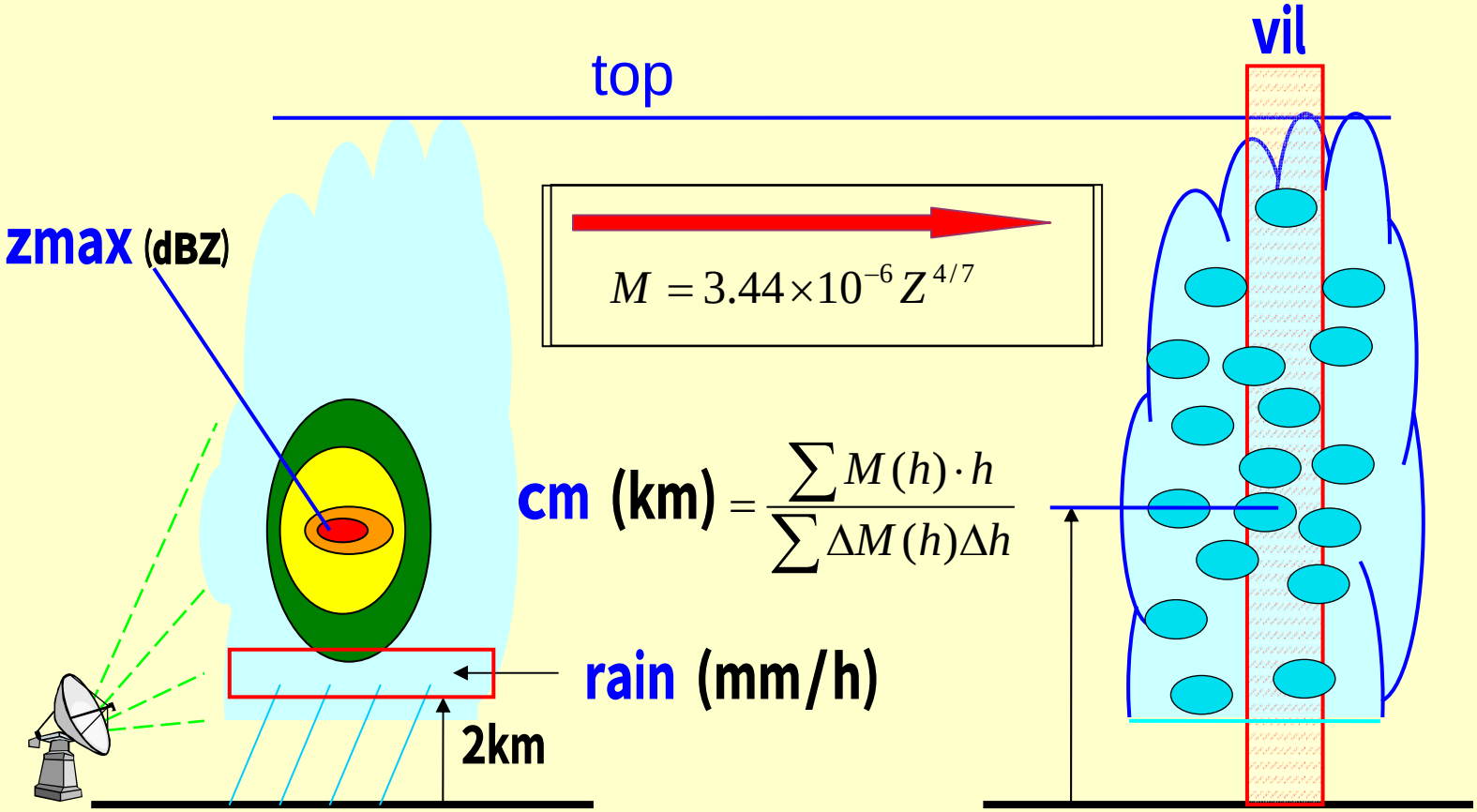
Composite radar map

0400JST 19 July 2006





Calculation of radar echo indexes

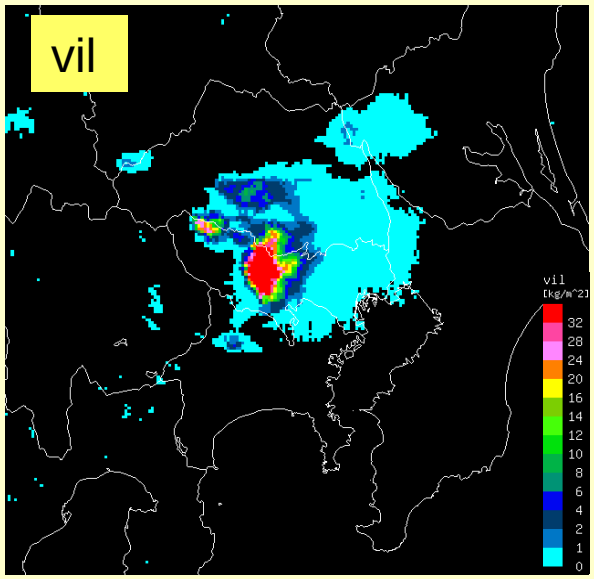


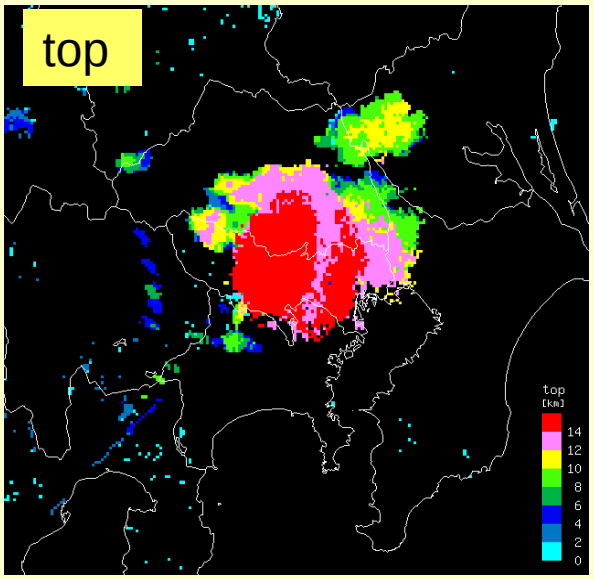
$$\text{vil} = \sum M(h) \cdot h$$

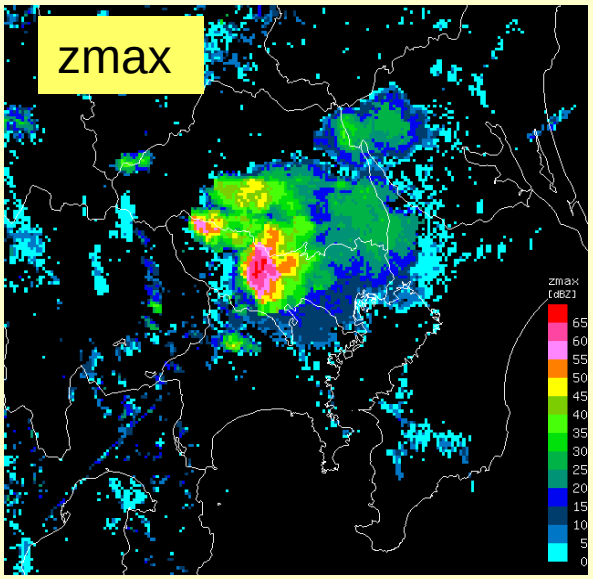
vild=vil/top

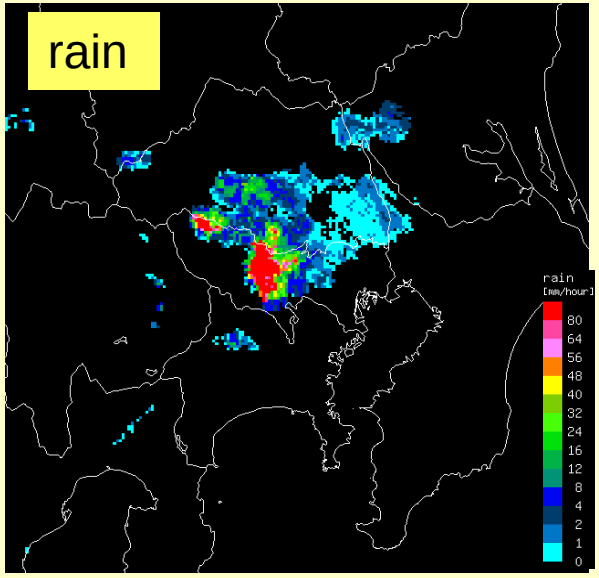
Example of radar echo index

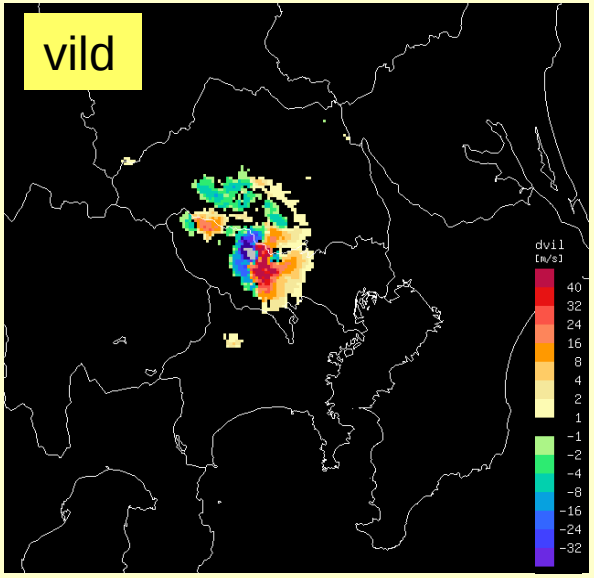
1300JST 15 JUL 2006

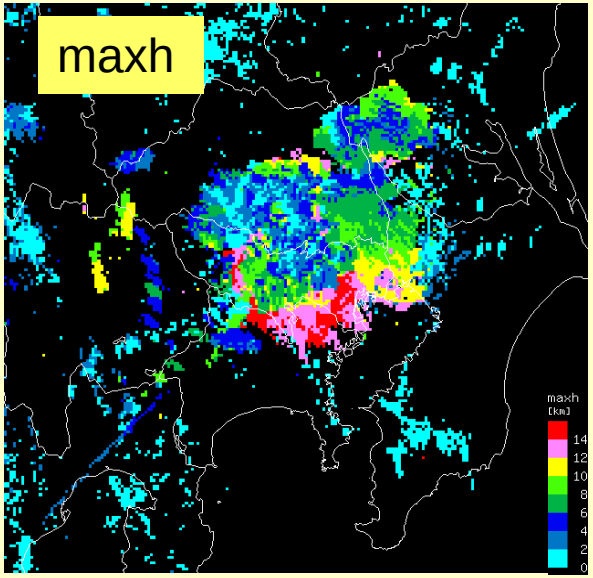




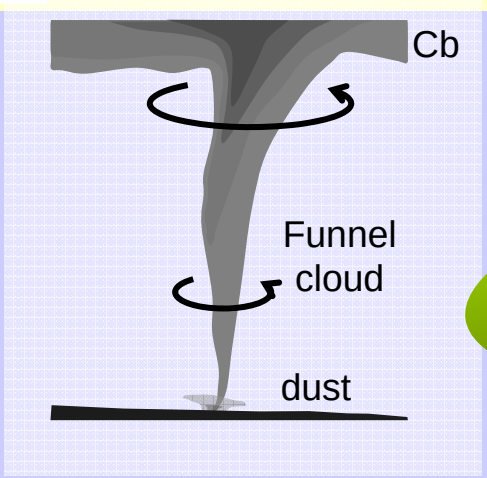


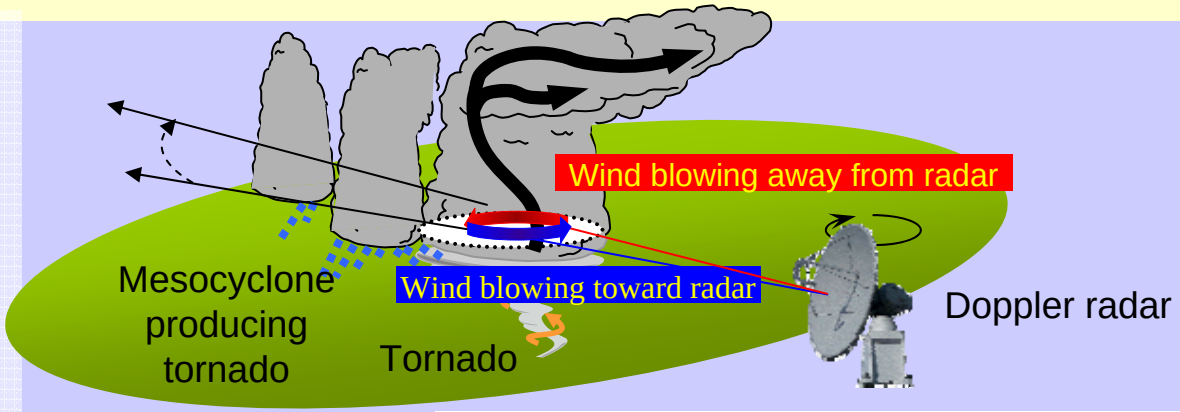


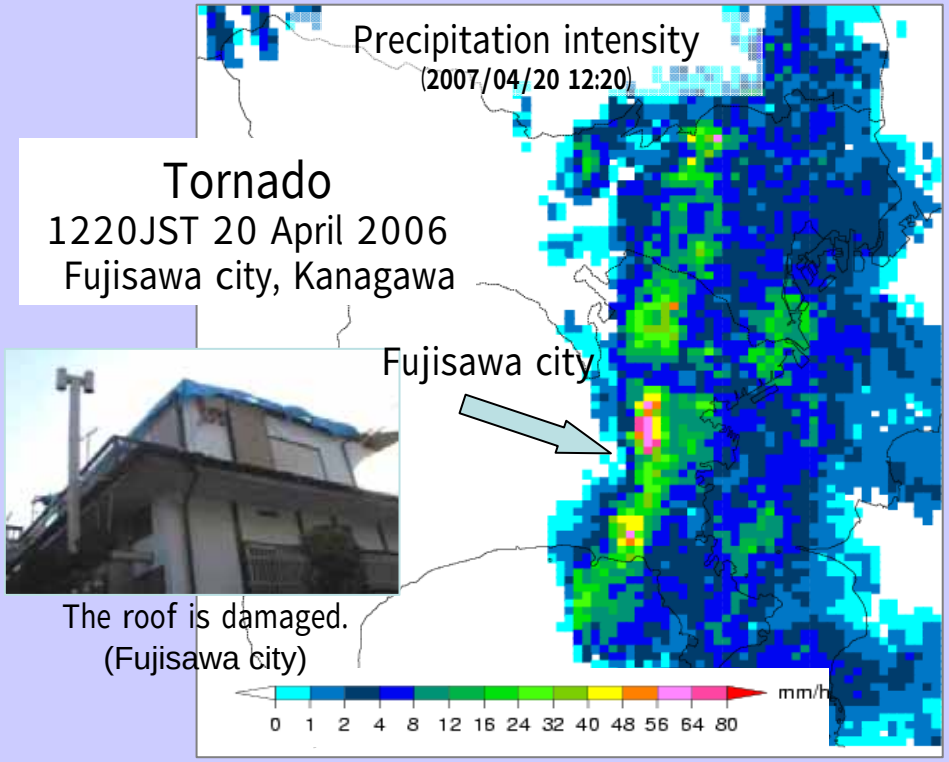


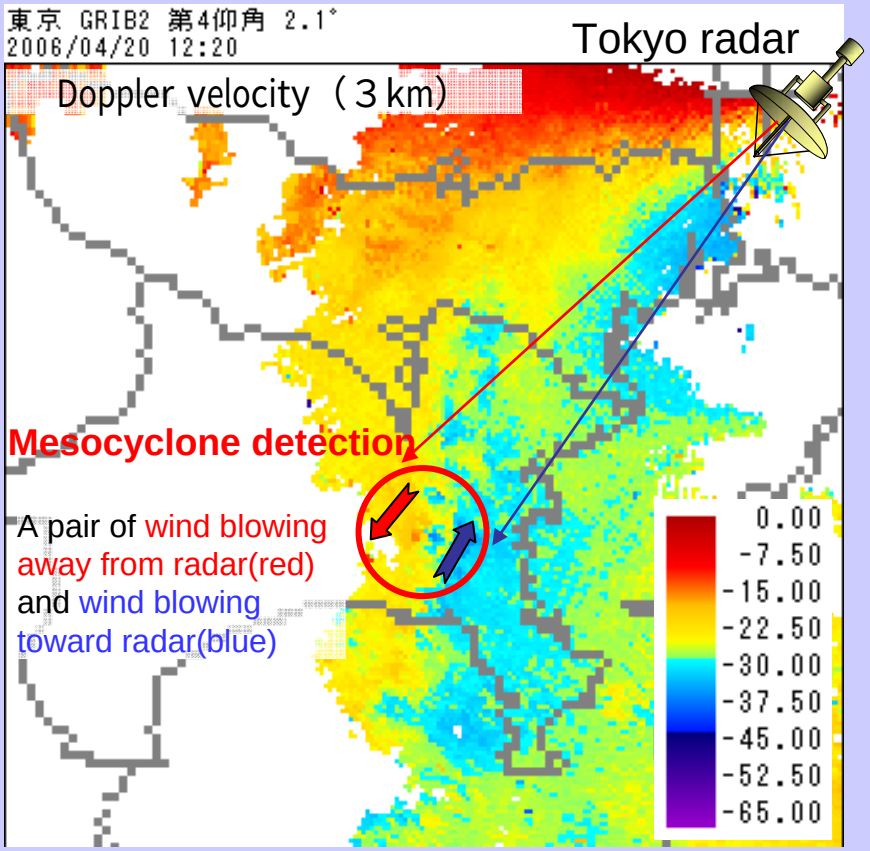


Mesocyclone detection with Doppler radar



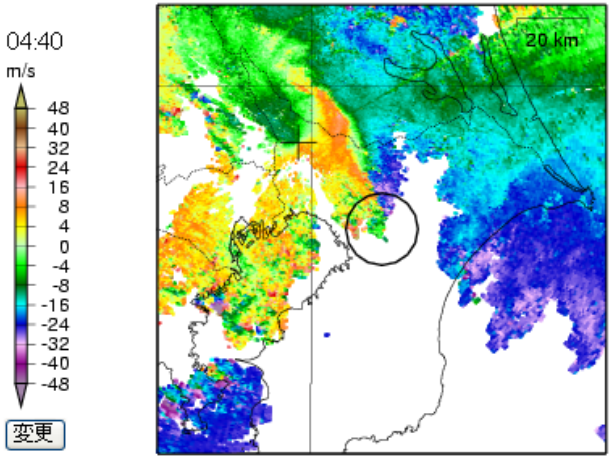




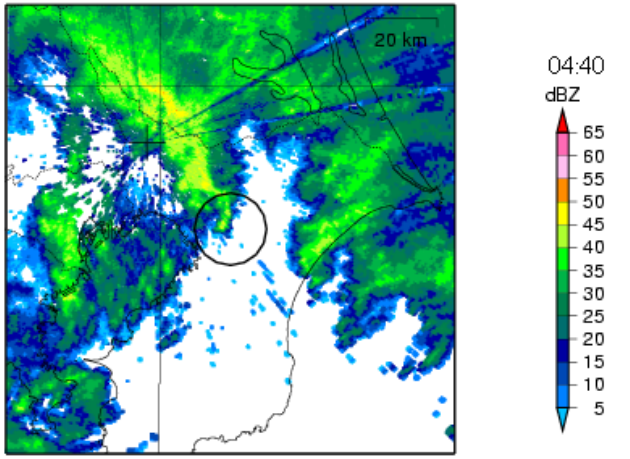


Example of mesocyclone detection

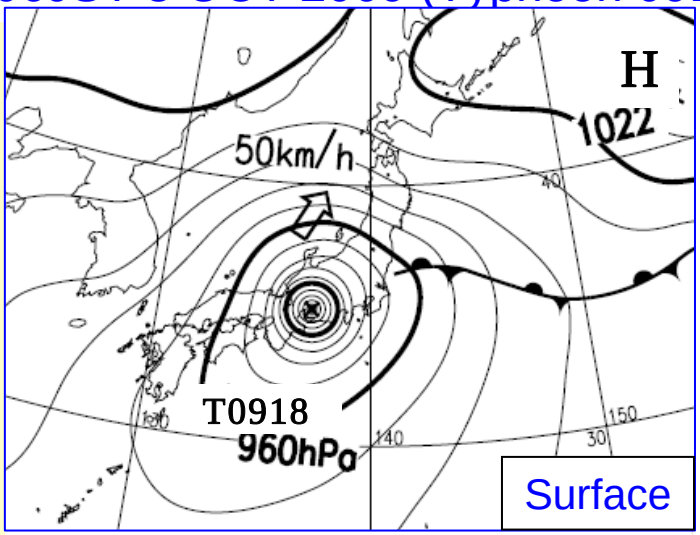
Doppler velocity



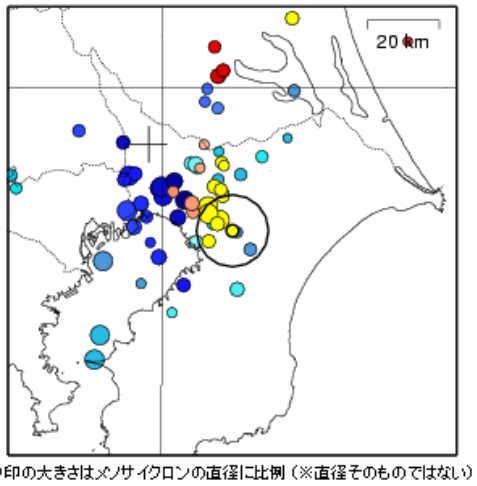
Echo intensity



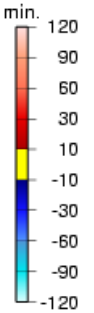
06JST 8 OCT 2009 (Typhoon 0918)



Mesocyclones



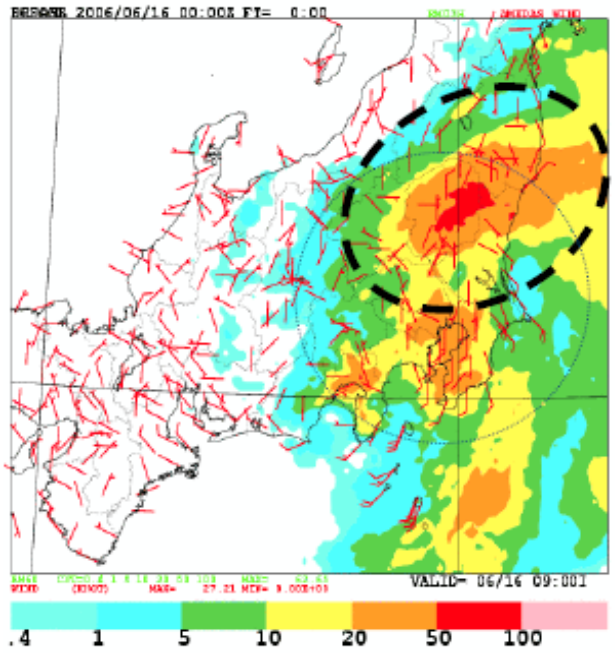
Time from 0436JST



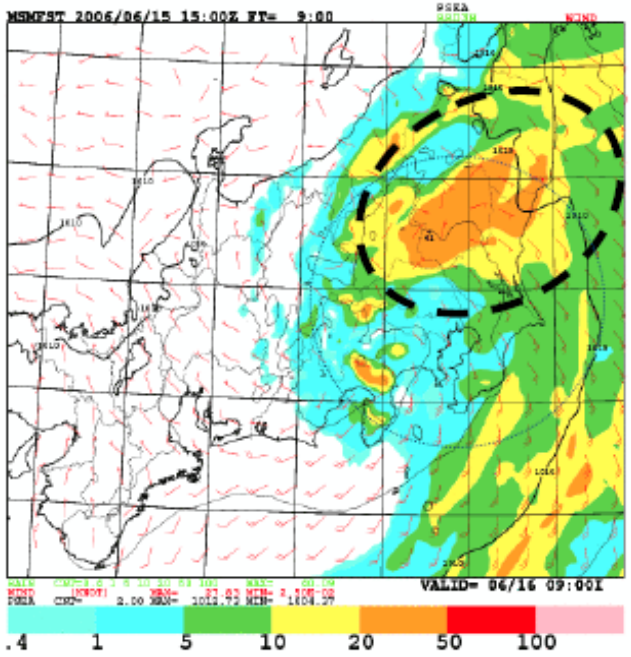
Impacts of Doppler velocity on Numerical Prediction

The Doppler radar (radial velocity), which was obtained from Doppler radar, was assimilated into the meso-scale numerical model of the JMA.

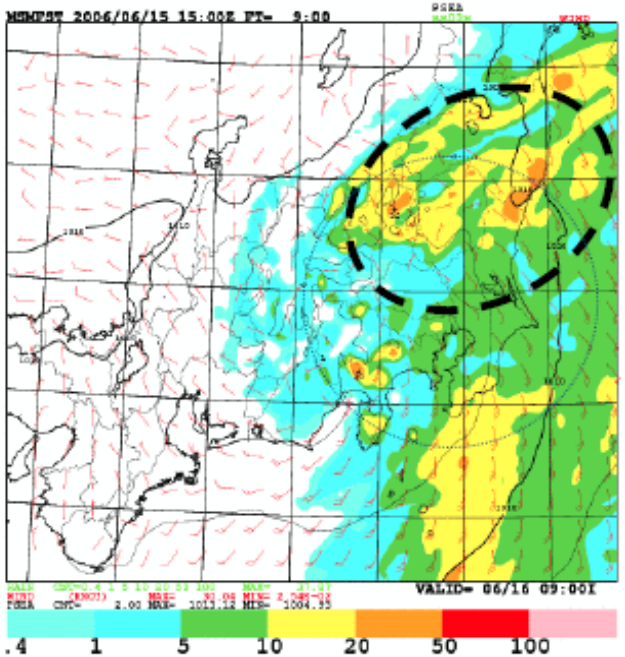
Precipitation



with Doppler velocity



without Doppler velocity



Rainfall amount during 6JST to 9JST forecast hours from the initial condition of 6JST on 16 June 2006.