Integrated use of weather forecasts and other disaster information for effective emergency response and preparedness in Japan

Kenzo Hiroki
Senior Researcher
Public Works Research Institute
Ministry of Land, Infrastructure and Transport
Case of Abukuma River Disaster
Isopluvial map of the Abukuma River Basin

Mafune Rainfall Ganging Station:
- maximum hourly precipitation of 90 mm
- total precipitation of 1,268 mm in a week
Precipitation and water levels of the Abukuma River

Maximum hourly precipitation of 90 mm

Above the specified stage for 6 days
Heavy Rain in August 1998

• Radar Rainfall Map (Aug 26 – Sept 1, 1998)

Source: Foundation of River & Basin Integrated Communications
Overflow of the river in Sukagawa City
Disaster Reduction is a fight against Information

- **Less time** for information dissemination (shorter internal processing time required)
- **Confusion** of information at the time of disaster
- **Trade-off** between certainty of information and required time

”Redundant, background information” is important
Issue specific directives to critical area/sites

Communication with heads of local government on evacuation of residents

Informing and consulting ruling bodies

Provision of disaster information to people through mass media

Priority changes by disaster phase
### Case 1

Bank collapsed in the Ara River

*(Top priority: communication with the head of municipal government)*

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30</td>
<td>Bank reported to be in a critical stage</td>
</tr>
<tr>
<td>8:40</td>
<td>Advised Mayor for issuance of evacuation order</td>
</tr>
<tr>
<td></td>
<td>Hotline with Mayor was set up</td>
</tr>
<tr>
<td>9:00</td>
<td>Evacuation order reached to 500 households in the effected area</td>
</tr>
<tr>
<td>9:02</td>
<td>Bank collapsed</td>
</tr>
</tbody>
</table>
11:20  Requested Defense Force for rehabilitation operation
13:00  Water level dropped
    Restoration of the bank began
2:00 (next day)
    Bank was restored
Started to break up at about 8:29
About 8:30
Collapsed at about 9:02
Case 2

Bank in danger of collapsing due to water leakage
(Top priority: giving orders at the site and communicating with higher-level organizations)

7:00  30 m-long crack found (water leakage)
      Requested for dispatch of flood-fighting teams

10:00 Crack became larger, more water leakage
       Requested for dispatch of Defense Force
11:45  Crack size became 250m long
       Evacuation order for flood-fighting teams
13:00  Muddy water started leaking
       Evacuation orders to all people
14:00  Water level began to drop
       Collapsing of bank prevented
Abukuma River on the verge of overflow
Flood-fighting effort
Crack in the bank
Cycle of Information Collection & Utilization for Disaster Management

Current Information

Predicted Information

Determine probability of the catastrophe

Judgment

(Assessment of risks to act or not to act)

Information Sharing
Information Collection & Utilization

Points to note for each phase

(1) (2) Type of Information, Information Collection and Judgment of Accuracy

【Type of Information】
Core information
• rainfall, water level, pressure pattern, facility condition, disaster management structure, etc
• Information directly related to important phenomena (levee failure, inundation, etc)

Background information
• topography, residents locations, management structure of other organizations, evacuation
• Information relevant to the event

【Points】
• Redundant information and error information for core information is important
  → improvement of visual information is a challenge
• Expand the amount of related information (quality &
(3) Judgment (Decision Making for Action)

【Judgment Flow】

1. Understanding the Current Situation
2. Options for Action
3. Prediction
   - water level, inundation, facility condition, etc
4. Decision Making

【Points】
- Make understanding the current situation easier (GIS, etc)
- Improve prediction precision
- Provide decision support information
- Weather forecasting manager to join in decision making
(4) Information Sharing and Follow-up

- Organize information (data, etc)
- Process information (data, etc)

【Points】
• Information sharing between weather and disaster management personnel
• Developing common format that can be understood by both weather and disaster management personnel
• Develop/improve information sharing mechanism

- Feedback information (execution status of actions decided)
- Monitor changes in situation

【Points】
• Establish feedback flow from disaster manager to weather personnel
Lead Time has to be taken into account

1. Information collection → judgment of information accuracy → decision making

2. Decision making → information sharing → preparation → action

Such processes require time

For an example

<table>
<thead>
<tr>
<th>Target</th>
<th>Measures</th>
<th>Required time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residents</td>
<td>evacuation warning → information collection → decision making</td>
<td>approx 1 hr</td>
</tr>
<tr>
<td>Decision making</td>
<td>evacuation preparation → evacuation → arrival at site</td>
<td>approx 2 hrs</td>
</tr>
</tbody>
</table>
Required prediction time depends on river scale / characteristics.
## Required prediction accuracy depends on river scale / characteristics

<table>
<thead>
<tr>
<th>River Basin</th>
<th>Small</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrival Time</td>
<td>Short</td>
<td>Long</td>
</tr>
<tr>
<td>Prediction from upstream W.L.</td>
<td>Difficult</td>
<td>Easy</td>
</tr>
<tr>
<td>Required rainfall prediction</td>
<td>current rainfall + local rainfall prediction (ex.local rainpour)</td>
<td>global area rainfall prediction (ex.typhoon movement)</td>
</tr>
</tbody>
</table>
Requirement for weather forecasting

1. Consideration to accuracy setting
   - Information regarding prediction accuracy
   - Forecast accuracy depends on availability of other relevant information

2. Lead time for disaster management has to be taken into account when determining target forecast time
   - Natural condition
   - Society condition
   - Target persons/organizations
Requirement for Disaster Management in response to Weather Forecasting

1. Action scenario with consideration to accuracy
   • Understanding of prediction accuracy
   • Consider action risk based on the accuracy

2. Action scenario with consideration to lead time
   • Accelerating decision making
   • Shorter action time & more accurate action
   • Understanding critical information
   • Raising awareness among residents

Collaboration with weather forecasting manager required for proper disaster management