SESSION 3: Enhancing links in the early warning chain

Flood early warning: linking regional, national and local levels

Experiences from the Philippines

UN-SPIDER EWEM
Bonn, 25/26 June 2013

Olaf Neussner, GIZ Philippines
Johannes Anhorn, South Asia Institute, Heidelberg University
Introduction

Floods are responsible for most economic losses caused by natural disasters in the Philippines, but also loss of life is considerable.

Five governmental flood early warning systems (FEWS) provide advance notice on impending floods.

There are more than 400 rivers with flooding problems.

Some smaller rivers have locally managed FEWS and were supported by GIZ.
Key Elements of LFEWS

Risk Knowledge
- Hazard
- Elements at Risk
- Vulnerability

Monitoring and Warning
- Rainfall
- River Level
- Warning Decision

Dissemination and Communication
- Radio
- Telephone
- Household Warning

Response Capability
- Evacuation Centre
- Search & Rescue
- Relief Goods

01/07/2013
8 GIZ supported LFEWS are running
8 more will be completed in 2013

Low cost approach.

Operated and maintained by local non-hydrologists.

Local ownership and empowerment.
Binahaan Flood Early Warning System

3 Levels
- Alert (Stand by)
- Preparation
- Evacuation

Data from Rain/River Gauges in Tingig

Warming to Municipality
Warming to Barangay
Warming to Area

Operation Center

Binahaan Watershed
Actual Performance of FEWS During a Flood

Binahaan Flood, 1-3 January 2011 (5 Hours Advance Warning)

- Alert Level 2 issued
- Alert Level 3 issued
- Alert Level 3 lifted
- Flood starts
- Water level upstream

Rainfall upstream

Graph showing time in hours on the x-axis and rainfall in mm/hour on the y-axis, with water level in meters on the right y-axis.
Examples of RS support for FEWS

Rain on an area (TRMM)
Examples of RS support for FEWS

ASTER DEM as basis for flood modelling

a) ASTER DEM, Version 2

b) ASTER DEM, with GIZ corrections
Flood Extent Mapping from HighRes TSX Data

→ Linking global, national, and local efforts

Project Background

- Joint project of DLR and GIZ with different objectives:
  - How can existing flood extent mapping methods and algorithms be enhanced with on-the-ground field data?
  - How can high resolution Synthetic Aperture RADAR Data enhance the whole DRM ‘cycle’ and provide useful data for local FEWS?
  - Aim: Identify the flood extent on a NRT basis with semi-automatic algorithms beneficial for local FEWS.
Flood Extent Mapping for Better Risk Knowledge

'-FLOOD' ALERT
Amount of Rainfall? Waterlevel? Damages?

Preparation for Field Trip
Transportation, Equipment, Translation, Staff, Security

Mapping
GPS Tracks, Waypoints, GPS Photography

Data Securing
Geodatabase, Reference Map, Damage Reports

Programming SAR Acquisition
Corner Coordinates, Timing, Look Angle, Mode

Flood? Yes
- Correct Position?
- Correct Timing?
- Access Possible?

Flood? No Flood?

Concept & Draft: J.Anhorn 2011, v1
The Flood Events

**TSX/TDX & RS2 Acquisitions**

- **Oras/Jipapad**
- **Pagsangaan**
- **Binaahan**
- **Abuyog**

<table>
<thead>
<tr>
<th>Date</th>
<th>January 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/01/11</td>
<td></td>
</tr>
<tr>
<td>22/01/11</td>
<td></td>
</tr>
<tr>
<td>07/04/11</td>
<td></td>
</tr>
<tr>
<td>21/05/11</td>
<td></td>
</tr>
<tr>
<td>04/07/11</td>
<td></td>
</tr>
<tr>
<td>18/12/10</td>
<td></td>
</tr>
<tr>
<td>31/01/11</td>
<td></td>
</tr>
<tr>
<td>16/03/11</td>
<td></td>
</tr>
<tr>
<td>29/04/11</td>
<td></td>
</tr>
<tr>
<td>12/06/11</td>
<td></td>
</tr>
</tbody>
</table>

**Waterlevel Jipapad as of 11th - 13th January 2011**

- **120 cm**
- **24 hours**

Source: own data, J.Anhorn 2012, v.1
Algorithm Development

Surface Scattering Mechanisms

Electromagnetic Wave & Microwave Polarization

SAR Geometric Effects

### Algorithm Development

<table>
<thead>
<tr>
<th>Preprocessing</th>
<th>Pixel</th>
<th>Gamma-MAP Filter</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong> Speckle Suppression Conversion to 8bit</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Segmentation</th>
<th>Object</th>
<th>Automatic / Manual Calibration</th>
<th>Scale / Homogeneity Parameter (Color &amp; Shape)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2</strong> Uniscale / Triscale</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification</th>
<th>Object</th>
<th>Tile-Based Threshold</th>
<th>≤ th&lt;sub&gt;glob&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3</strong> Automatic / Manual</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Post-classification</th>
<th>Pixel</th>
<th>Elevated Area Flood Size Island Elevation</th>
<th>Altitude Size A ≤ th&lt;sub&gt;A&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4</strong> DEM Integration</td>
<td></td>
<td>Δh ≤ th&lt;sub&gt;DEM&lt;/sub&gt;</td>
<td>I ≤ th&lt;sub&gt;i&lt;/sub&gt;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Domain</th>
<th>Control Variables</th>
<th>Increasing User Input</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Risk Knowledge
Risk Knowledge
Risk Knowledge
Key Elements of LFEWS

Risk Knowledge
- Hazard
- Elements at Risk
- Vulnerability

Monitoring and Warning
- Rainfall
- River Level
- Warning Decision

Dissemination and Communication
- Radio
- Telephone
- Household Warning

Response Capability
- Evacuation Centre
- Search & Rescue
- Relief Goods

26/06/2013
Summary

FEWS are depending to a large extent on terrestrial data collection (rain and water level).

The precision of the systems are enhanced with RS in areas with few ground data:

- Rain (TRMM) in Google Earth with watershed vector files
- DEM data for flood modelling
- Radar data for flood extent maps and better risk communication

Better timing and localizing of warning and evacuation mean better performance of the FEWS.
THANK YOU

Contact

olaf.neussner@giz.de
anhorn@sai.uni-heidelberg.de