In His Name The Most High

Design of Automated Local Flood Warning Systems

By:

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➢ *Outline of Presentation*

- ✓ *Natural disasters*
- ✓ *Higher vulnerability of LDCs to such disasters*
- ✓ *Damage caused by natural disasters*
- ✓ *Increasing trend in damage vs. tech. advances*
- ✓ *Flood damage mitigation--methods*
- ✓ *Flood warning systems---overview*
- ✓ *Purpose of flood warning systems*

➢ *Outline of Presentation*

- ✓ *Factors affecting the need for LFWs*
- ✓ *Types of LFWs*
- ✓ *Design of effective warning systems*
- ✓ *Hardware and software configuration*

Natural Disasters

- **Geological nature**
  - Earthquakes
  - Landslides
  - Volcanoes
- **Meteorological origin**
  - Floods
  - Droughts
  - Famines
  - Cyclones
  - Tornadoes
  - Forest fires

➢ *Higher vulnerability of LDCs to ….*

- ✓ *Variety of climate regime*
- ✓ *Unstable landforms*
- ✓ *Population density*
- ✓ *Poverty*
- ✓ *Illiteracy*
- ✓ *Lack of infrastructure development*

➢ *Damage caused by natural disasters*

- ✓ *Over 60% of all reported major ND in LDCs;*
- ✓ *Major disasters since 1900 have caused*
  - ❖ *Over 45 million deaths (60% in Asia)*
  - ❖ *Over 3.7 billion people affected globally (85% in Asia)*
- ✓ *Floods and droughts casued largest # of deaths*
- ✓ *In 1991, roughly 44% of the damage due to flood alone*

➢ *Damage caused by natural disasters*

✓ *Average annual damage casued by flash floods in Iran between 1991-1997*

- ❖ *Home destroyed: 11547*
- ❖ *Farm animals died: 56957*
- ❖ *Farmland destroyed: 12905*
- ❖ *Road: 856 ha*
- ❖ *Killed: 71 #*

Increasing trend in damage vs Tech. Advances

- *Technological advances in:*
  - *Vast multi- sensor networks*
  - *More precise mapping capabilities using RS & GIS*
  - *Quicker hydrological and meteorological models*
  - *Increasing forecast lead time*

Have not reduced damage caused by floods

➢ *Increasing trend in damage vs Tech. Advances*

- ✓ ***In Nov. 1999, 35 researchers from 9 countries met in Italy. Recommendations made:***
  - ❖ ***Improvement in forecasting and warning***
  - ❖ ***Application of existing knowledge and research results in flood damage mitigation***
  - ❖ ***Due attention to social science components and links***
  - ❖ ***Sustainable flash flood mitigation policies that take a long-term outlook***
  - ❖ ***Development of processes to build culture of cooperation and understanding among org. Involved***

Flood damage mitigation---Methods

- ***Structural measures***
  - *Dam construction*
  - *Watershed management*
  - *River training works*
  - *Land use management*
- ***Non-structural measures***
  - *Flood warning systems*

Non-structural measures

- *Warning and emergency planning for flooding are based on the reality that no matter how thorough and accurate our research and investigations regarding flood prevention efforts via engineered structural works or land use management are, some risk will always remain*

➢ *Non-structural measures*

✓ ***Warning and emergency planning for flooding are based on the reality that no matter how thorough and accurate our research and investigations regarding flood prevention efforts via engineered structural works or land use management are, some risk will always remain***

Flood warning systems---Overview

- ***Local flood warning systems: After WW2***
- ***Early flood warning systems***
  - ***Simple tables***
- ***Early 1970: 70 flash flood alarm systems***
- ***Early 1970: Development of ALERT***

  Automated Local Evaluation in Real Time systems
- ***Late 1970 and early 1980: IFLOWS***

  Integrated Flood Observing and Warning Systems

Purpose of warning systems

- ***To empower individuals and committees to ..***
  - ***Death***
  - ***Injury***
  - ***Property loss and damage***
- ***To signal those at risk to prepare for flooding both physically and psychologically***
- ***To integrate such factors as:***
  - ***Flood prediction***
  - ***Assessment of likely flood effects***
  - ***Dissemination of warning information***
  - ***Response of agencies and the public in the threatened comm.***

Factors affecting the need for LFWs

- ✓ *Hydrologic characteristics of the watershed*
- ✓ *Frequency of flooding*
- ✓ *Flood loss potential*
- ✓ *Relationship between warning time and benefits*
- ✓ *Need for other hydrologic capabilities*
- ✓ *The communities interest and awareness*
- ✓ *Cost of the system*
  - ❖ *Capital investment*
  - ❖ *maintenance*

Types of LFWs

- **Manual systems**
  - Local data collection system
  - A community flood coordinator
  - A simple-to-use flood forecast procedure
  - A communication network to distribute warnings
  - A response plan
- **Automated systems**
  - Automatic reporting of river stage and rainfall gauges
  - A communication system
  - Automated data collection and processing equipment
  - Analysis and forecasting software

Automated systems

- ***Three of the more prominent automated LFWs include:***
  - ***Flash flood alarm systems***
  - ***ALERT***
  - ***IFLOWS***

Flash flood alarm systems

- ✓ *Water level sensors connected to an audible and/or visible alarm device*
- ✓ *The water level sensors is set at a predetermined critical water level and is located a sufficient distance upstream of a community to provide adequate lead-time to issue a warning*
- ✓ *Raingauges upstream of a community are preset with alarms that sounds when a predetermined flood-causing rainfall amount is exceeded*

Design of effective warning systems

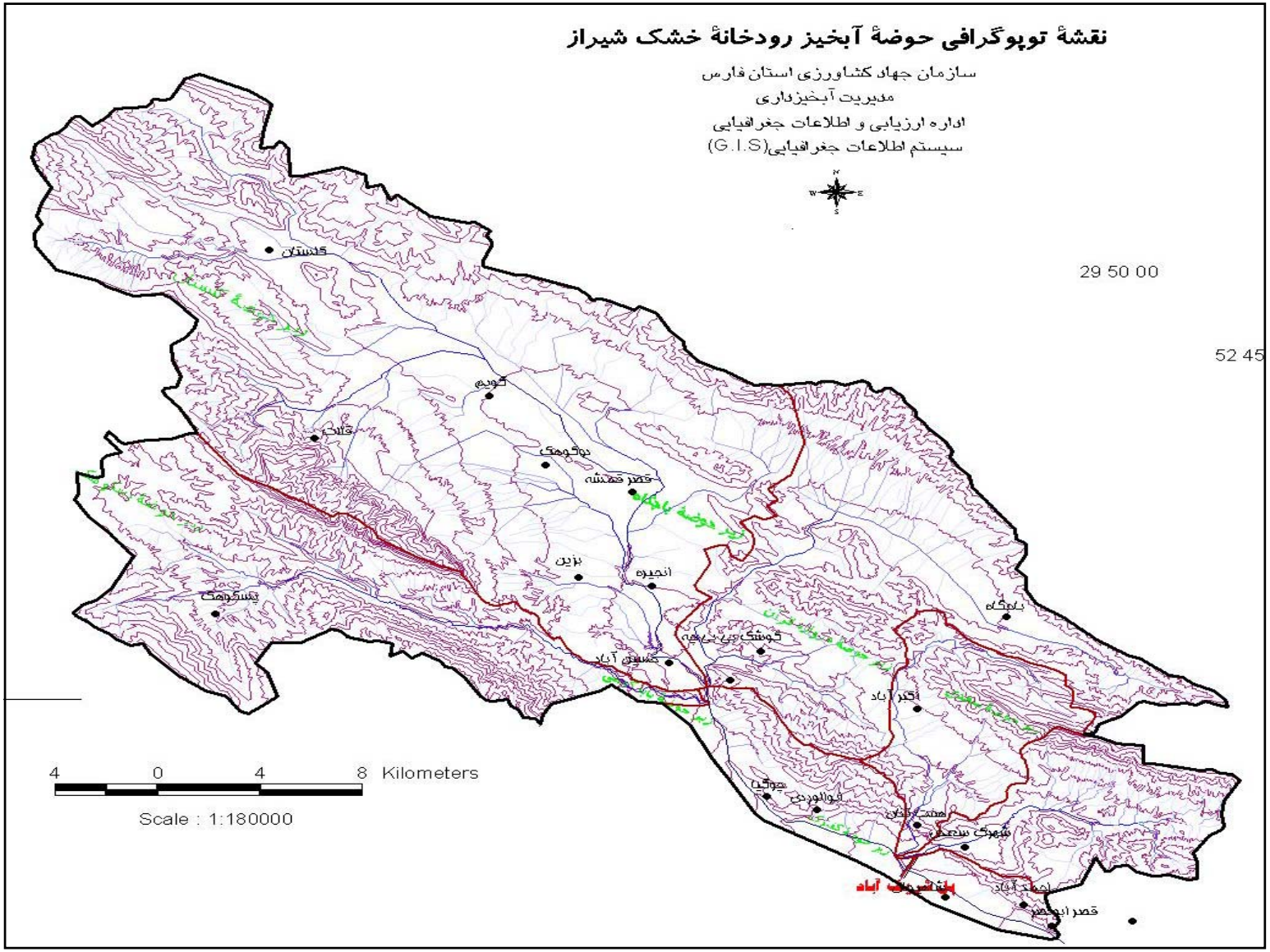
- ***Warning messages should:***
  - ***Be timely and reliable***
  - ***Have local and individual meanings***
  - ***Be forward looking***
  - ***Suggest appropriate responses***
  - ***Come from locally credible sources***
  - ***Be reinforced socially (e.g., via personal networks)***
  - ***Go to those at risk (usually a diverse group)***

Design of effective warning systems

- ***Warning messages should:***
  - ***Make provision for easy confirmation and extra infor.***
  - ***Use an appropriate range of message dissemination modes***
  - ***Employ multiple channels of dissemination***
  - ***Incorporate continuous learning and updating procedure***

Design of effective warning systems

- ***Weaknesses in warning systems that should be avoided:***
  - *Complex arrangements for decision making and …*
  - *Lack of sufficient time to accomplish all communication steps*
  - *Decision bottlenecks where systems become overly reliant on single persons*
  - *Assumptions that the broadcast media will disseminate a warning*
  - *Assumptions that those at risk are a homogeneous group with uniform needs*
  - *Failure to draw on the full range of available experience*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