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1. General introduction

Viet Nam is located in the tropical monsoon of Southeast Asia- one of the most disaster-prone regions in the world.

Many kind of natural disasters including: typhoons, floods, flash floods and landslides

Flooding and typhoons are major annual occurrence in Viet Nam causing massive damage and loss for people life.
- Heavy rain, flash floods, landslides occur very often in the mountainous region of the country.

Provinces with high potential for flash floods

- **In Northern:**
  - **Including the provinces:** Lai Chau, Son La, Dien Bien, Lao Cai, Yen Bai, Thai Nguyen, Ha Giang, Tuyen Quang, Bac Can and Cao Bang.

- **In Central and Highland:**
  - **Including the provinces:** Thanh Hoa, Nghe An, Ha Tinh, Quang Binh, Quang Nam, Binh Thuan, Kon Tum, Gia Lai and Dak Lak.
MAP OF AREAS AFFECTED BY FLASH FLOODS IN VIETNAM IN 1990-2010
Flash foods in 2016

• 10 flash floods occurred in 8 provinces in the North and Central of Vietnam such as Thai Nguyen (July 01\textsuperscript{st}), Binh Phuoc (July 18\textsuperscript{th}), Quang Ninh (July 5\textsuperscript{th}), Ha Giang (July 29-30\textsuperscript{th}), Lao Cai (August 5\textsuperscript{th}, 19\textsuperscript{th}), Yen Bai (August 20\textsuperscript{th}), Nghe An (September 14, 18\textsuperscript{th}) and Quang Binh (October 15\textsuperscript{th}).

• The flash floods caused extreme damages on human lives and properties to these provinces.
The provinces where flash floods occurred in 2016:

- Ha Giang (29,30/VII)
- Thai Nguyen (2/VII)
- Quang Ninh (5/VII)
- Nghe An (14,18/IX)
- Quang Binh (15/X)
- Lao Cai (5, 19/VIII)
- Yen Bai (20/VIII)
- Binh Phuoc 18/VII
- Binh Phuoc 15/X

Hydrograph at Yen Bai station:

Hydrograph at Mai Hoa station:
Hydrometeorological Forecasting undertake warning by two methods:

2. Flash flood warning and forecasting

Rainfall Station at Nghia Lo Town

a- General forecasting and warning

b- Automatic warning
a- General warning and forecasting

Flash flood warning and forecasting are made daily for the areas with high risk of flash flood as follow in three steps:

1. To detect and forecast development of heavy rain causing weather pattern in integration with basin’s hydrological condition and coverage.

2. To give warning on possible flash flood within the small area based on the predicted rainfall.

3. To give a warning based on heavy rain and analysis observed rainfall map.
b- Automatic warning

Flash flood waning and forecasting System in Son La Province were established in 2000. This system has been maintained and developed up to now.
Established the flash flood warning system with 8 automatic rainfall gauges in Lao Cai province.
# Application of the MRCFFG System

**MRCFFG - Mekong River Commission Flash Flood Guidance System**

Current Date: 2016-11-26 09:23 UTC  
Product Date: 2016-08-05 06:00 UTC

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<th>Merged MAP</th>
<th>ASM</th>
<th>Previous FFG</th>
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Application of the MRCFFG System

Application in warning flash flood in heavy rainfall on August 05, 2016 in Northern mountains
Application of the MRCFFG System

FFG 06hr Aug 05 00UTC

Regions occurred flash floods
Some figures in the flash flood event in Lao Cai province on August 05, 2016
3. Weather forecasting and nowcasting

Data sources:
- Geostationary satellite: MTSAT, FY-2, Himawari;
- Polar Satellites: NOAA, METOP, FY-1, TRMM;
- Weather Radar, Microwave, NWP, radiosonde;

Forecasting models:
- Global models: GSM, GFS, IFS
- Regional models: HRM, WRF, COSMO, NHM
Satellite Data
Weather Rada Data
Analysis illustrates thunderstorms from radar.
24 hours Accumulated rainfall

**JMA**

From 19h - 01/12/2016 to 19h - 02/12/2016

Model: GSM
Pointing forecast charts from the deterministic products

Temperature and dew point temperature

Accumulated rainfall in 3 hours and the relative humidity

Wind level at a value of 10m

Sea level pressure

Cloud cover and Kinder index
Pointing forecast charts from the combinatorial products

- Kindex index relative thunderstorms forecast
- Rainfall speed mm/3h
- Temperature at the level 2m
- Wind direction at 10m
- Wind speed at 10m
- Cloud cover
The rainfall forecast regional, points (global and regional)
The probability of rainfall forecast from combining...
Short-term complex system SREPS

3 regional models HRM, WRFARW và WRFNMM and 5 global models GEM, GFS, GME, GSM, NAVGEM
The structure simulate warning and forecasting rainfall

Quantitative precipitation forecasting
4. Hydrometeorological networks

- International Station Network
- National Telegraphic Station Network consisting of:

  + 186 synoptic stations;
  + 1322 rain gauges, including 531 rain gauges in hydro-met. stations and 791 independent rain gauges;
  + 400 automatic rain gauges;
  + 257 hydrologic stations;
  + 8 Pilot stations;
  + 6 Radiozone stations;
  + 21 ocean-meteorological stations;
Weather radar network:
- 7 stations including: Viet Tri, Phu Lien, Vinh, Dong Ha, Tam Ky, Nha Trang and Nha Be.
- 5 radar types: MRL-5 (Russia); TRS 2730 (France); DWSR-93C, DWSR-2500C, DWSR-2501C (USA)

4. Hydrometeorological networks
5. Organizational structure hydro-meteorological forecasting in Viet Nam
**Human resources**

Doctor has 20 people, accounting about 0.64% rate on the total number of employees, including: Specialized meteorological has 08 people (0.25% percent); Specialized hydrological has 03 people (0.1% percent); Specialized oceanography has 03 people (0.032% percent); Specialized environmental has 2 people (0.064% percent); Other specialized 06 people (0.19% percent).

Master has 151 people, accounting about 4.81% rate on the total number of employees, including: Specialized meteorological has 41 people (1.31% percent); Specialized hydrological has 34 people (1.08% percent); Specialized oceanography has 05 people (0.16% percent); Specialized environmental has 20 people (0.637% percent); Specialized climate change has 03 people (0.1% percent); Specialized information technology has 03 people (0.1%); Specialized electronics and telecommunications have 04 people (0.13% percent); Specialized economics, accountants have 11 people (0.35% percent); Other specialized 30 people (0.955% percent).
Human resources

Bachelor has 1,233 people, accounting about 39.3% on the total number of employees, including: Specialized meteorological has 453 people (14.4% percent); Specialized hydrological has 391 people (12.4% percent); Specialized oceanography has 10 people (0.318% percent); Specialized environmental has 37 people (1.178% percent); Specialized information technology has 55 people (1.75%); Specialized electronics and telecommunications have 33 people (1.05% percent); Specialized economics, accountants have 127 people (4.04% percent); Other specialized 127 people (4.04% percent).
INFORMATION COMMUNICATION SYSTEM

NCHMF

Bulletin, Warnings

Fax, internet, LAN

Regional Centers

Central Gov. authorities
Centre committee Flood and Storm control

Media

Specially services

Local Authorities

Media

Community
The products and provided services
THANK YOU FOR ATTENTION