Flood Management of Han River Flood Control Office

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Water Resources Information Center
Water Resources in Korea

Total Water
129 (100%) (unit: billion m³)

- River
- Dam
- Groundwater
- Sea
- Runoff
  - June~Sept.: 43%
  - (Oct.~May): 15%

Loss
42%

- River
- Dam
- Groundwater
- Sea
- Runoff
  - (Oct.~May): 15%

Average precipitation of the world: 807mm
Average precipitation of Korea: 1,277mm
1.6 times the world average

Annual precipitation per capita of the world: 16,627m³/year
Annual precipitation per capita of Korea: 2,629m³/year
14.2% of the world average

Precipitation concentrate from June to September

Mountain area 70%

Annual precipitation (unit: mm)
Several organizations have their own roles according to the functions.

Water quantity and quality are managed in different ways.

- **MOLIT (Ministry of Land, Infrastructure, and Transport)**
  - Flood Control
  - Water Shortage Control
  - Water Supply
  - Dam & Rivers
  - Groundwater
  - Multi Regional Water Supply

- **Ministry of Environment**
  - Water Quality
  - Meteorology
  - Regional Water Supply
  - Waste Water Treatment Facility

- **Ministry of Agriculture, Food and Rural Affairs**
  - Water Supply (Irrigation)
  - Reservoirs for Agricultural Use

- **Ministry of Trade, Industry and Energy**
  - Electricity Generation
  - Hydropower Generation of Dams

- **Ministry of the Interior and Safety**
  - Disaster Rescues with Local Government

**Water utilization**

**Flood control**

**HRFCO**
- Precipitation (Rain Radar)
- Water level, Flow rate
- Evapotranspiration, soil moisture
- Data sharing

**HSC**
- flow rate, sediment
- Automatic discharge measurement
- Evapotranspiration, soil moisture

**Kwater**
- Survey for dam op.
- Preci., water level
- Flow rate, sediment
- evapotranspiration, soil moisture
River management

Rivers of Korea

<table>
<thead>
<tr>
<th>contents</th>
<th>number</th>
<th>length(km)</th>
<th>River bank length</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>National river</td>
<td>62</td>
<td>2,998</td>
<td>2,972</td>
<td>99.13</td>
</tr>
<tr>
<td>Local river</td>
<td>3,775</td>
<td>26,843</td>
<td>20,581</td>
<td>76.67</td>
</tr>
</tbody>
</table>
4 Flood Control Offices

**doing 365 Water Management**

- **Han river FCO** (since 1974)
  - Basin area: 41,464.89㎢

- **Geum river FCO** (since 1990)
  - Basin area: 13,264.25㎢

- **Yeongsan river FCO** (since 1991)
  - Basin area: 15,163.83㎢

- **Nakdong river FCO** (since 1987)
  - Basin area: 29,934.29㎢

- **Total Basin Area**: 99,827.26㎢
HRFCO History

- 1920’s: Regulation regarding reports of Rainfall & Water level
- 1960’s: Committee for Hangang(riv.) Flood Management, Storm & Flood Act
multi-purpose Dams, Flood Forecasting Facilities

1974. 7. Foundation of HRFCO

2005. 5. River Information Center (RIC) organized for the Professionalism

2009. 6. Biseulsan
2011. 11. Sobaeksan Rain radar station installed
2015. 4. Seodaesan
2016. 6. Garisan

2016. 3. RIC reorganized as a Water Resources Information Center
Strengthen its task, especially River flow management
Tasks for Water Resources Management

- Hydrological survey
- River Flow Management
- Water Resources Informatization
- Improvement of Flood & Low Flow management Technique
- International and Domestic Cooperation

365 days!
Hydrological Survey (Han river Basin)

- River system: Han river, Anseong stream
- **Basin area**: 41,465 km² (South 31,648 km²)
  * Imjin river: 8,139 km² (South 3,186 km²)
- **Annual mean preci.**: 1,440.3 mm

**Measurement Stations**

<table>
<thead>
<tr>
<th>Water level</th>
<th>Precipitation</th>
<th>Automatic Discharge Measurement</th>
<th>Rain Radar</th>
</tr>
</thead>
<tbody>
<tr>
<td>142</td>
<td>147</td>
<td>17</td>
<td>2</td>
</tr>
</tbody>
</table>

Stations have been increased every year on the whole country

6 Rain Radar Stations
58 ADM
Structural Measures for Flood Management

- Dredging river bed

- Reinforcement of embankment

- Flood Retention and dam
Non-structural Measure for flood

Flood Forecast

One of the Non–Structural Countermeasure
Forecasting River Flow
Informing Possibility of the Floods in advance

Designating 50 point for flood forecast of the whole country
( Han FCO : 14, Nakdong FCO : 14, Geum FCO : 9, Yeongsan FCO : 12)

Dividing criteria into 4 level ( Attention, Watch, Warning, Severe)
Flood Forecast and Control

The flood control by dam

(Dam) Flood control
*Soyang-river, Chungju, Hwacheon, Hoengsung

ensure the flood control capacity

- Restrict dam level during flood (6.21~9.20)
- Preliminary outflow for the flood defense

Lowered the peak level 1~2m by Dam Control in 2009!!
Flood Forecast Information Providing
FCO – Integrated Information Monitoring

Dam Operation
Inflow, Outflow, Quality

Agricultural reservoir
Operation

Agricultural Dam by KRC
(Korea Rural Community Corporation)

Integrated Control Center (FCO)

Integrated Information Monitoring
(River, Dam, Weir, Meteorological, Sewage, Waste Water Treatment data)

Real-time Data Exchange
with other agencies
(ME, KMA, K-Water, KHNP, Local authorities)

Water Supply facilities

Sewage & Waste Water Treatment Plant

Meteorological Data

Weir Operation
Weir Inflow, Outflow, Quality

Dam Operation Co.
- Multipurpose Dam by K-Water
  (Korea Water Resource corporation)
- Hydro power Dam by KHNP
  (Korea Hydro & Nuclear Power corporation)
- Agricultural Dam by KRC
  (Korea Rural Community Corporation)
Flood Risk Map

- Analyze and Indicate flood area by embankment breaches or wave overtopping
- Support efficient regional development planning considering flood measures
✓ Divide Nak-dong River Watershed into 1,784 Sub-basin
✓ Flash flood prediction by critical stage

<table>
<thead>
<tr>
<th>Stage</th>
<th>Attention</th>
<th>Caution</th>
<th>Alert</th>
<th>Serious</th>
</tr>
</thead>
<tbody>
<tr>
<td>depth</td>
<td>0.5m (knee)</td>
<td>1.0m (waist)</td>
<td>1.2m (chest)</td>
<td>Overflow (levee)</td>
</tr>
</tbody>
</table>
International cooperation

Activities as a member of international organizations
- UN ESCAP/WMO Typhoon Committee WGH vice-Chairman, WMO RAII WGHS Chairman

Technology Tie-up and Sharing Information
- Developing Korean Brand Technology on water resources management
Flood Forecast case

<2017.7.16>
Flood Warning Issue
(Down stream Evacuation)

* Overflow crises of Goesan dam
  - increased dam water level
    nearly up to dam crest(137.65 EL.m)
  - Flood warning issued
    and Dam discharge control

Dam Release opening all gates

<table>
<thead>
<tr>
<th>시간</th>
<th>현재수위 (EL.m)</th>
<th>유입량 (m^3/s)</th>
<th>방류량 (m^3/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017-07-16 01</td>
<td>133.19</td>
<td>375</td>
<td>302</td>
</tr>
<tr>
<td>2017-07-17 00</td>
<td>132.97</td>
<td>446</td>
<td>403</td>
</tr>
<tr>
<td>2017-07-16 23</td>
<td>132.84</td>
<td>506</td>
<td>519</td>
</tr>
<tr>
<td>2017-07-16 22</td>
<td>132.88</td>
<td>588</td>
<td>655</td>
</tr>
<tr>
<td>2017-07-16 21</td>
<td>133.08</td>
<td>696</td>
<td>866</td>
</tr>
<tr>
<td>2017-07-16 20</td>
<td>133.55</td>
<td>866</td>
<td>1219</td>
</tr>
<tr>
<td>2017-07-16 19</td>
<td>134.53</td>
<td>1140</td>
<td>1666</td>
</tr>
<tr>
<td>2017-07-16 18</td>
<td>135.78</td>
<td>1600</td>
<td>2150</td>
</tr>
<tr>
<td>2017-07-16 17</td>
<td>136.95</td>
<td>2146</td>
<td>2465</td>
</tr>
<tr>
<td>2017-07-16 16</td>
<td>137.55</td>
<td>2611</td>
<td>2640</td>
</tr>
<tr>
<td>2017-07-16 15</td>
<td>137.6</td>
<td>2868</td>
<td>2555</td>
</tr>
<tr>
<td>2017-07-16 14</td>
<td>137.2</td>
<td>2793</td>
<td>2539</td>
</tr>
</tbody>
</table>
Flood Information provision

Block the walk at 5.5m
Block the traffic at 6.2m
Submerged at 6.5m

Submerged: 8 times
Duration: 157 hr
Max: 11.03m
The dams exceeded or nearly approached the restrict levels against flood * Soyang 0.77 ↑, Chungju 0.06 ↓

Dam operation company, such as K-water, must get the approval from FCOs and report regarding dam release.
Vision of Flood Forecast

Flood Forecast Paradigm is Changing

Changing Focused on People’s Life!
Vision of Flood Forecast

Expanding from River to Basin

Forecasting Inundation of the Infrastructure around River
- Main Road, Railway, Bikeway

Expanding Flood Forecast Area to the Administrative District
- Changing from Point(Line) to Space

Expanding Flood Forecast Area to Waterfront Park
- Parking lot, Camping, performing area
Vision of Flood Forecast

Securing Lead Time for Flood Response

- Rain Radar
- Real-time Discharge Measurement System
- Flood Forecaster (cf. weatherman)
- Reorganization

Advanced Equipment

Forecasting Technique

Distributed Model
- Forecasting based on Probability Analysis

Organization
Vision of Flood Forecast

Focusing on People's Life

- Improving Information Providing System for Easy Delivery
  - Pass Directly to the People with Smart Phone and Internet

- Providing Flood Information Customized People’s Life
  - Leisure, Waterfront Activities, Cultural Performing

- Strengthening Cooperation with Related Organizations
  - Joint Training and Workshops about Hydrological, Weather, Disaster Reduction with Related Organizations
Thank you!!
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Ji-youn SUNG

ขอบคุณค่ะ
Cảm ơn

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