

# Socio-economic impacts of typhoon struck the Korean Peninsular

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## I. Introduction

- ◆ The Korean Peninsular has affected a few typhoons from June to September.
- ◆ Recently, the generation frequency of typhoons in WNP shows a similar or a decreasing trend for normal value. However, damage by typhoons has dramatically increased because the intensity of typhoons affecting the Korean Peninsula (KP) is getting stronger (\*Park et al. 2006).
- ◆ People think typhoons give us a lot of damage, but they have positive effects such as
  - ✓ To get water resources,
  - ✓ To improve air quality,
  - ✓ To remove harmful red tides,
  - ✓ To make energy balance of the Earth moving the equator to polar.
- ◆ However, there are not tries to understand and to maximize positive effects of typhoons.
- ◆ The purpose of this study is to find out the climatological characteristics of the typhoons landfall on the South Korea for the period of 1951~2007 and to analysis the socio-economic valuation of the typhoon affecting the Korean Peninsular for the period of 2002~2007.

## II. Data and Methodology

### < Frequency and intensity analysis >

- ✓ **Methodology**
  - Frequency, intensity and point of recurvature changes of the typhoons affecting the Korean Peninsular (KP) by using RSMC Best Track data from 1951 to 2007
- ✓ **Data of Typhoon Information**
  - TC(Tropical Cyclone) best-track data of the Regional Specialized Meteorological Centers (RSMC)-Tokyo Typhoon Center
  - Latitude, Longitude, and central pressure for the period of 1951 to 2007

### < Economic value analysis >

- ✓ **Getting water resources**

Area of South Korea × Mean Precipitation × Rate of Outflow × Rate of Raw Water Sales × Average Costs of Water

- Area of South Korea : 99,828 km<sup>2</sup> (Ministry of Land, Transport and Maritime Affairs (MLTM), 2008)
- Mean Precipitation : Average for 60 Stations (mm) (Korea Meteorological Administration, 2009)
- Rate of Outflow and Raw Water Sales, Average Costs of Water (The Korea Water Resources Development Corporation (K-Water), 2009)

- ✓ **Improving air quality**

Reduction of pollutants × Sum of Area for 7cities × PBL Altitude × Social Costs of Air pollutants per kg

- Reduction of pollutants : Observation Data for SO<sub>2</sub>, NO<sub>2</sub>, CO, PM<sub>10</sub> (Ministry of Environment Republic of Korea (MEV), 2009)
- Sum of Area for 7 Cities (Seoul, Incheon, Daejeon, Gwangju, Daegu, Busan, Ulsan) : 5,364 km<sup>2</sup> (MLTM, 2008)
- Planetary Boundary Layer Altitude : Concentrations of the air Pollutants for each observation points assumed to be the same up to 1km that is PBL altitude
- Social Costs of Air Pollutants per kg (MEV, 2003)

- ✓ **Removing harmful red tide**

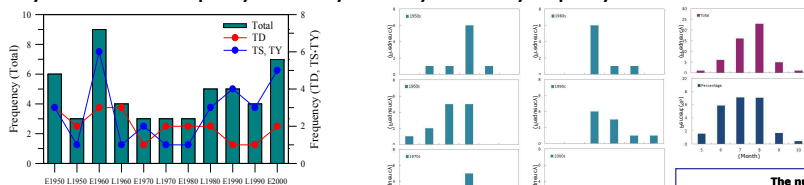
Damages of harmful red tides / Frequency of harmful red tides

- Using damages and frequency of harmful red tides (National Fisheries Research & Development Institute (NFRDI) , 2009)

## III. Result

### ◆ Variation of landfall typhoons on the KP

- ✓ 5-year variation of frequency & intensity
- ✓ 10-year monthly frequency variation

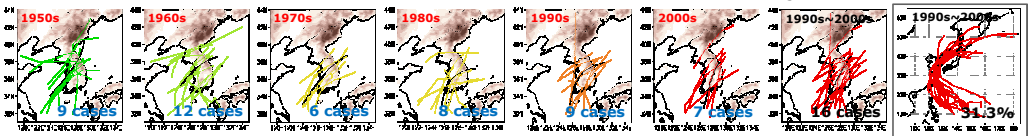


- ▶ 1950s~1970s: In generally, typhoons landed on the KP in August
- ▶ 1980s~1990s: Many typhoons landed on the KP in July
- ▶ Totally, typhoons have landed on the KP in August.

- ▶ The frequency of the landfall typhoons on the KP has been increased after 1970s.

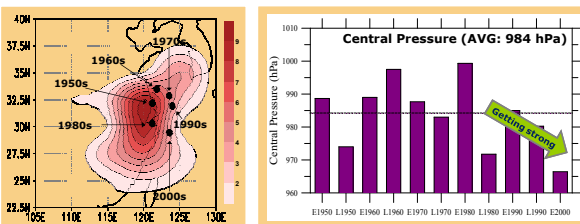
Percent(%) =  $\frac{\text{The number of landfall typhoons on the KP}}{\text{The number of genesis frequency in WNP}}$

### ✓ Changes in the track of typhoons



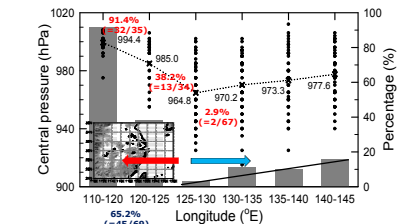
- ▶ Most of the typhoon passed to the East Sea after landing on the West Coast, but the typhoon passed to the East Sea after landing on the South Coast in the 1990s and 2000s.
- ▶ Landing on the west coast of NK through the mainland of China : 31.3% (7 of them landing directly into the South Coast)

### ✓ The change of the point of recurvature and intensity



- ▶ The point of recurvature : move China's East Coast to KP and south

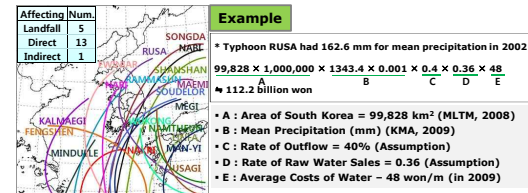
### ✓ The change of intensity on 30N



- ▶ Distribute strong typhoons in 125-130E

### ◆ Socio-economic valuation of typhoons : Typhoons affecting the KP in 2002~2007

#### ✓ Getting water resources by precipitation



#### ✓ Improving air quality by precipitation

	Before landfall	Passing	Density Difference	Economic value (100 million)
SO <sub>2</sub> (ppb)	6.24	4.14	2.1	3.2
NO <sub>2</sub> (ppb)	24.9	15.6	9.4	9.1
CO(ppm)	6.1	4.3	1.8	879.3
PM <sub>10</sub> (ug/m <sup>3</sup> )	44.8	27.7	17.1	26.4

#### ✓ Removing harmful red tide by wind and precipitation

Year	The Number of Case	Damages (100 million)	Control costs (100 million)
2002	13	49.0	3.8
2003	11	215.0	19.6
2004	6	1.2	0.2
2005	9	10.6	1.2
2006	8	0.7	0.1
2007	17	115.0	6.8

## IV. Summary

- ◆ In case of landfall typhoons on the KP, the frequency of strong typhoons was increased and most of them were landed in August.
- ◆ The typhoon passed to the East Sea after landing on the South Coast in the 1990s and 2000s.
- ◆ The point of recurvature moved China's East Coast to KP and south.
- ◆ Typhoons gave us total 805.2 billion won for 19 landfall typhoons on the KP from 2002 to 2007.

## V. Acknowledgement

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