Assessment of seawater intrusion affected by climate factors and anthropogenic activities: Case study of South Korea

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1. Korea Institute of Civil Engineering and Building Technology
2. Nakdong River Flood Control Office, Ministry of Environment
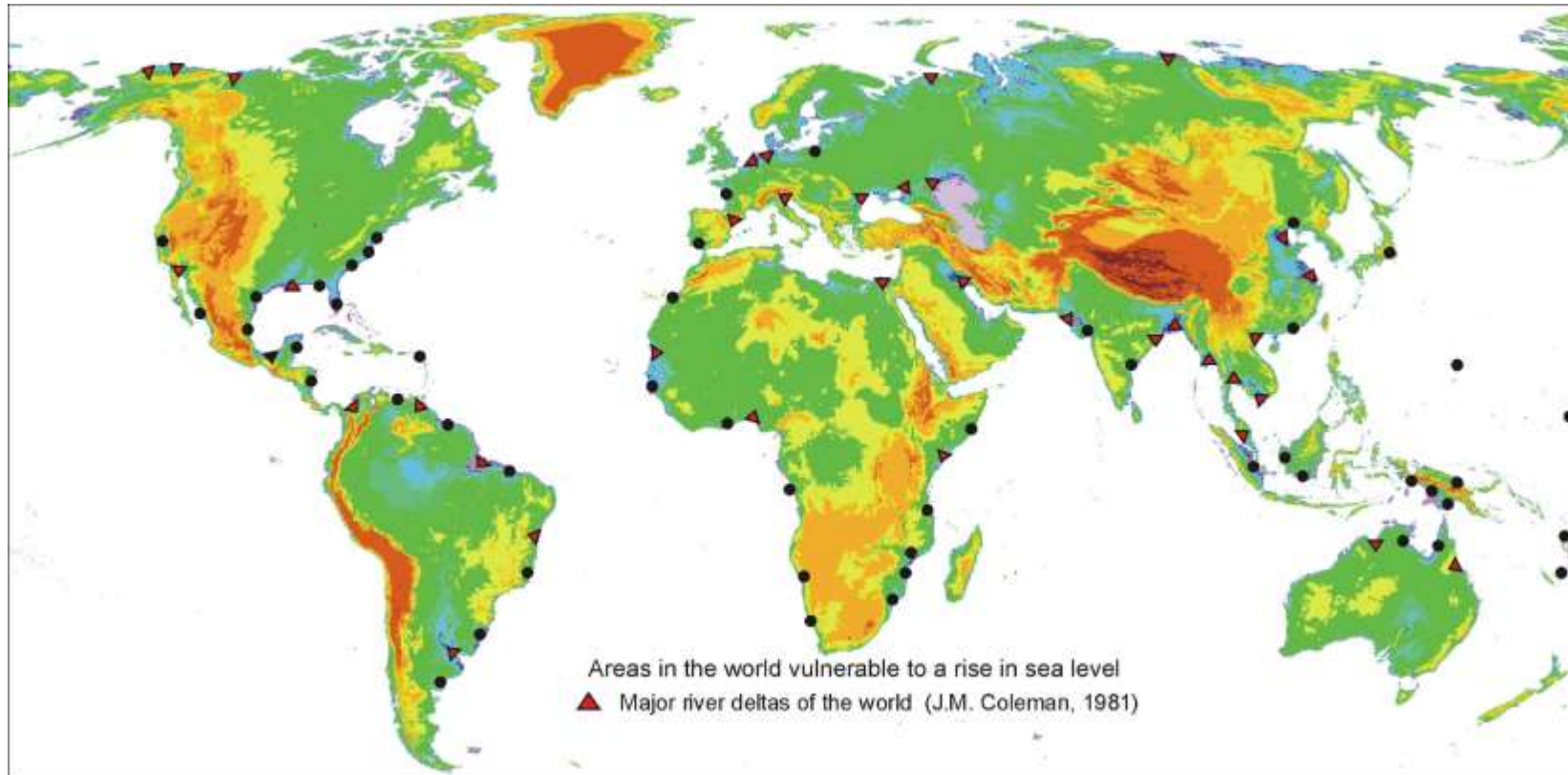3. Han River Flood Control Office, Ministry of Environment

Goal

to complete a comprehensive water management study to investigate the long term changes by climate factors as well as anthropogenic activities in fresh groundwater recourses in coastal & island regions.
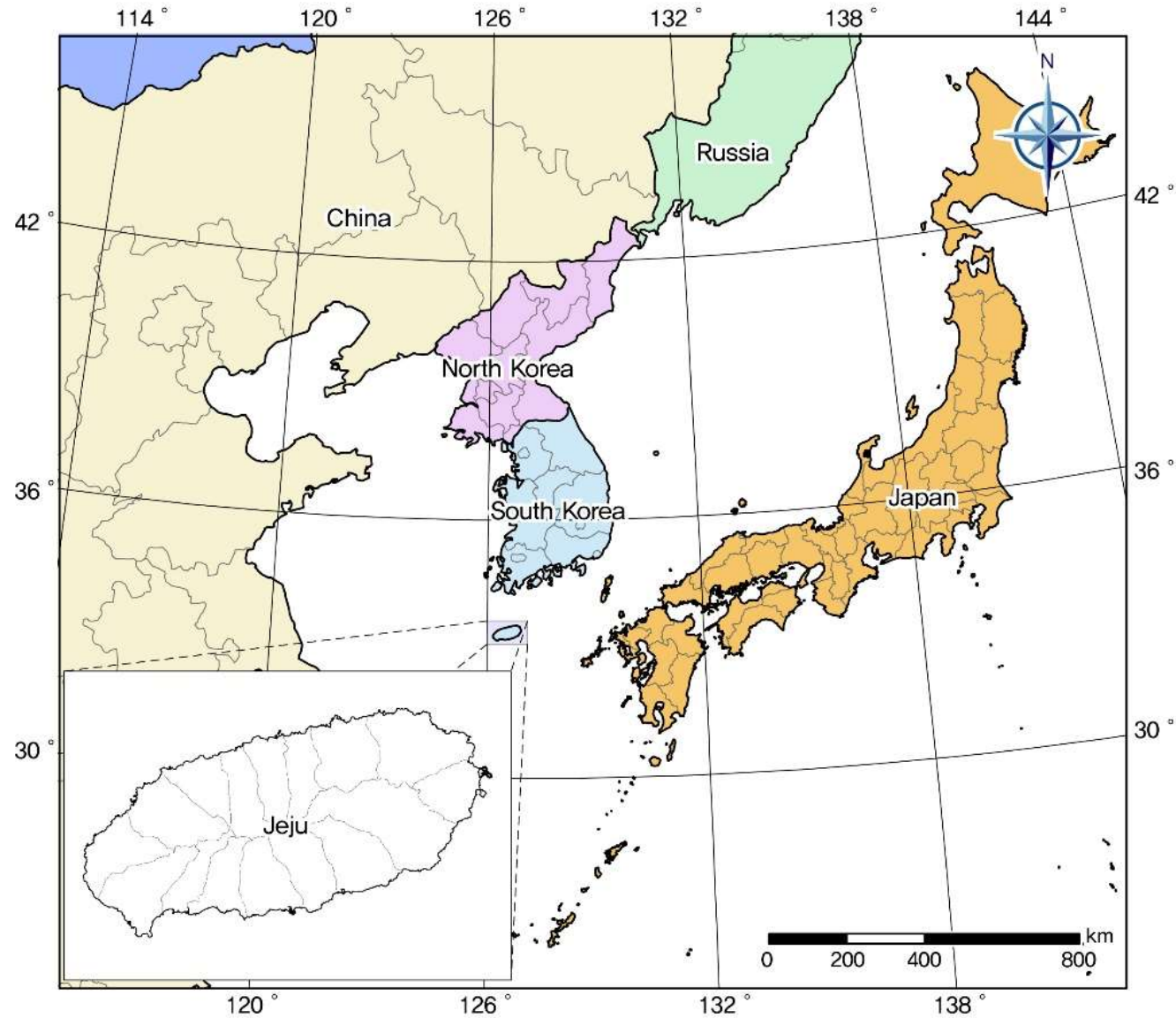
Background

Areas in the world vulnerable to a rise in sea level
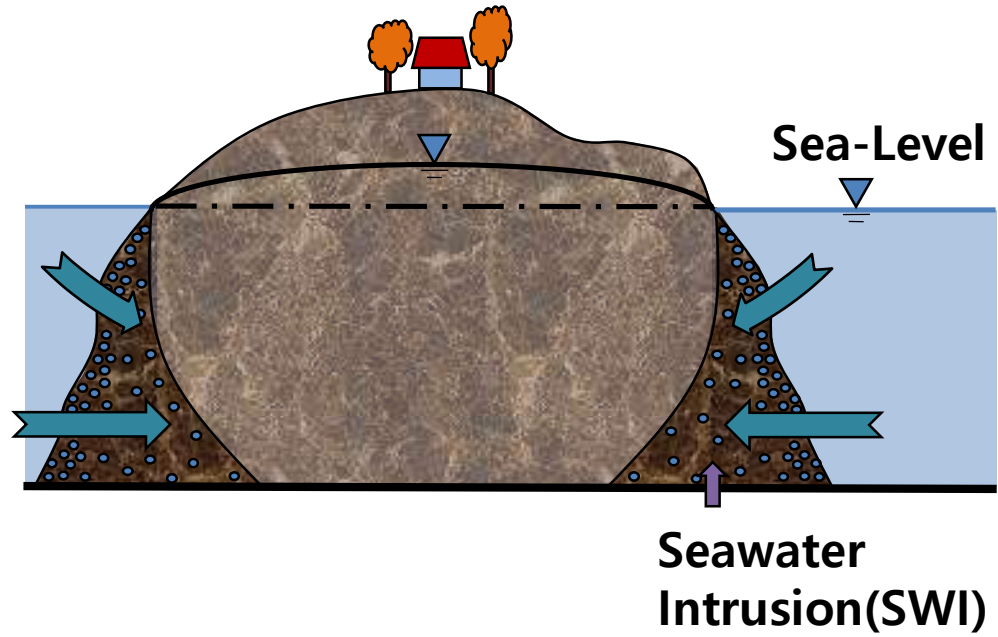▲ Major river deltas of the world (J.M. Coleman, 1981)

World map with possible vulnerable coastal deltaic areas suffering salt water intrusion problems, now or in the future (Oude Essink et al., 2011).
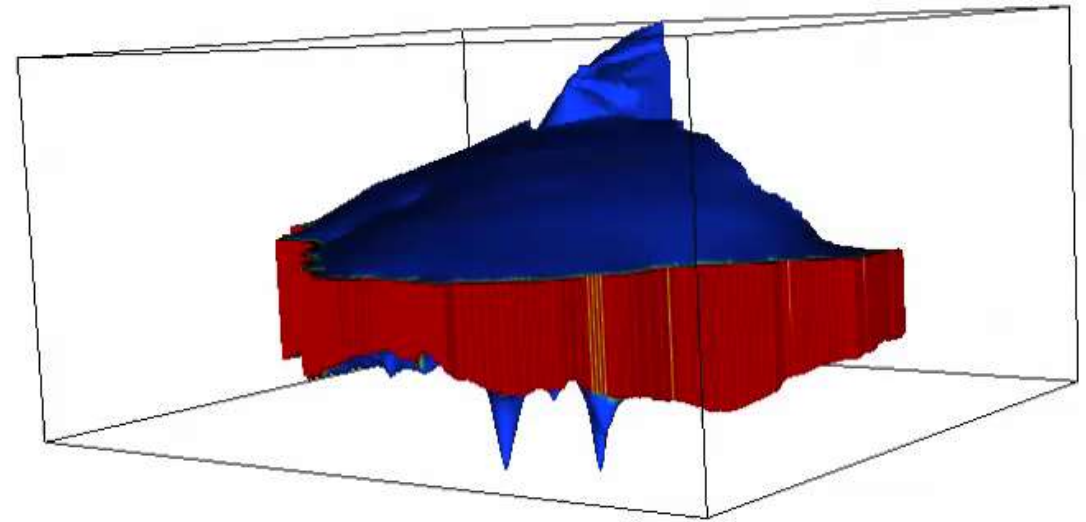
Seawater intrusion in Jeju Island, KOREA

Background

Sea-Level

Seawater
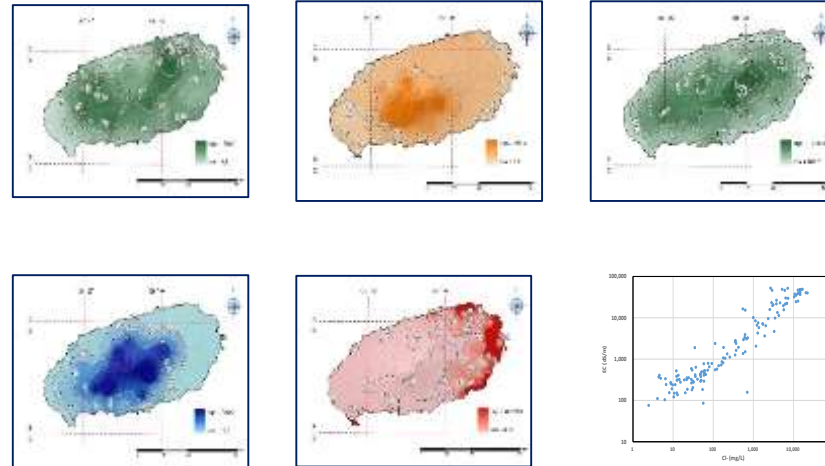Intrusion(SWI)

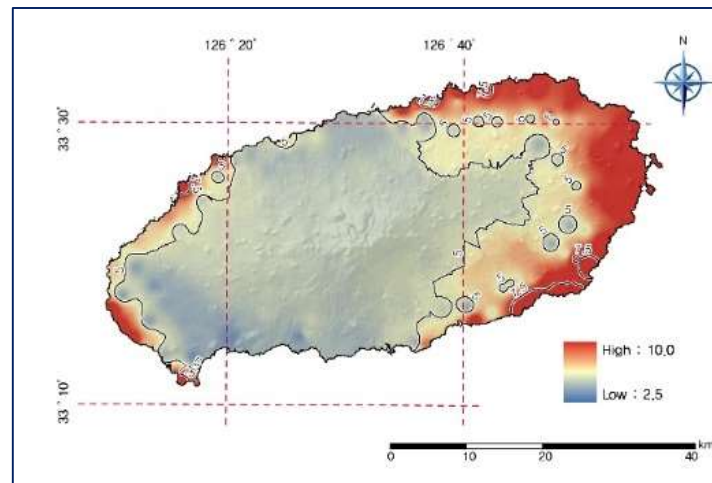Three-Dimensional Numerical model for SWI

Results

GIS-based Vulnerability Assessment to Saltwater Intrusion of coastal aquifer in Jeju Island, KOREA

GALDIT is an index-based SWI vulnerability model that is increasingly being used in many parts of the world to identify regions that are vulnerable to various types of SWI based on six major parameters.
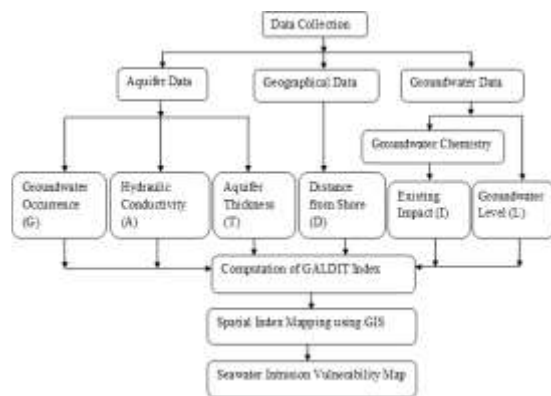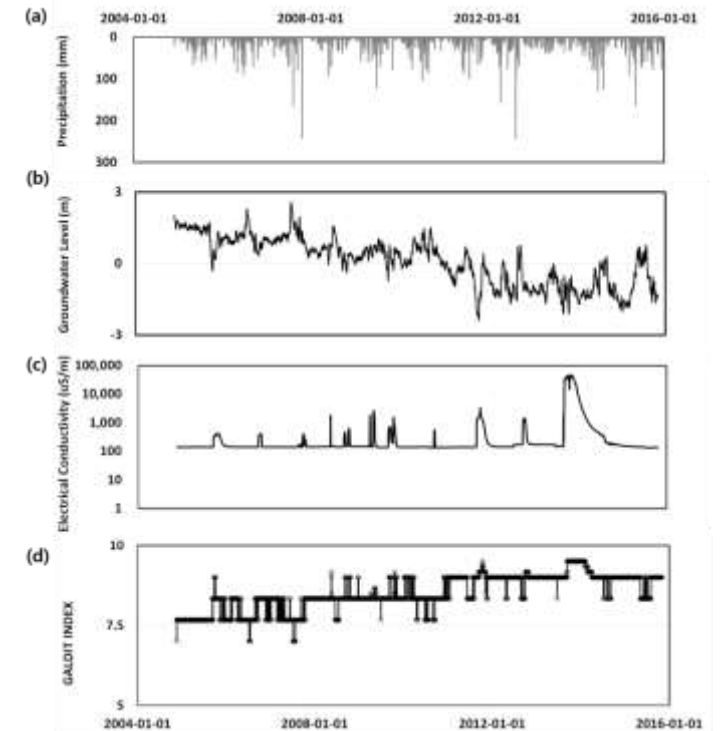

$$GALDIT\ vulnerability\ index = \frac{1{\times}G + 3{\times}A + 4{\times}L + 4{\times}D + 1{\times}I + 2{\times}T}{15}$$

where, (G):Groundwater occurrence,
(A) : Aquifer hydraulic conductivity
(L): Height of groundwater level above sea level,
(I): impact magnitude of existing seawater intrusion
(D): Distance from the point of interest to the shoreline,
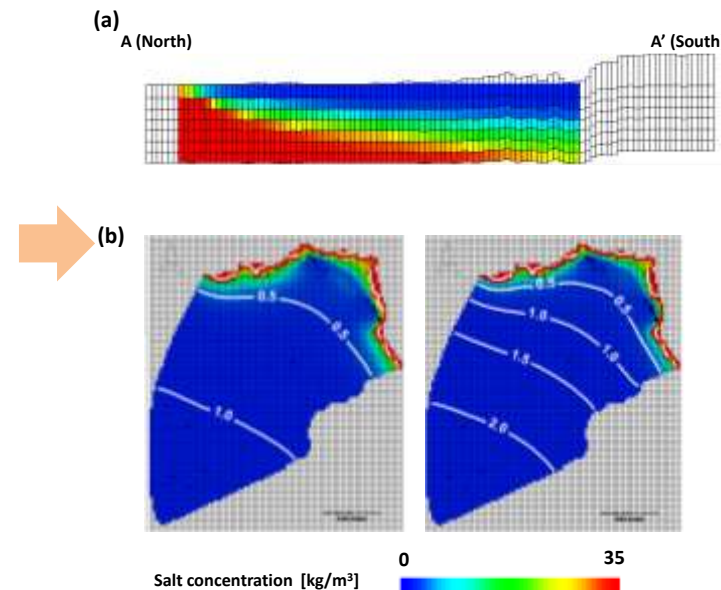(T): Aquifer thickness

Results – GALDIT parameters

Results – Modified GALDIT spatial map

Results – Long-term trend of SWI

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Results

The effect of climate change and pumping in coastal aquifers

Results – Climate and pumping scenarios
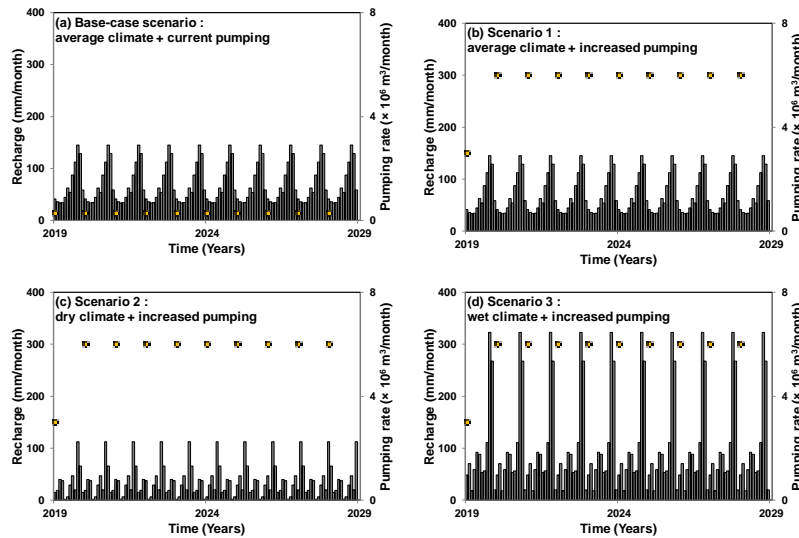

Results – Numerically simulated SWI

Salt concentration [kg/m³]   0   35

Results – Vulnerability change due to future scenarios

6.1-6.9
6.9-7.6
7.6-8.3
8.3-9.1
9.1-9.8
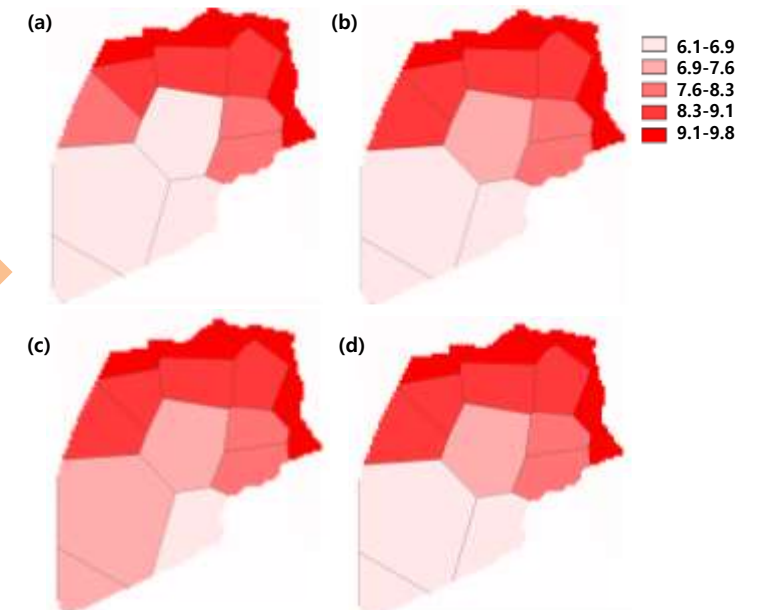
The model results show that the saltwater intrusion effects occurring through landward movement of the wedge might result in considerable reductions in freshwater and high vulnerability in coastal aquifers.

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Seawater Intrusion Vulnerability Assessment based on Index based numerical ranking system
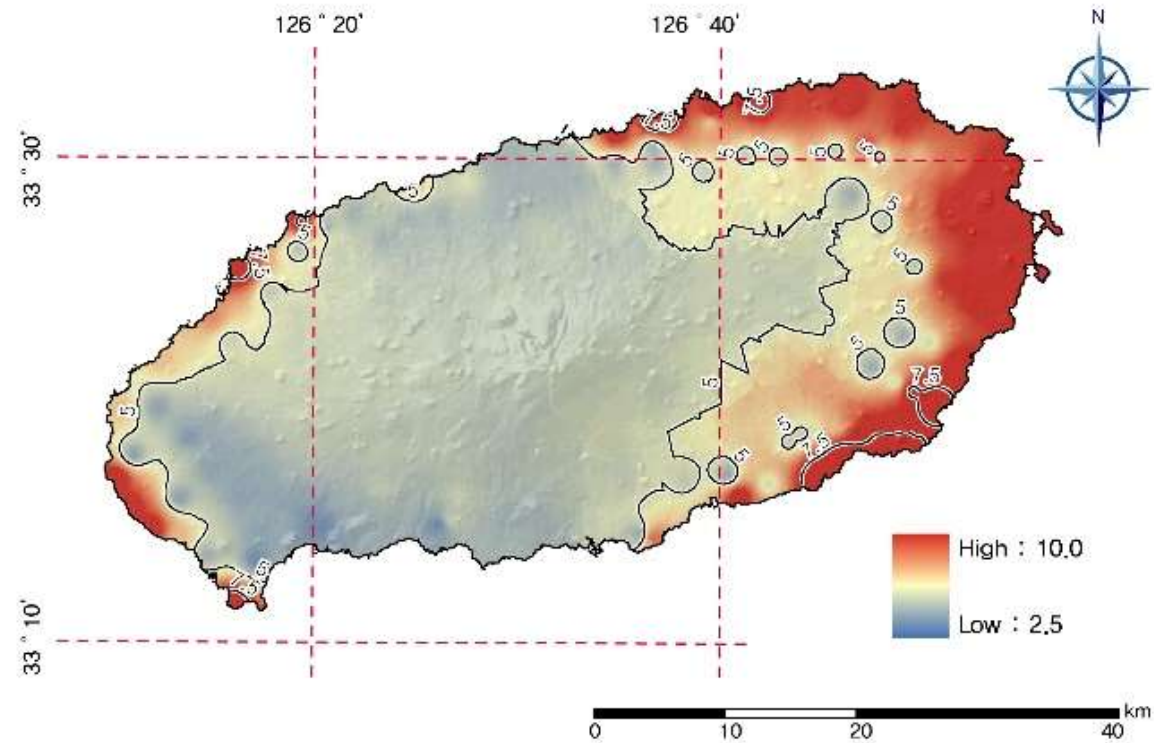
1) acquisition of good data and 2) inter-disciplinary collaboration !

THANK YOU