3C2) Impact of Sea Breeze Event on Air Pollution Dispersion at East Coast of South Korea

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1. Introduction

Most of the major cities are situated at the coastal area and the land - sea breeze showed significant role for coastal air quality. Land - sea breeze is a mesoscale thermally induced wind due to the differential heating between land and sea. This difference produces a pressure gradient between land and sea that creates the dynamic air flow between landward and seaward.

Several models and monitoring were conducted and published about the sea breeze events but they could not present the local air circulation pattern at all coastal area. The impact of sea breeze depends on the geography, land use pattern, temperature/pressure gradient, inversion height, etc. and the resulting wind flows are known to affect the transport of air pollutants. Bastin(2005) told that the depth of the breeze flow may be less than 200m by night and reached thousands meters during the day. Similarly, the wind flows over mountains terrain may transport air pollutants to higher altitudes and lower level at plain area. In this study, we operated commercial software to visualize the local sea breeze impact at the west coast of South Korea(near Anmyeong - Do).

2. Material and Method

First of all the modeling domain was selected as in Fig. 1, based on the preliminary judgment of sea breeze affected buffer zone then the selected domain was setup on the modeling software HOTMAC/ RAPTAD. HOTMAC is a computer code that forecasts wind, temperature, humidity, clouds, fog, and atmospheric turbulence distributions over complex surface conditions and RAPTAD is a three-dimensional computer code that forecasts pollutant concentration distributions using the wind and turbulence computed by HOTMAC.

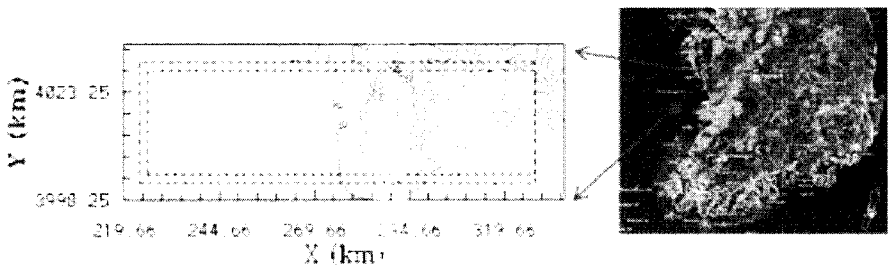

Fig. 1. Figure display the study site near Anmyeong - Do.

Three dimensional geographical data(topographical data) of 30 second resolution, averaged meteorological data such as temperature, wind speed, wind direction, inversion height, etc. are considered for this model. One week(Julian day, July 11 - 17) wind blow pattern around the selected area was modeled based on the given parameters.

3. Results and Discussions

Modeling duration was selected at mid of July(Julian day 193 - 199) which is the summer time of South Korea. Because of the high difference in temperature between land and sea due to the heavy sun intensity, there exists frequent sea breeze.

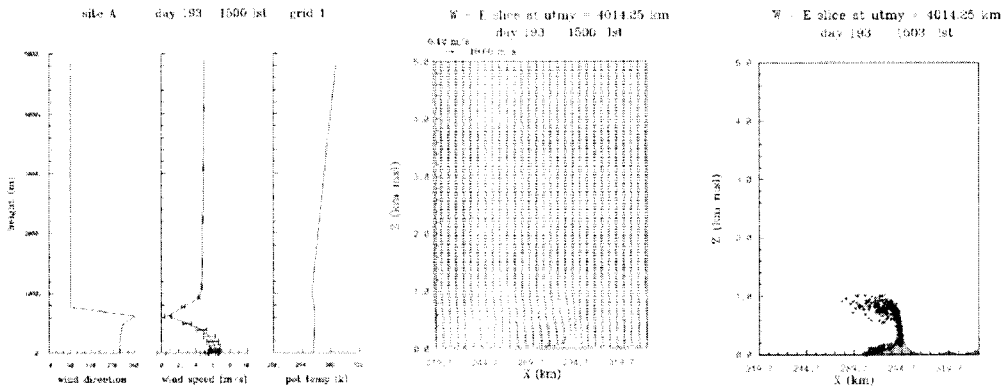

Fig. 2. Figure displays the mechanism of wind flow pattern at different altitude and its impact on air pollution dispersion.

Fig. 2(a) displays the change of wind speed and wind direction based on the geography and altitude up to 5000m. Figure 2(b) visualizes the air circulation pattern at different altitude and its obstruction by existing mountain. Similarly figure 2(c) shows the mechanism of air pollution dispersion and its impact by sea breeze and the landscape.

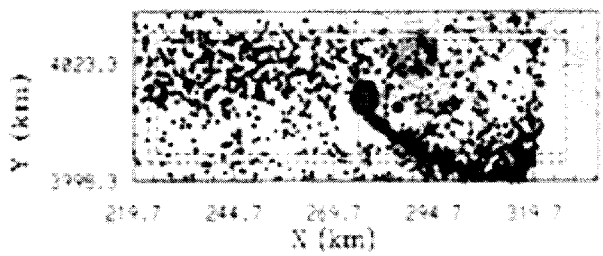

Fig. 3. Air pollution distribution at the study domain.

The source was set near the sea beach at the study domain as shown in figure 3. The air pollution was dispersed up to 50km towards land side during the day time and showed the reverse mechanism as the night deepen. It is also concluded that the air pollution dispersion was affected by topography, land use pattern, meteorology, etc. which can be observed from figure 2(c).

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