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연안에서 오염확산에 영향을 미치는 열적 내부 경계층의 발달

Development of Thermal Internal Boundary Layer influenced upon Pollutant Diffusions in the coastal region

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I. Introduction

An internal boundary layer generally forms whenever air flows across the surface discountinuity between land and water(Echols, 1970, Echols and Wagner, 1972, Sethuraman, 1982). Lee(1982), Choi and Choi(1994), and Plate(1971) explained that the internal boundary layers at the coastal site are produced by the different downwind surface roughness, surface temperature, and vapour pressure of inland from those of sea and can be classified as the mechanical, thermal and mositure internal boundary layers. The spartial and temporal variations of the thermal internal boundary layers(TIBL), which develops within a sea breeze srably stratified flowr regime passing over warm land surface is a key element in modelling with particular regarad to air quality dispersion analyses for coastal located pollutant sources and to impact of emissions resulting from the sea breeze fumgigation process.

This paper describe a predictive method for diurnal growth and recession of thermal internal boundary layer at a coastal site during the prevailing onshore winds in the winter time.

II. Data Analysis and Numerical Methods

In order to investigate the growth of internal boundary layer in Cheju Island from December 25, 1986 through 26 for 24 hours, we used a non-hydrostatic grid-point numerical model with one way double nesting technique. The authors incresed the horizontal resolution of the model with grid intervals of 5km and 1.5km at 33°N for the fine-mesh and the coarse-mesh model in making a modification for double nesting. Vertical resolution is also increased with the number of 15 levels in Z^* coordiate.

In the coarse-mesh model, leteral boundary data are provided with 12 hourly G-ANL data (global analysis) made by Japan Meteorological Agency. The prediction of the model made lateral boundary data for the fine-mesh model, and horizontal and vertical interpolations of the same global analysis data made initial fields such as winds, potential temperature, specific humidity for all two models with different resoultions. Initial temperatures of sea surface water were obtained from sea surface temperature data acquired by NOAA satellite, which were analyzed by National Fisheries Research and Development Agency.

III. Result

The growth of the internal boundary layer was usually affected by the surface roughness of complex terrain, land and sea surface temperatures, solar and long wave radiation and topography, etc.. According to our numerical simulation the growth of the internal boundary layer took a place during daytime, while the recession of the internal boundary layer started shortly after the sunset time, showing the disapperance of the internal boundary layer at night.

The depth of internal boundary layer is deeper near coastal regions than near the top of mountain, partly due to the surpress by the downslope and back flows. From the numerical simulation we may conclude that the area with a large vertical change of diffusion coefficients well matched the region to form the growth and recession of thermal internal boundary layers.

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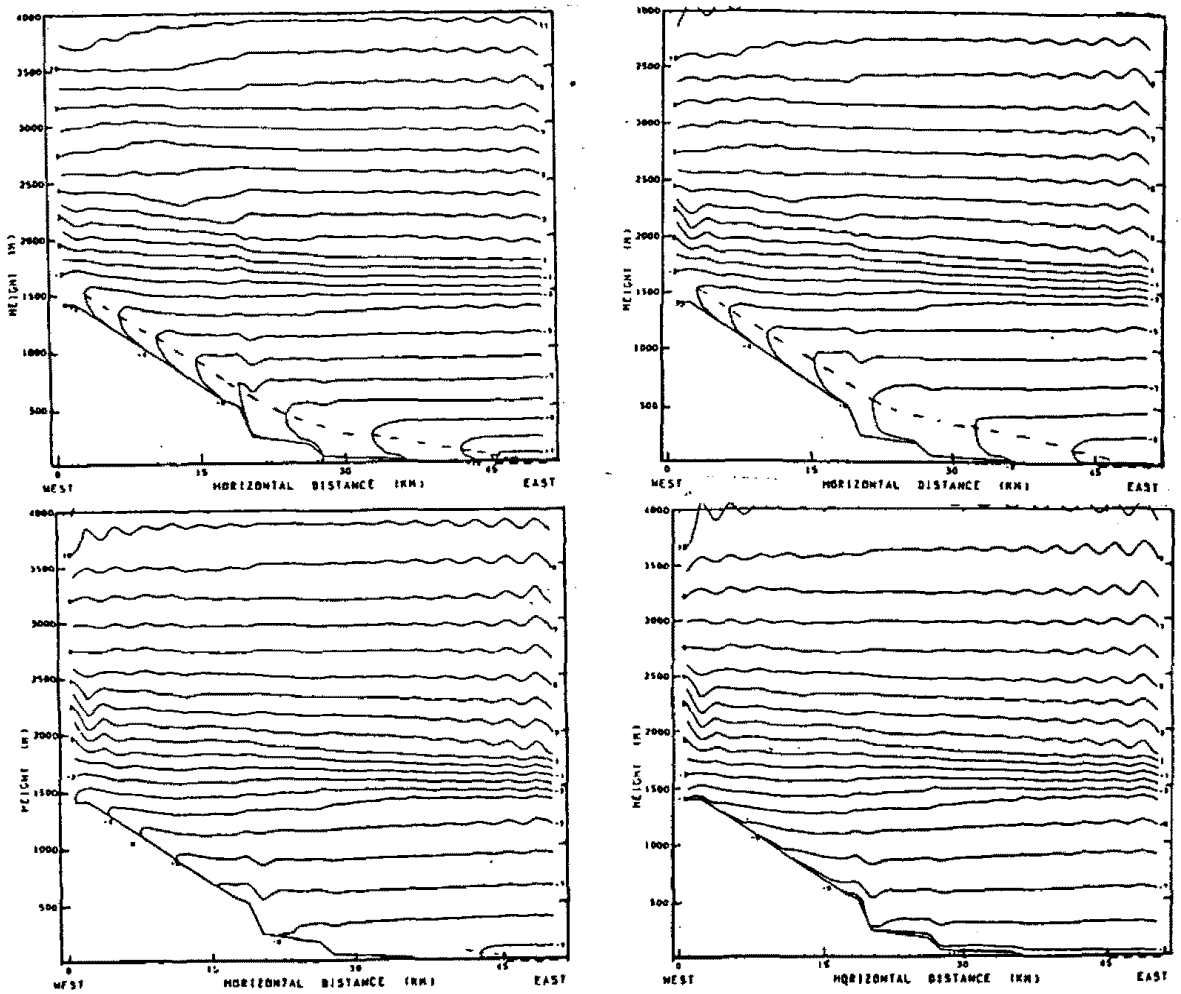

Fig. 7 Verical profiles of potential temperature deviation(K) near the Cheju Island at 12(a), 15(b), 18(c), 21(d) LST on December 25, 1986.