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Assessment on the improvement of wind fields in the planetary boundary layer simulated using NOAH-LSM in complex coastal area

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1. Introduction

Land surface consists of urban areas, soil, vegetation, snow, topography and inland water (lake and river). Land surface processes describe exchanges of momentum, energy, water vapor, and other trace gases between land surface and the overlying atmosphere. It has been recognized that land surface processes in association with heterogeneous vegetation and soil properties play a critical role in influencing the diurnal and vertical structure of the planetary boundary layer (PBL) and local wind circulations (Chen and Dudhia, 2001).

The NOAH Land Surface Model (LSM) provides Weather Research and Forecasting model (WRF) with surface sensible heat flux, latent flux, and skin temperature as lower boundary conditions. This will be helpful to realistically simulate local wind circulations, and the vertical structure of the planetary boundary layer (PBL).

We focus on the improvement of accuracy of wind fields over complex coastal area during clear skies and light winds. The NOAH-LSM was used to improve the lower boundary conditions in WRF. During the clear skies with weak wind speed, wind fields simulated with NOAH-LSM was compared with the case without NOAH-LSM.

2. Brief description of the NOAH Land Surface Model

This study used the NOAH-LSM, which has been widely recognized by the land-surface research community and which is coupled to the WRF model. Detailed descriptions of the NOAH-LSM model formulations and development are provided elsewhere (Chen and Dudhia, 2001; Koren *et al.*, 1999)

The current implementation of the NOAH-LSM has a two-layer soil model with 0.1 m and 1.9 m thick layers, and it also has a distribution of soil types. The NOAH-LSM simulates soil moisture, soil temperature, skin temperature, snowpack depth, snowpack water equivalent, canopy water content, and the energy flux and water flux terms of the surface energy balance and surface water balance. Fig. 1 shows a schematic representation of the NOAH-LSM. The WRF Noah Land Surface Model was initialized from soil temperature and moisture fields of the NCEP-NCAR reanalysis data.

3. Case and Domain

The Seoul metropolitan area of the Korean peninsula has a complex terrain including an irregular coastline and moderately high mountains. This implies mesoscale circulations such as mountain-valley breeze and land-sea breeze can play an important role in wind fields and ocean forcing.

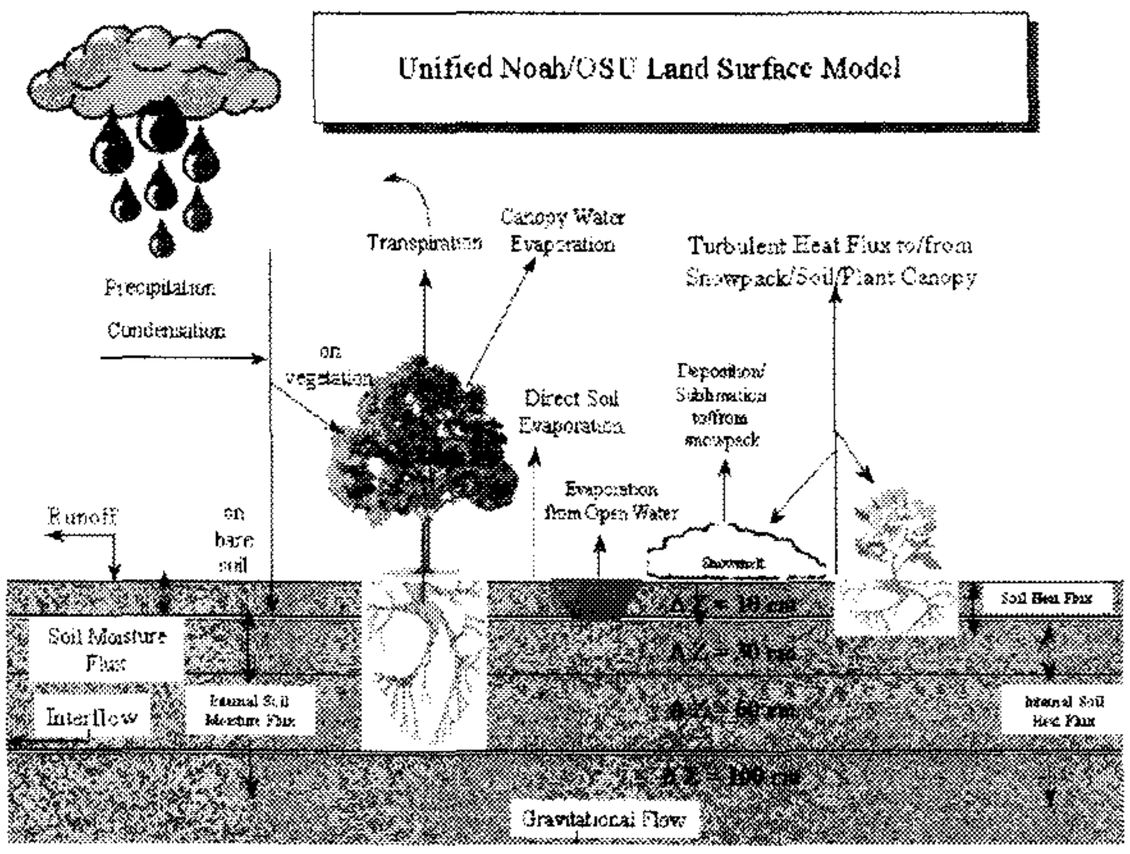

Fig. 1. A schematic representation of the NOAH land surface model.

The case was consecutive days between 0000 LST 28 and 0000 LST 31 May 2005, that were characterized by clear skies and light winds. Table 1 indicates summary of the characteristics of meteorological conditions. Mean wind speed at Seoul weather station on 29 May was less than 2 m s^{-1} and maximum temperature recorded 30.1 ℃.

Table 1. Summary of the characteristics of meteorological conditions at Seoul weather station, 28-30 May 2005.

Date	Meteorological condition			
	Solar radiation (MJ m^{-2})	Maximum temperature (℃)	Mean wind speed (m s^{-1})	
			08-10 LST	14-16 LST
28 May	21.1	27.7	1.5	2.9
29 May	24.7	30.1	1.8	1.5
30 May	24.9	26.3	2.4	3.4

4. Results

Compared with standard WRF model simulation without LSM, a WRF simulation coupled with LSM provides a better agreement with surface wind observations and simulates well mesoscale circulations such as mountain and valley winds on land and sea breeze in the coastal areas.

참 고 문 헌

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