

OA13 Prediction of snowfall in the Kangnung coast - complex case

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1. Introduction

Numerical prediction of snowfall is undertaken by three-dimensional non-hydrostatic numerical model of MM5 in the complex case of (a) high pressure system in the north-eastern China and low pressure system in the southern Korea and (b) high pressure system in the eastern China and low pressure system in the East Sea near Hiroshima in Japan. In general, rainfall and snow fall should be made by sufficient amount of clouds and their difference is subjected to the frozen of raindrops or cloud drops under 0°C ⁽¹⁻³⁾. It was reported that when snowfall occurs near Mt. Taegualyung, rainfall (no snowfall) occurs near Kangnung city in the coast. The most difficulty is how to make a judgement to distinguish snowfall and rainfall and in this study (Choi, et al, 2003), the understandable method is suggested with numerical simulation results.

2. Numerical methods and data

The complex case study of snowfall in the mountainous coastal region had been undertaken from 1800LST January 21, 2003 through 1800LST January 24, 09, 2003. The numerical model used was MM5 with an initial meteorological data set of NCEP. A triple nesting were made with grid numbers of 125 x 105 with horizontal 27km interval and vertical grid number of 23 in the coarse domain and in the second domain, grid number of 82 x 82 with 9km interval and in the third domain, grid number 61 x 61 with 3km interval, with 22 levels in the vertical spread from 10 m to 10 km with sequentially larger intervals. 9km and 2.50 degree interval terrain data set was used for the largest domain and then the 0.9km interval data was used for fine mesh domain. MRF method was adopted as boundary layer, simple ice method for the prediction was also considered. When we have snowfall, we also simultaneously have rainfall and 3 hours accumulated snowfall was treated as the summation of ice and water.

3. Results and Discussion

Before 0900LST, January 22, north-westerly wind prevails in the inland and coastal regions of Kangwon province and a little amount of moisture from the East Sea into the coastal region occurs, resulting in the deficit of moisture amount for the formation of snowfall from small amount of clouds in the coast. On the other hand, during the snowfall period from 1200LST January 22 to 1800LST, January 24, 2003, the mixed type of (a) high pressure system in the north-eastern China and low pressure system in the south-eastern part of Korean peninsula, which shows a typical pattern of high pressure in the north and low pressure in the south like pattern (a) (Fig. 1 and 2).

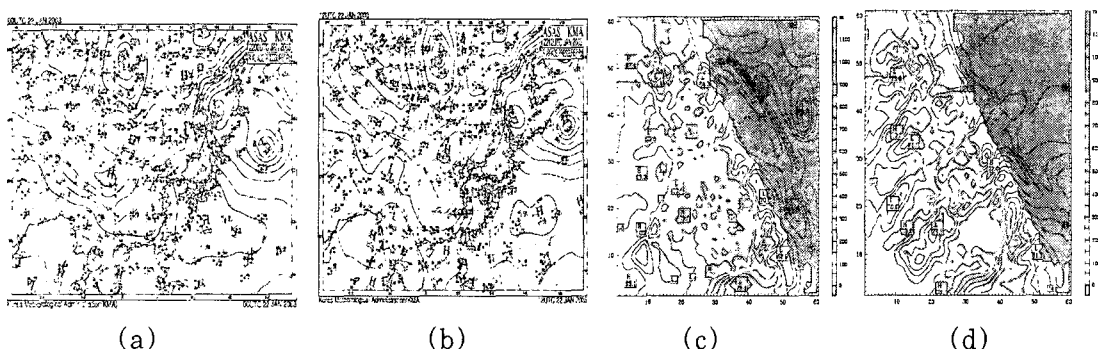


Fig. 1. Surface weather maps at (a) 0000UTC (0900LST), January 22 and (b) 1200UTC (2100LST) January 22, 2003. and relative humidity (%) at (c) 0300LST and (d) 0900LST, January 23.

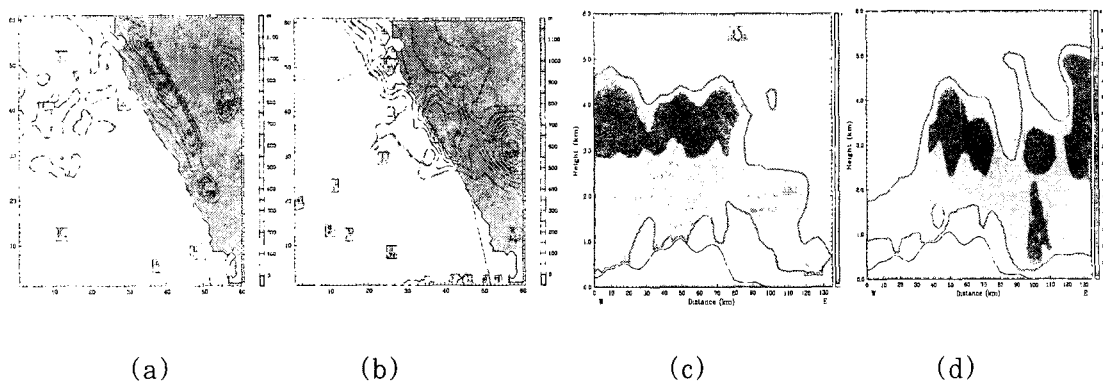


Fig. 2. Total precipitation amount in the past 3 hours (cm at a) 0300LST and (b) 0900LST, January 23 and total cloud mixing ratio (g/kg) at (c) 0300LST and (d) 0900LST, January 23.

From 2100LST January 22 to 2100LST, January 23, pressure pattern is changed like type (b), which shows high pressure system in the west and low pressure

system in the east, with the existence of low pressure center near Hiroshima in Japan. This pressure pattern induces northerly wind from the East Sea and northerly wind induces sufficient moisture from the sea into the inland coast near Kangnung city and further mountain side in the west (Mt. Taegualyung of 868m height). Near the ending time (2100LST), January 23, wind pattern is changed into north-westerly wind, which can induce dry air masses from the western inland of Korea.

The snowfall band is in the coincided area of minimum sensible heat flux band and its negative value area. Similarly to the latent heat, the snowfall band is detected in the area of minimum value of latent heat flux. Simultaneously, the snowfall band directly coincides the area of relative humidity of 100%. After the saturated water vapors forms a great low cloud near the right side of the mountain top under westerly wind, it falls down below 0°C air temperature, resulting in the formation of snow (Fig. 3 and 4). As it falls down toward the ground over 0°C air temperature, it becomes rain. When cloud is developed along the eastern slope of the mountain and goes down toward Kangnung city and snowfall occurs in the Kangnung city.

References

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