Classification of Heavy Ocean-effect Snow by Doppler Radar Observations

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At 3-22th December 2005, there was rare persistent snowfall weather process over Shandong peninsula. According to statistics, there were all together 7 snowstorm-days, and the snowstorm-days were 4th, 6th, 7th, 11th, 12th, 13th and 21th respectively. The maximum 24 hours average precipitation of snowfall was 27mm which appeared at 4th, Rong cheng. The second largest precipitation was 24mm at 7th, Weihai. The third largest precipitation was 21mm at 6th, Yantai. The above three numbers of daily precipitation of snowfall were extreme value since there were local meteorological records of ocean-effect snow. In addition, the probability of snowstorm is low, there are only 15-time in winter from 1965-2006.
The daily amount of snowfall is defined as the accumulated amount of snowfall from 20:00 to 20:00 the next day. Therefore,there are two requirements for the definition of ocean-effect snow day:(1)the observation of weather phenomenon should be snowfall on surface. (2)Shan dong peninsula is controlled by north-west wind which is behind westly trough on 700hPa and 850hPa from 20:00 to 08:00 the next day. Once the amount of snowfall of any station at Shan dong is more than 10mm, the day can be defined as ocean-effect snow day. By using of Doppler radar observations at 6-minutes intervals at Yantai December 2005, a classification of ocean-effect snow clouds and spatial distribution of snowfall was made. Considering the clouds which emerging below 2km are low, we applied the basic reflectivity factor and radial velocity at 0.5° elevation into this research. Radar locates at Yantai city with height above sea level of 0.41 km. The radar scans a time every 6 minutes. There are 9 elevation angles and the lowest one is 0.5°.
The results indicated that the mode of radar echo pattern always predominated at anyone of the seven heavy ocean-effect snowfall process. Four snowfall modes were defined: L-mode, single line-mode, double lines-mode and wide mode. Three of them showed significant train-effect on radar basic reflectivity factor picture. The prevailing wind direction was northwesterly at mid-troposphere, a wind shear of northeasterly and northwesterly wind occurred at low-troposphere on peninsula north sea.The distribution patterns of heavy snowfall was related to the position of the shear. When the inflection point located to the west of Yantai and was far away from coastal line, the center of snowstorm was nearby Yantai. While when the inflection point located to the east of Yantai, the center of snowstorm was at Weihai,The wide mode was different from the others for its wide radar echo and northwesterly wind at every level. There was no wind shear at low troposphere. Spatial distribution patterns of heavy snowfall were up to cloud type, and the snowfall centers of these four modes were at different area: L was at Yantai, Single and double lines were at Weihai, while the second center was at Zhao yuan. The snowfall distribution of wide mode was well-distributed, the center was at Wen deng, and the amount of snowfall in snowstorm zone was not so different from other snowfall zone.

Keywords: ocean-effect snowstorm, spatial distribution pattern, reflectivity factor, radial velocity

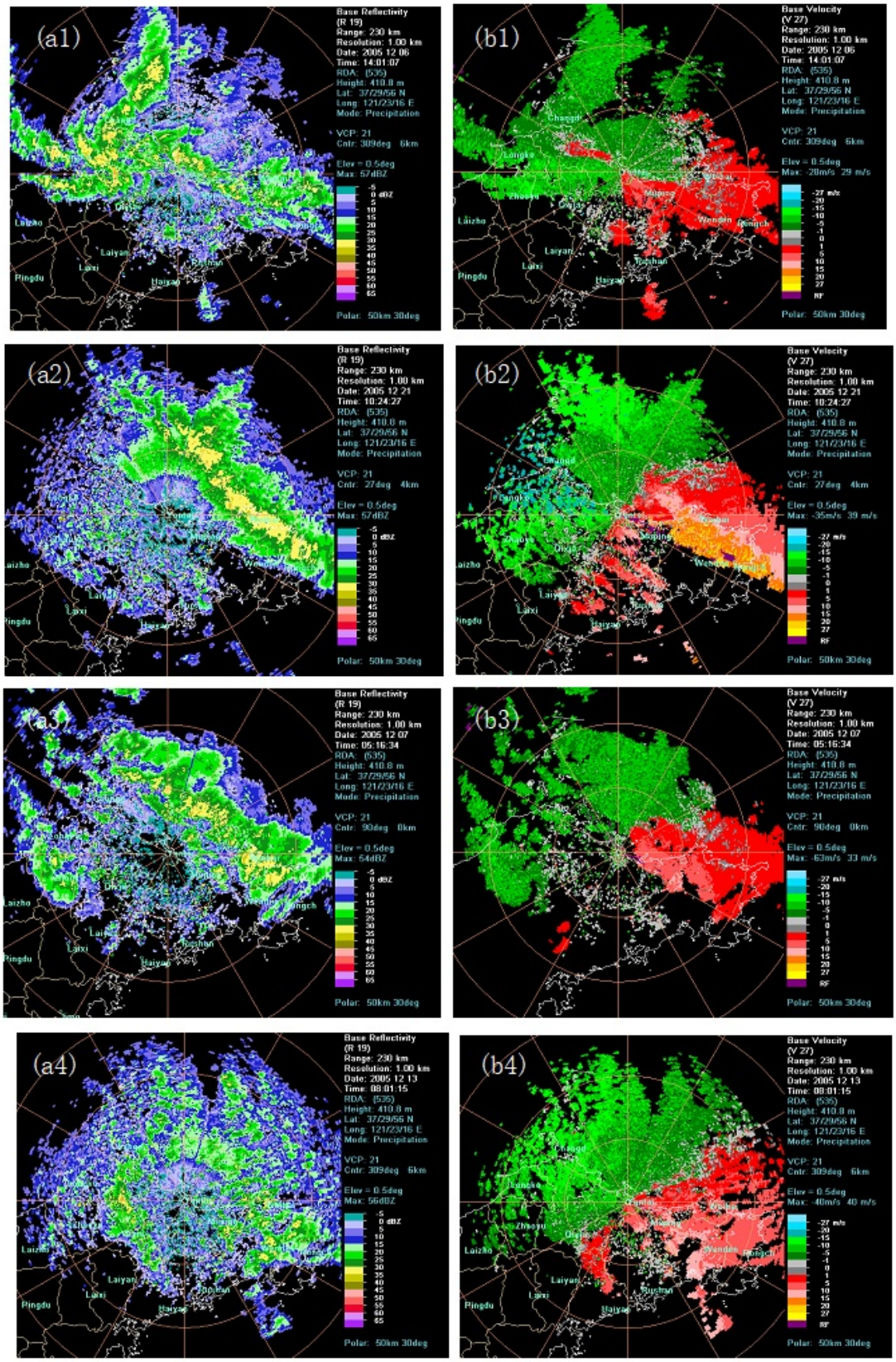

Fig1. Modes of ocean-effect snowfall Basic reflectivity factor (a) and radial velocity (b)