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Statistical Characteristics of Mesoscale Convective Systems over the Middle Reaches area of the Yellow River During 2005-2014

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Based on the hourly TBB and cloud images of FY-2E, meteorological observation data, and NCEP reanalysis data with $1^\circ \times 1^\circ$ spatial resolution from May to October during 2005-2014, the climatic characteristics of mesoscale convective systems (MCS) over the middle reaches area of the Yellow River were analyzed, including mesoscale convective complex (MCC), persistent elongated convective systems (PECS), meso-βscale MCC (MβCCS) and Meso-βscale PECS (MβECS). The results are as follows: (1) MCS tended to occur over the middle and south of Gansu, the middle and south of Shanxi, the middle and north of Shaanxi, and the border of Shanxi, Shaanxi and Inner Mongolia. MCS over the middle reaches area of the Yellow River formed in May to October, and was easy to develop the mature in summer. MCC and MβECS were main MCS causing precipitation in summer. (2) The daily variation of MCS was obvious, and usually formed and matured in the afternoon and the evening to early morning of the next day. Most MCS generated fast and dissipated slowly, and were mainly move to the easterly and southeasterly, but the moving of round shape MCS was less than the elongated shape's. (3) The average TBB for the round shape MCS was lower than the elongated shape MCS. The development of MCC was most vigorous and strong, and it was the strongest in August, while that of MβECS wasn't obviously influenced by the seasonal change. The average eccentricity of the mature MCC and PECS over the middle reaches area of the Yellow River was greater than that in USA, and the former was greater than in the lower reaches area of the Yellow River, while the latter was smaller. (4) The characteristics of rainfall caused by MCS were complex over the middle reaches area of the Yellow River, and there were obvious regional difference. There was wider, stronger and longer precipitation when the multiple MCS merged. The rainfall in the center of cloud area was obviously greater than in other region of cloud area. The heavy rain mainly occurred in the left and backward quadrant of MCS. The most precipitation intensity of MCS was generally greater than 50 mm•h-1. The ratios of rain areas and cloud areas for the different types and regions MCS were significantly different. (5) There were obvious inter-annual variation characteristics of MCS. The number of MCS was more in 2011 and less in 2009 than the normal year, and the circulation situation in 2011 was nearly opposite to 2009, which were related not only to the subtropical high, geopotential height anomaly on 500 hPa in the middle latitude and transportation and gather of warm and moisture airflow in lower layer but also to the cold vortex systems on 500 hPa.