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Analysis of the Convective Storm using Meteosat Second Generation and SPOL Radar over a Megacity, on May 18, 2014

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The rapid populational growth in urban areas of Southeast and South Brazil has increased anthropic effects on severe weather caused by thunderstorms whose impacts require mitigation on a small space-time scale more susceptible to natural disasters such as flooding. The 18 May 2015 thunderstorms in The Metropolitan Area of São Paulo (MASP) caused many losses due to heavy rain, gusty winds and falling hail. The local press reported 310 tons of ice removed from the surface. Meteosat Second Generation (MSG) images, polarimetric weather radar measurements, radiosondes and surface weather variables data sets were used to analyze the event. The environmental thermodynamic analysis showed a dry layer at mid levels with wind shear at upper levels. Diabatic heating increased throughout the day and made the atmosphere very unstable at the end of the afternoon with greater potential energy induced by the local sea breeze. The 0 °C isotherm was at 3781 m. Initially, the rapid horizontal expansion of the storm caused by environmental wind shear was observed at 10.8 mm IR MSG channel brightness temperature (BT) was of -57 ° C. The brightness temperature differences (BTD) between WV and IR MSG channels evidenced vertical moisture transport from near the surface to the upper levels during convection. In the mature stage, radar reflectivity showed widespread multi cellular storm structures. Vertical cross-section indicated reflectivities between 45 dBZ to 55 dBZ with cloud tops with reflectivity greater than 30 dBZ at 14 km altitude when updrafts were more intense. Vertical profiles of differential reflectivity (ZDR) showed a deep column from to +2 to +4 dB between 6 km to 12 km altitude where intense vertical transport of large drops and a mixture of water and ice well above the 0 ° C isotherm level. This environment increased efficiency of the Wegener-Bergeron-Findeisen type microphysics with rapid ice crystal growth to hail with later precipitation at the surface that lasted from 1855 UTC to 1935 UTC. The thunderstorms main cores crossed MASP also due local circulations induced by the heat island. These results can contribute to the development of nowcasting tools and short-term warning systems by integrating satellite and weather radar data sets so to increase the resilience of megacities to such severe convective events.