Analysis and validation of severe storm parameters derived from TITAN in Southeast Brazil

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The implementation of TITAN (Thundestorm Identification, Tracking and Nowcasting) System at IPMet in December 2005 has provided real-time access to the storm severity parameters derived from radar reflectivity, which are being used to identify and alert of potentially severe storms within the 240 km quantitative ranges of the Bauru and Presidente Prudente S-band radars. The potential of these tools available with the TITAN system is being evaluated by using the hail reports received from voluntary hail observers to cross-check the occurrence of hail within the radar range against the TITAN predictions. Part of the ongoing research at IPMet aims to determine "signatures" in severe events and therefore, as from 2008, an online standard form was introduced, allowing for greater detail on the occurrence of a severe event within the 240 km ranges of both radars. The model for the hail report was based on the one initially deployed by the Alberta Hail Program, in Canada, and also by the Hail Observer Network established by the CSIR (Council for Scientific and Industrial Research), in Pretoria, South Africa, where it was used for more than 25 years. The TITAN system was deployed to obtain the tracking properties of storms for this analysis. A cell was defined by the thresholds of 40 dBZ for the reflectivity and 16 km3 for the volume, observed at least in two consecutive volume scans (15 minutes). Besides tracking and Nowcasting the movement of storm cells, TITAN comprises algorithms that allow the identification of potentially severe storm "signatures", such as the hail metrics, to indicate the probability of hail (POH), based on a combination of radar data and the knowledge of the vertical temperature distribution of the atmosphere. Another two parameters, also related to hail producing storms, called FOKR (Foote-Krauss) index and HMA (Hail Mass Aloft) index is also included. The period from 2008 to 2013 was used to process all available information about storm characteristics, such as, onset time, duration and size of hail. The results of the analysis for the time evolution of the storm cells properties enabled the identification of the following key signatures for hail-producing cells: storm volume varying between at least 250 km3 and 1850 km3; average speed of more than 50 km/h; FOKR and POH indices with values between 3 and 4 and 0,8 to 1, respectively, observed at the same time as hail was reported to have fallen on the ground; HMA parameters (mass of hail accumulated aloft) peaking between 80 tons and 808 tons, preceding the time of the hail observed on the ground. The onset of hail, indicated in the reports, corroborates the time near the observed collapse of the cell indicated by a decreasing value of the severity indices provided by TITAN. This ongoing research will add more cases to include not only hail-producing cells, but also those associated with extreme winds and flash floods, to contribute towards the improvement of IPMet′s radar bulletins issued routinely by the operational sector for the private and public sector, like the Civil Defense Authorities of the state of São Paulo.