A Nowcasting Approach to Detecting South African Hazardous Convective Storms

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ABSTRACT

This work extends the previous study of Hardy and Nel[1] that defined the Hazardous Potential Index (HPI) to detect potentially hazardous convective storms over South Africa. Hazardous storms are destructive and pose a threat to life and property. The HPI was designed to identify storms, in the absence of ancillary meteorological radar data, using only satellite imagery from Meteosat Second Generation (MSG)/SEVIRI. Potentially hazardous storms are identified by evaluating indicators of hazardous storms in infrared data from the Meteosat-8 and Meteosat-9 satellites.

The HPI made use of six indicating factors; namely the cumulus cloud, active region, overshooting top, small ice particle, active region growth and cumulus cloud (rainfall estimation) temperature factors. The false alarm rate associated with the HPI may be reduced through an adaptation of the HPI algorithm by removing the cumulus cloud and active region factors and by incorporating an evaluation of the change in the cloud top temperature of a candidate storm. A decrease in the average cloud top brightness temperature is indicative of vertical development within the candidate storm.

The modified HPI algorithm monitors the areal growth and brightness temperature changes of candidate regions of cumuliform cloud, establishes the presence of overshooting cloud tops and small ice particles in the cloud by using multispectral band-differencing and estimates the rainfall rate associated with a candidate cloud. The sum of these indicator factors is used to generate a graphical product that may be used in nowcasting applications to identify hazardous storms.

The performance of the HPI and the modified HPI are evaluated against the CAPSAT[2] "Severe Convective Storms" composite product over 20 historical case studies to demonstrate the effectiveness of the HPI products in detecting hazardous convective storms and to illustrate the improved performance of the modified HPI algorithm.

[1] C.H. Hardy and A.L. Nel, 2010: *Detection of hazardous storms over South Africa using MSG/SEVIRI image data*, In: Remote Sensing of Clouds and the Atmosphere XV, edited by R.H. Picard, K. Schfer, A. Comeron, M. van Weele, Proc. SPIE, **7827**, 78270X

[2] I.M. Lensky and D. Rosenfeld, 2008; *Clouds-Aerosols-Precipitation Satellite Analysis Tool (CAPSAT)*, Atmos. Chem. Phys., **8**, pp. 6739-6753