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Lightning detection and prediction from multi-sensor remote observations

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Lightining represents one of the most feared threat due to atmospheric phenomena. The detection and temporal prediction of Lightining is of fundamental importance for the safety of the citizens and for preventing economic losses.
Nowadays ground networks of remote sensors, even portable, are the most used tool for detecting the lighting activity in real time. These sensors are basically low noise receivers tuned on Very Low Frequency / Low Frequency (VLF/LF) bands of the electromagnetic (EM) spectrum. They receive EM emission generated either by the current flow from the top of the cloud to the ground or within the cloud itself. The arrival time of this emission at the receivers, located at different sites, allows estimating the position of the lightining on the ground surface.
Alterative lighting detection approaches have been studied in literature. They are mainly based on the use of weather radar and satellite Meteosat Second Generation (MSG) observations. The physical principle used to infer the lighting occurrence from these sensors is based on the measure of the radar reflectivity and the brightness temperature, being both of them recognized to be good indexes for identifying the convection .
In this work we analyze the potential use of a synergic multisensor approach to detect and predict the lighting occurrence in central Italy. This work is motivated by needs expressed by the part of local companies which, due to lighting activity, experiment unexpected blackouts and their production interruption. To this aim, weather radar data and MSG satellite observations are used together with ground lighting sensors. Temporal trends of radar reflectivity, radar bin heights against chosen isotherms and MSG brightness temperature will be used as short term precursor of lightining. On the other hand, the regional instability index like the Lifted Index (LI), K-index, and Maximum Buoyancy (MB) index estimated from MSG satellite observations are used as longer term precursor. The results of lighting detection are validated against the ground sensor network measurements.