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On the influence of spatial and temporal resolution of satellite observations for characterizing convective initiation

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Early warnings for developing severe convective storms remain a challenge for operational meteorology. To advance forecasting skills, the improvement of current satellite-based nowcasting methods for the early detection of convective initiation is one promising direction. In the present study, attention is focused on the influence of the spatial and temporal resolution of satellite observations, and an optimal use of the capabilities offered by the current European geostationary Meteosat Second Generation satellites. A set of cases of developing isolated convective cells for the years 2013-2015 are considered for this purpose. Using rapid scan observations from Meteosat with 5 minute repeat cycle as baseline, the limitations of the 15 minute repeat cycle of Meteosat's prime service are illustrated. Specifically, due to typical growth times of about 30 minutes for convective storms, it is shown that the temporal sampling is too low to fully resolve the growth phase. In addition, the effects of spatial resolution are analyzed, contrasting SEVIRI's 3x3km2 standard resolution observations with results obtained using the HRV channel. A recently developed scheme for cloud property retrievals using the HRV channel is used for this purpose, showing differences in the typical life cycle attributable to spatial resolution of the underlying datasets. Finally, our results are discussed in the context of the instrumental characteristics of the upcoming Flexible Combined Imager, which will be flown on the Meteosat Third Generation satellites expected for launch in late 2021.