SSASE: A Regional Index for Assessing Severe Storm Environments in Subtropical South America

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Subtropical South America is one of the regions most affected by severe storms (hail, tornadoes, and non-tornadic high winds) in both frequency and intensity [1]. In Argentina, hail damage has a significant impact on agriculture. In Mendoza, where viticulture is the main economic activity, hail damage can lead to a loss of up to 22% of profits. [2]

Due to the small horizontal scale of most severe storms and the lack of reliable reports worldwide, robust statistics on the subject are scarce. To approximate this, several studies [3] [4] [5] have developed indices to determine whether an environment is favorable for the development of severe storms, primarily for the Global North. However, there is a lack of such information for the Global South.

We have developed an index called SSASE (Subtropical South American Severe Index) to identify potential environments representative of our study region. Using linear discriminant analysis, we incorporate Convective Available Potential Energy (CAPE), 0–6 km wind shear, and vertically integrated moisture divergence. Since logarithmic relationships have been shown to be more effective in distinguishing between severe and non-severe storms, all input parameters are logarithmic. The integration of moisture convergence improves detection in eastern Argentina, where convergence plays a more significant role. The method was calibrated and evaluated using 3-hourly ERA5 reanalysis data. Our goal is to assess SSASE's ability to capture the annual and daily cycles of severe storm occurrence, their spatial distribution, and interannual variability to develop a suitable climatology for the region.

We evaluated the method using the CORDEX-CORE regional climate model available for South America, selecting RegCM 4.7 for the period 1979–2005 due to its sufficient vertical resolution and temporal granularity. Our aim is to detect the frequency of occurrence and the annual and daily cycles of severe storms in regional climate models. Furthermore, this information will be valuable for assessing changes in severe events under climate change scenarios

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