**Objective**

Severe Weather Events (SWE) identification in Southern Brazil, using a polarimetric weather radar data with Machine Learning (ML) techniques.

**Introduction**

This work presents our experience with radar data analysis for single and dual polarimetric systems, using machine learning techniques to explore complex data and obtain an overview and better understanding of the observed phenomena. In less than 5 years, in Brazil we increased our radar coverage, from 23 single polarization weather radars to 15 more dual polarization radars, mainly S-Band, with a concentration in the southern region, an area prone to severe weather, mostly related to Mesoscale Convective Systems. Weather radars in the south of Brazil play an important role in quantitative precipitation estimation and severe weather monitoring and forecasting. The major economical activity in this region is agro-industry and en-ergy production, responsible for more than 35% of hydropower energy generation used in the country, directly dependent on precipitation distribution, water availability and severe storms.

**Data**

- **Radar**: Volumetric scans from polarimetric weather radar.
- **Atmospheric electric discharges**: Total lightning data from Earth Networks Total Lightning Network (ENTLN).

**Period**: January 2015 to July 2016

**Methodology**

The polarimetric moments used were Z, ZDR, KDP and RH0V and radar products such as height of the maximum reflectivity (HMAX), and azimuthal, vertical and radial shear.

**Results**

Table 1 shows the correct identification by models only in the previously identified regions. And all regions identified are compared in table 2.

**Comments and Conclusions**

The performance of the models may be directly related to the inaccuracy of location information, time and duration of events, but 80% of the events were fully identified during the 30 minutes preceding the SWE. In addition, some regions which were not previously identified as SWE, were indicated by the models as possible occurrence of severe weather. In regions where the models were not applied during training, a comparison was made with total lightning data. This comparison showed good correlation between the identified regions and high values of total lightning data or lightning jump. In this way, this study is efficient as a tool to support the decision, by meteorologists, in the identification and prediction of SWE. In order to improve these results, will be investigate the regions with no previous classification of SWE but which were identified as possible severe events.

**References**


**Acknowledgements**

This research was partially supported by CAPES/Brazil. Earth Networks provided the total lightning data.

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**Figure 1**: Brazilian weather radar network (left), and Hydrometeorological System in Parana State, with 2 S-Band weather radars, 1 Single Pol and 1 Dual Pol (right).

**Figure 2**: Some examples of studied SWE.

**Figure 3**: Identification by M-MLP and M-SVM models compared to M-ENTLN.

**Figure 4**: Output from models M-MLP, M-SVM and M-ENTLN on 03/02/2016, related Fig 2(a) and Fig 2(b).

**Figure 5**: Output from models M-MLP, M-SVM and M-ENTLN on 07/13/2015, related Fig 2(d).