***A new methodology for the identification of wet-snow conditions for snow sleeves forecast on the overhead power lines***

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The resilience of the electricity system is very relevant for the Transmission and Distribution System Operators (TSO&DSO), also considering the extreme meteorological events that cause significant disruptions to the system. Wet snow is one of the most critical atmospheric phenomena that has a significant impact on the overhead power lines during wintertime. This type of snow is characterized by high liquid content flakes, able to adhere to the conductors of the power lines. This causes the formation of heavy snow sleeves on overhead power line conductors that can lead to numerous and prolonged electrical failures and to significant structural damages to the lines. To increase the resilience of the electricity system, a forecasting and warning system for wet snow overload called Wet-snow Overload aLert and Forecasting (WOLF) has been implemented. This forecasting tool represents an information system able to predict the wet snow overload on overhead power lines on the Italian territory.

In this study we propose a new method for the identification of wet snowfalls that can be alternative or complementary to the Thermal Window method (TW), currently in use. In the thermal methodology, wet snowfall occurs when the temperature falls within a specific range of values that has been established based on several experimental case studies at the snow sleeves monitoring facility in Vinadio. The new method, instead, is based on fraction of the Frozen Precipitation (FP) i.e. the fraction of the solid precipitation content compared to the total content (solid + liquid). This variable can be derived from the meteorological model outputs currently used in the WOLF system, using the mixing ratios of the solid and liquid fraction of hydrometeors. In this framework, high spatial resolution (1 km) test simulations were carried out on an area centered on Vinadio in order to better describe the snow physical processes in the complex orography area of the study. The model used is WRF-ARW with the same operational configuration used in the WOLF forecasting tool. Moreover, other simulations with different meteorological drivers (i.e. the ECMWF Integrated Forecasting System (IFS) and the Global Forecast System (GFS)) were carried out in order to analyze the differences in performance of the meteorological predictions for the most significant wet snow events occurred in the recent years.

The first results obtained from the analysis of some wet-snow case studies in Vinadio show that the FP method is able to better predict the timing of the wet snow events and the alternation of wet and dry snow precipitation during an ongoing event. The thermal window method, on the other hand, is generally more imprecise in the timing of wet snow and it often leads to significant overestimation of the sleeve load. The comparison of the two methodologies is planned to continue enlarging the sample of the case studies analyzed and evaluating the possibility of an operational implementation of the new FP method in the WOLF forecasting tool.