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Snow measurement campaign for snowpack model and satellite retrieval validation in Italian Central Apennines within SMIVIA project

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The Apennine mountain range is the backbone of the Italian peninsula, crossing it from North-West to South-East for approximately 1200 km. The main peaks are found in Central Apennines, especially in the Gran Sasso d'Italia massif, which hosts the highest Apennines peak, named Corno Grande, with its 2912 m a.s.l. During the winter season, Central Apennines are typically covered with snow, with thickness that can vary between a few centimeters to several meters. Despite the historical presence of snow in these territories, the Apennine snowpack is poorly studied and weather data coming from automatic measurement stations and manual snow measurements hardly coexist. Thus, within the SMIVIA (Snow-mantle Modeling, Inversion and Validation using multi-frequency multi-mission InSAR in Central Apennines) project, we identified the measurement sites of Pietrattina, at 1459 m a.s.l., and Campo Felice, at 1545 m a.s.l., both located in Central Apennines. There we collected automatic measurements using ad hoc installed automatic weather-snow stations (AWSS) and where we performed systematic manual measurements of the snowpack properties, from November 2020 till April 2021. The AWSS measures every 5 minutes air temperature, relative humidity, wind speed, wind direction, incoming short-wave radiation, reflected short-wave radiation, soil surface temperature, snow surface temperature and snow height. The manual part of the campaign included the digging of 10 and 8 snow pits at Pietrattina and Campo Felice sites, respectively, to measure vertical profiles of snow density, temperature, grain shape, grain size and fractional content of light absorbing impurities. Manual snow measurements provide important information on the state of the snowpack, and give the opportunity to reconstruct the history of the snowpack. Their proximity to automatic weather stations let us evaluate the impact of the very local atmospheric conditions on the snowpack

evolution. These measurements were performed within the SMIVIA project to: i) evaluate the ability of the snow cover model SNOWPACK to reproduce the observed snow cover properties; ii) verify the possibility to infer snow height and snow water equivalent from the data retrieved with Earth observation satellites; iii) investigate whether the use of a combination of snow numerical models and remote sensing data may provide better results compared to using each of the aforementioned approach, separately. Nevertheless, the data collected during the SMIVIA campaign at the measurement sites of Pietrattina and Campo Felice during season 2020-2021 can also provide precious information for other fields of study, like hydrology, biology and chemistry.