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Mapping the effects of VAIA storm using Sentinel 2 data

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Extreme meteorological events are important causes of damages even in the Alpine environment where topography can interfere with windstorms. These events can be characterized by winds up to 190 km/h that can damage human infrastructures and alter intensively the vegetation. Such an event occurred in the night between 28 and 29 October 2019, the low pressure area "Vaia" over Germany caused violent gusts over the eastern Alps, which crashed about 8 million cubic meters of timber. The protective forest, that plays an important role in avalanche and landslide prevention and protection, was uprooted in several areas of the Dolomites (Livinallongo del Col di Lana, Rocca Pietore, Colle Santa Lucia, Alleghe). The occurrence of similar episodes are rare considering that in 1990 the windstorm “Vivian” destroyed the protective forest of Curaglia in the Graubünden Canton (Suisse). The impact of such an event was not limited only to the forest, the "Vaia" windstorm was combined also to an intense alluvial event, similar to that of 1966, that interrupted telecommunications and main and secondary communication routes. This study presents the support provided by the ESA’s Sentinel imagery to the identification and mapping of these avalanche risk areas. The Sentinel 2A MSI imagery, 10m of resolutions, collected October 21st (pre-event) and November 10th (post-event), atmospheric corrected, were properly processed to compute NDVI. The multitemporal comparison of the NDVI values, together with the analysis of the spectral values identifying the different land cover classes, allowed the analysis of the forest cover in terms of variation and the discrimination between areas covered by "existing forest" and "uprooted forest".
The area under investigation (with an altitude ranging between 1000 and 1900 m a.s.l. and an extension of about 300 km2), is characterized by a vegetation cover where firs and larches are dominant. The analysis considered in addition to the event effects also the seasonal phenological variations of the vegetation according to the forest types present in the study area. The woodland areas with uprooted trees and the deciduous forest without leaves are, in fact, extremely similar from the spectral point of view during this season.
The results of the analysis of the images, integrated with the data of the digital elevation model allowed the identification of the areas with the forest on the ground and with a slope greater than 30°. These areas represent the loss of protective forest areas where the attention of decision makers must be focused on. This study can represent a tool for improving the knowledge about extreme events in alpine environments. Furthermore, this study evidences the support of remotely sensed images for a synoptic description of the territory useful for the definition of the avalanche risk.