Not too soon, nor too late: intermediate snowpack melt-out dates guarantee the highest seasonal grasslands greening in the Pyrenees

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In mountain areas, the phenology and productivity of grassland are closely related to snow dynamics. This is mainly due to the limited growing period that plants have in these regions which starts when the snowpack has melted. Previous studies have relied on satellite imagery, which is too coarse, hampering a full understanding of the interactions between grasslands and snowpack. This work exploits very high spatial resolution observations (1×1 m) of snow depth and Normalized Difference Vegetation Index (NDVI) acquired with an Unmanned Aerial Vehicle (UAV) at a sub-alpine site in the Pyrenees, the Izas Experimental Cathcment. During two snow seasons (2020–2021), 14 NDVI and 18 snow depth distributions were acquired over 48ha. Despite the snow dynamics being different in the two seasons, the response of grasslands greening to snow melt-out exhibited a very similar pattern in both. The NDVI temporal evolution in areas with distinct melt-out dates reveals that sectors where the melt-out date occurs in late April or early May (optimum melt-out) reach the maximum vegetation productivity. Zones with an earlier or a later melt-out do not reach peak NDVI values. The results show that knowledge of the snow depth distribution is not needed to understand NDVI grassland dynamics. The analyses did not reveal significant implications of spatial differences in snow duration for the diversity and richness of grassland communities within the study area.