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Measurements and modelling of the impacts of light absorbing impurities during two contrasted snow seasons at Col du Lautaret

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Light absorbing impurities (LAP) in snow, such as dust or black carbon, trigger potent snow-climate feedbacks. However, detailed measurements of the evolution of LAPs in seasonal snow are scarce, especially in the Alps. Here, we conducted detailed measurements of LAP in snow, snow physical and optical properties in the French Alps at a high altitude site. The dataset includes chemical measurements of mineral dust and black carbon (precisely elemental carbon and refractory black carbon), as well as spectral albedo measurements. The analysis of this dataset reveals strong discrepancies between elemental carbon and refractory black carbon measured concentrations, making it challenging to link the content of LAP to their radiative impacts. Using the dataset, the ensemble version of the Crocus snow model is evaluated and used to estimate the impacts of light-absorbing particles on snow cover evolution. Their impact on snowmelt turns out to be extremely sensitive to both meteorological conditions and uncertainties of the snow model, with a median shortening of 10 days for both snow seasons.