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## Statistical downscaling of extremes in seasonal predictions - a case study on spring frosts for the viticultural sector

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Spring frost events occurring after budburst of grapevines can damage new shoots, disrupt plant growth and cause large economic losses to the viticultural sector. Frost protection practices encompass a variety of vineyard management actions across timescales, from seasonal to decadal and beyond. The cost-effectiveness of such measures depends on the availability of accurate predictions of the relevant climate hazards at the appropriate timescales.

In this work, we present a statistical downscaling method which predicts variations in the frequency of occurrence of spring frost events in the important winemaking region of Catalunya at the seasonal timescale. The downscaling method exploits the seasonal predictability associated with the predictable components of the atmospheric variability over the Euro-Atlantic region, and produces local predictions of frost occurrence at a spatial scale relevant to vineyard management.

The downscaling method is designed to address the specific needs highlighted by a representative stakeholder in the local viticultural sector, and is expected to deliver an actionable prototype climate service. The statistical procedure is developed in perfect prognosis mode: the method is trained with large-scale reanalysis data against a high-resolution gridded observational reference, and validated against multi-model seasonal hindcast predictions.

Our work spotlights the potential benefits of transferring climate predictability across spatial scales for the design and provision of usable climate information, particularly regarding extremes.