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Pollen dispersal over complex terrain: How does anisotropic airborne pollen transport affect interpretation of fossil pollen records? A case study in Northern Patagonia.

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Accumulated pollen in stratified fossil reservoirs is used to infer temporal changes in vegetation composition. Transport and dispersal by winds are known to introduce large biases in the interpretation of polynic records. In order to calibrate the models used to infer information about past species distributions, human activities and climate, contemporary time series of polynic records are assessed and modelled. In this study we analyse measurements collected hourly in Bariloche, Argentina (41° 10’ S, 71° 15’ W, 850 masl) of the species Weinmannia trichosperma, a characteristic forest tree which grows only the western (Chilean) slopes of the Andes, but not on the eastern (Argentinian) slopes where the measurements were collected. Instead of the simplistic Gaussian plume mixing model that is usually employed by the palynological community, we apply a full 3D Lagrangian dispersion model to interpret the observations and assess the impact of long-range transport over the Andean mountain range. The Lagrangian calculation of the origins of the air masses (the "backward footprint") is consistent not only with the Chilean Weinmania pollen measurements but also with a set of species only found on the dryer steppe located to the east of the measurement site in Argentina. The agreement of the modelling results indicates that significant interpretation mistakes may arise from inconsistent transport treatment. We also discuss the further application of inverse trajectory modelling to the estimation of source intensity.