



## Probabilistic Forecasting of Thunderstorms in the Eastern Alps

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A probabilistic forecasting method to predict thunderstorms in the European Eastern Alps is developed. A statistical model links lightning occurrence from the ground-based ALDIS detection network to a large set of direct and derived variables from a numerical weather prediction system. The NWP system is the high resolution run of the European Centre for Medium-Range Weather Forecasts. The statistical model is a generalized additive model framework, which is estimated by Markov chain Monte Carlo simulation. Gradient boosting with stability selection serves as a tool for selecting a stable set of potentially nonlinear terms. Three grids from  $64 \times 64 \text{ km}^2$  to  $16 \times 16 \text{ km}^2$  and 5 forecasts horizons from 5 to 1 day ahead are investigated to predict thunderstorms during afternoons (1200 UTC to 1800 UTC). Frequently selected covariates for the nonlinear terms are variants of convective precipitation, convective potential available energy, relative humidity and temperature in the mid layers of the troposphere, among others. All models, even for a lead time of five days, outperform a forecast based on climatology in an out-of-sample comparison. An example case illustrates that coarse spatial patterns are already successfully forecast five days ahead.

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