

EGU21-5810

<https://doi.org/10.5194/egusphere-egu21-5810>

EGU General Assembly 2021

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## Environmental and geographical effects on fog occurrence

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Fog is a very complex phenomenon (Gultepe et al., 2007). In some areas it can contribute substantially to hydrological and chemical inputs and is therefore of high environmental relevance (Blas et al., 2010). Fog formation is affected by numerous factors, such as meteorology, air pollution, terrain (geomorphology), and land-use.

In our earlier studies we addressed the role of meteorology and air pollution on fog occurrence (Hůnová et al., 2018) and long-term trends in fog occurrence in Central Europe (Hůnová et al., 2020). This study builds on earlier model identification of year-to-year and seasonal components in fog occurrence and brings an analysis of the deformation of the above components due to the individual explanatory variables. The aim of this study was to indicate the geographical and environmental factors affecting the fog occurrence.

We have examined the data on fog occurrence from 56 meteorological stations of various types from Romania reflecting different environments and geographical areas. We used long-term records from the 1981–2017 period.

We considered both the individual explanatory variables and their interactions. With respect to geographical factors, we accounted for the altitude and landform. With respect to environmental factors, we accounted for proximity of large water bodies, and proximity of forests. Geographical data from Copernicus pan-European (e.g. CORINE land cover, high resolution layers) and local (e.g. Urban Atlas) projects were used. Elevation data from EU-DEM v1.1 were source for morphometric analysis (Copernicus, 2020).

We applied a generalized additive model, GAM (Wood, 2017; Hastie & Tibshirani, 1990) to address nonlinear trend shapes in a formalized and unified way. In particular, we employed penalized spline approach with cross-validated penalty coefficient estimation. To explore possible deformations of annual and seasonal components with various covariates of interest, we used (penalized) tensor product splines to model (two-way) interactions parsimoniously, Wood (2006).

The fog occurrence showed significant decrease over the period under review. In general the selected explanatory variables significantly affected the fog occurrence and their effect was non-

linear. Our results indicated that, the geographical and environmental variables affected primarily the seasonal component of the model. Of the factors which were accounted for, it was mainly the altitude showing the clear effect on seasonal component deformation (Hůnová et al., in press).

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