

Chemical Characterization of Impactor Samples from seven Sites in GUAN (German Ultrafine Aerosol Network)

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Keywords: aerosol, chemical size distribution, seasonality, spatial distribution

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GOALS AND METHODS

Introduction

Within the German Ultrafine Aerosol Network (GUAN) the collection of size-segregated PM was carried out at seven sampling sites in Germany by identical equipment concurrently. The seven sites (Fig. 1) were distributed between one traffic site (Leipzig: Eiba), two urban sites in residential areas (Augsburg: Au, Leipzig, IFT), two rural sites (Bösel: Bö, Melpitz: Me), and two mountain background sites (Hohenpeißenberg: HP, Schauinsland: SI). Using weather forecast days with a mainly uniform air mass inflow to Germany and without precipitation were selected to collect PM by low pressure impactors (5-stage BERNER-type, LPI80/0.05, Hauke, Austria)

In connection with the physical PM characterization regional sources, long range transport episodes and seasonality have been investigated over two years.

Experimental

The samples were collected between 00:00 and 24:00 by five-stage BERNER-LPI in parallel at all sites. Seasonality and air mass origin were major criteria of the selection of sampling days.

After collection the samples were frozen till analysis in Leipzig. After weighing the samples were divided for chemical analysis:

Water soluble ions and levoglucosan were analysed from an aqueous extract by IC with conductivity detection, resp. IC with amperometric detection (ICS3000, DIONEX).

OC/EC was analysed by a thermographic method (C-mat 5500, Ströhlein)).

PAHs and alkanes were analysed by Curiepoint pyrolysis GC-MS (JPS350, Japan Analytical Industries, GC6890N and MS5973inert, Agilent).

RESULTS

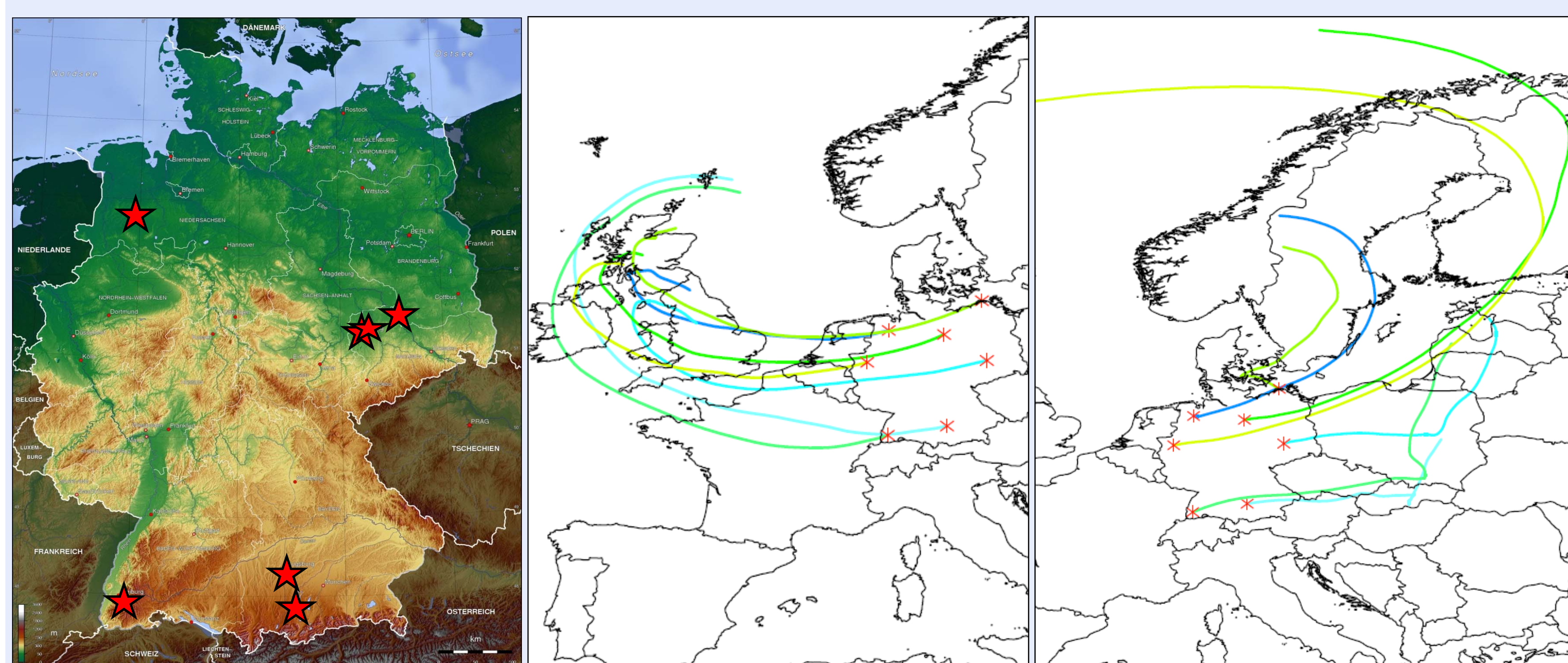


Fig. 1. Map of Germany with asterisks for the sampling sites and back trajectories for two days of PM collection

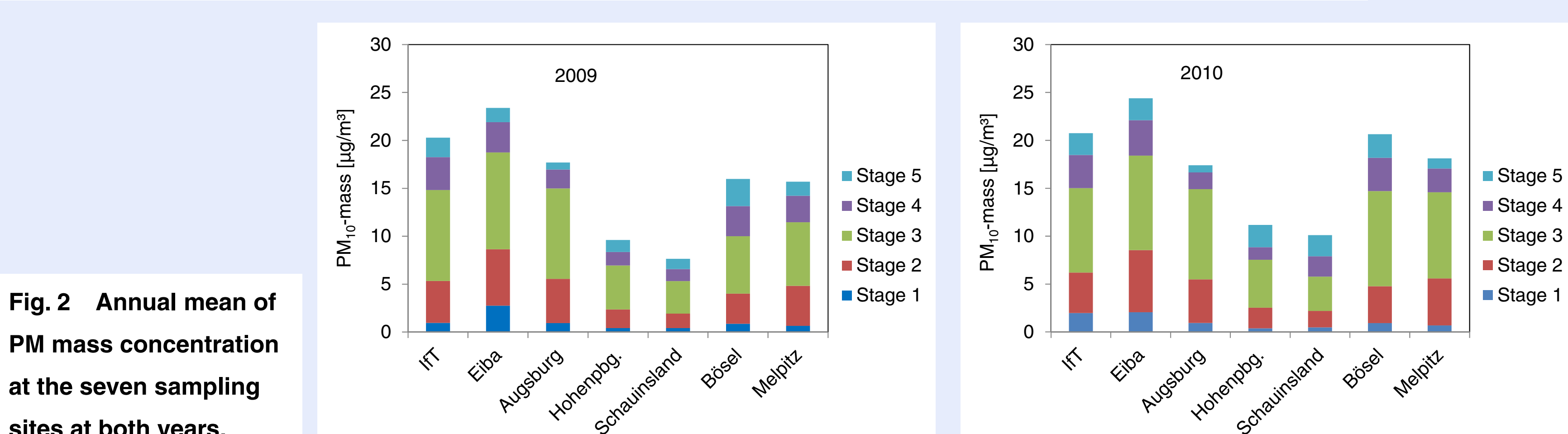


Fig. 2 Annual mean of PM mass concentration at the seven sampling sites at both years.

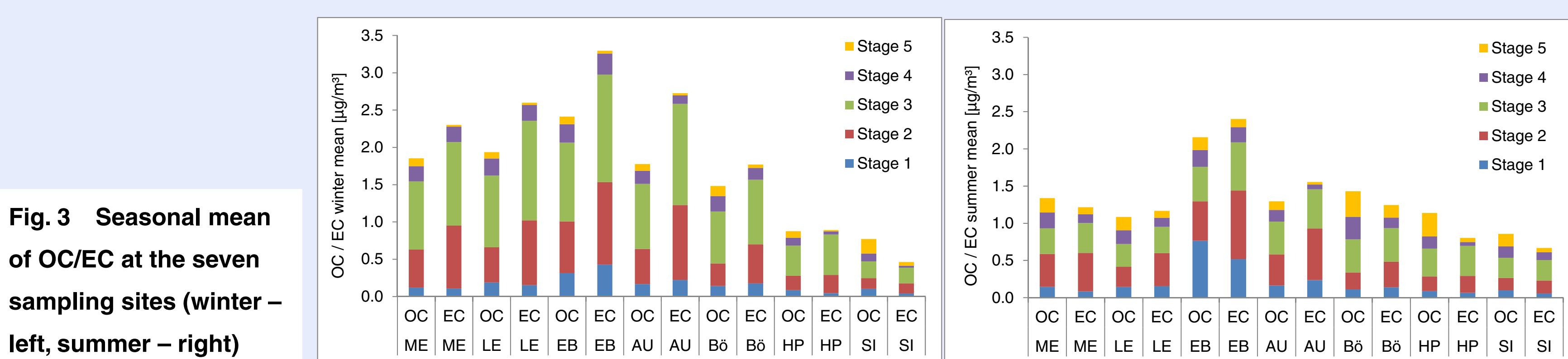


Fig. 3 Seasonal mean of OC/EC at the seven sampling sites (winter - left, summer - right)

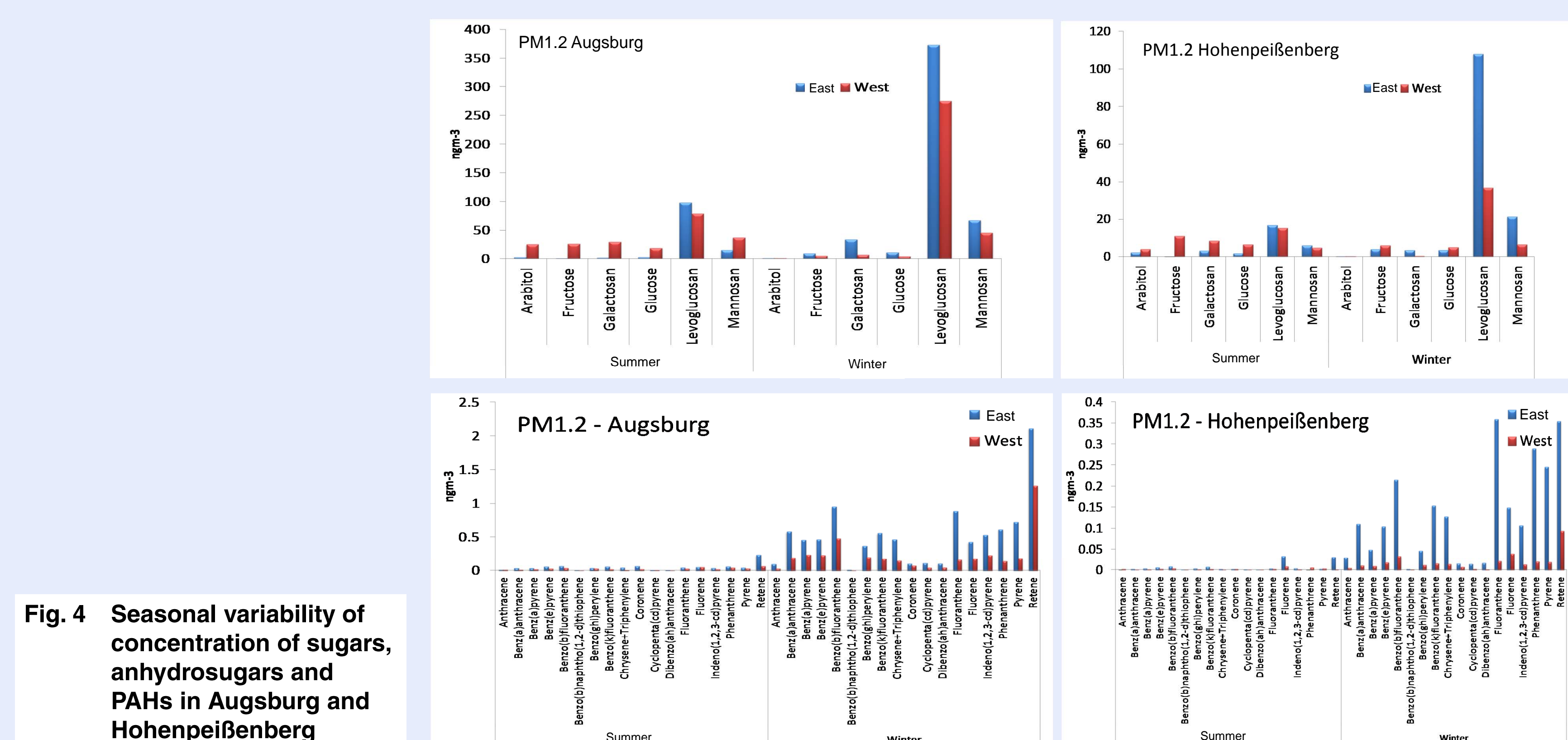


Fig. 4 Seasonal variability of concentration of sugars, anhydrosugars and PAHs in Augsburg and Hohenpeißenberg

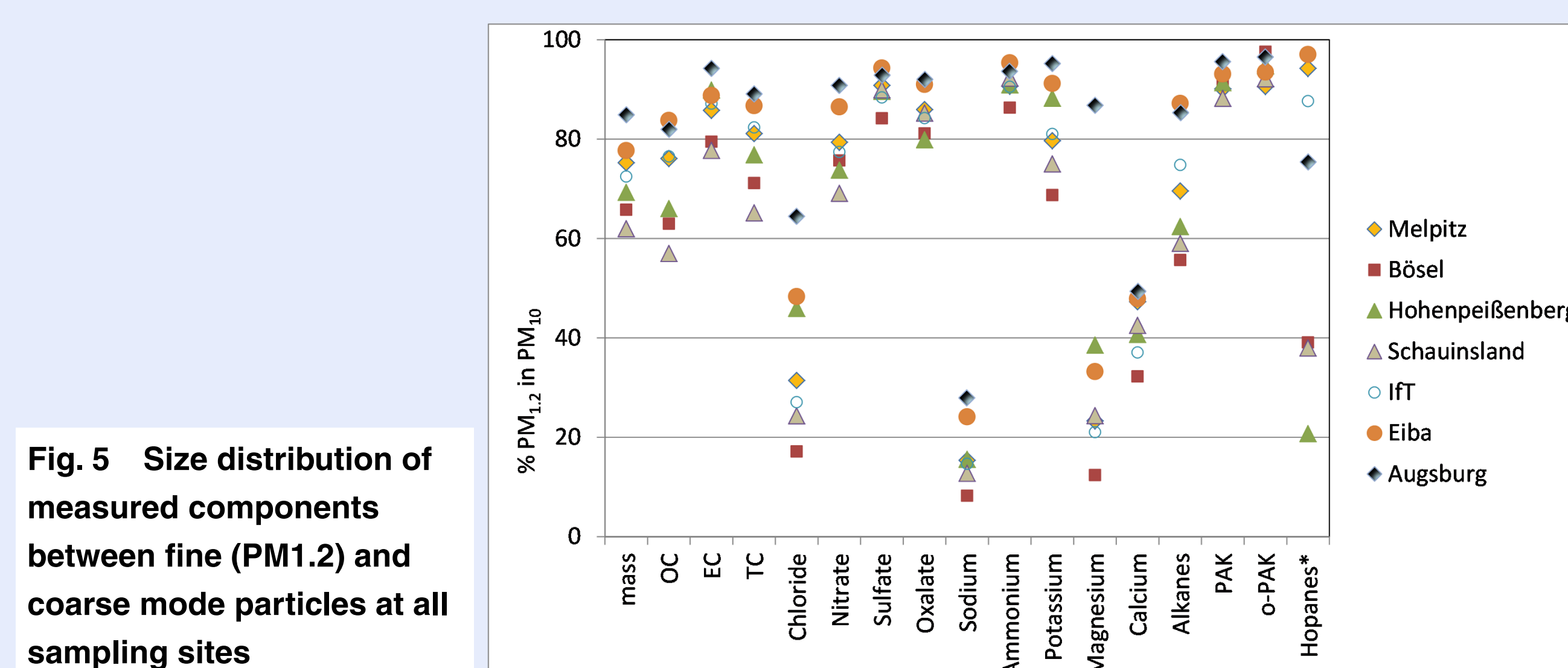


Fig. 5 Size distribution of measured components between fine (PM1.2) and coarse mode particles at all sampling sites

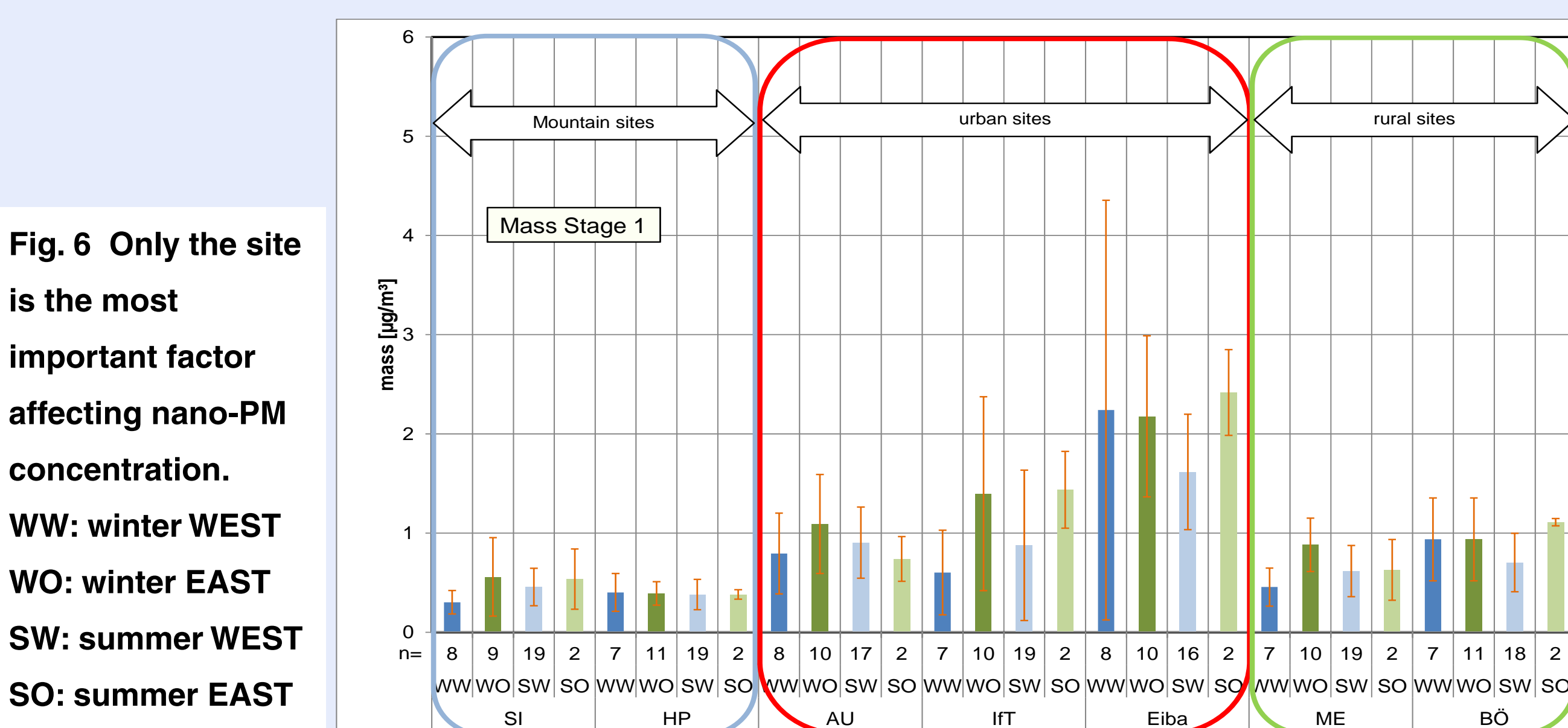


Fig. 6 Only the site is the most important factor affecting nano-PM concentration. WW: winter WEST WO: winter EAST SW: summer WEST SO: summer EAST

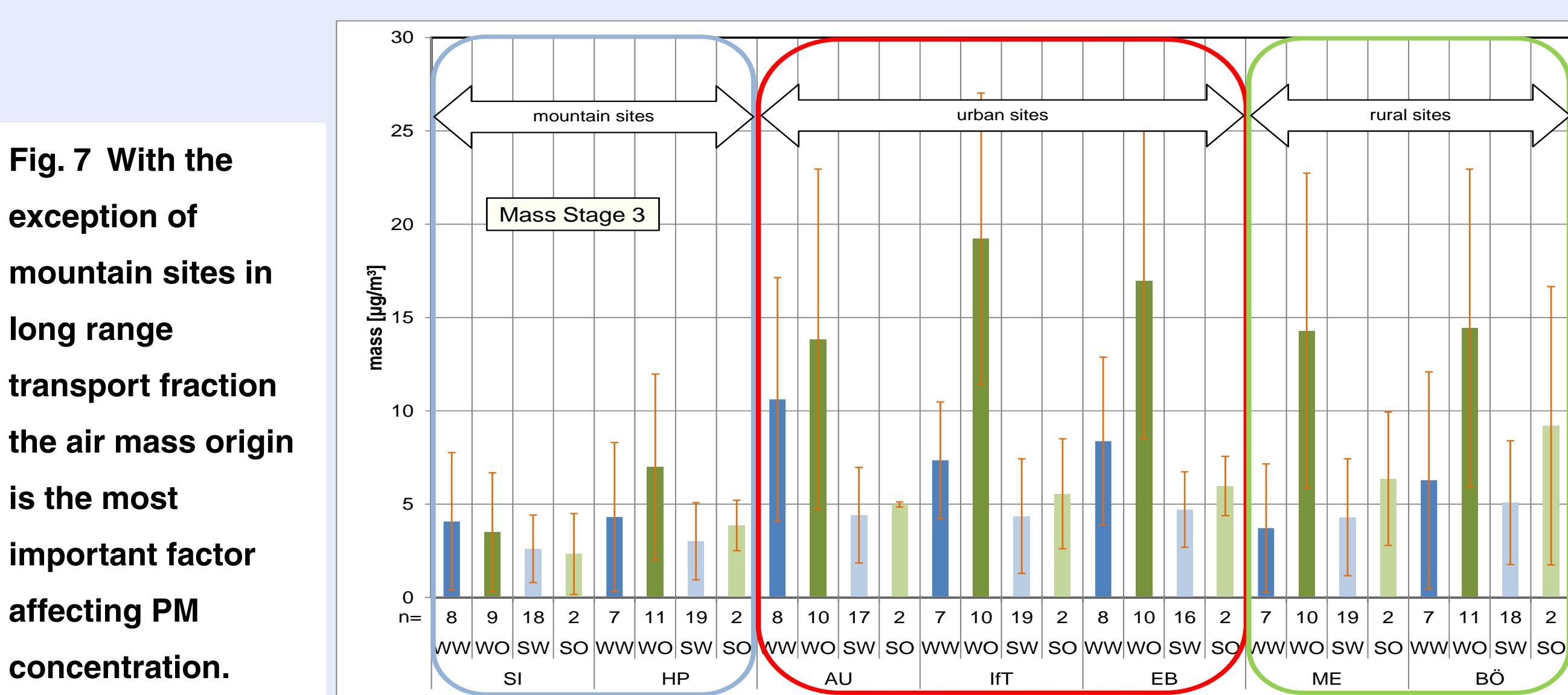


Fig. 7 With the exception of mountain sites in long range transport fraction the air mass origin is the most important factor affecting PM concentration.

SUMMARY

- Local effects and long range transport of PM are determining effects for PM constitution in all seasons.
- EC was found at highest typically at the traffic site in Leipzig followed by the urban sampling sites.
- EC percentage is decreasing with particle size while OM has a second maximum in coarse mode particles but not only in winter.
- Levoglucosan, a wood burning tracer, was found in good correlation to PAH concentrations.
- Mountain sites comparability was influenced by free tropospheric air during winter measurements.
- Easterly air masses transport high concentrations of pollutants from wood and coal burning during winters to Germany.

The authors thank all colleagues at the sampling sites for their experimental help, the IFT staff for the excellent laboratory work and the German Umweltbundesamt for the financial support and helpful discussions during GUAN.