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Interactive comment on "Observational study of aerosol hygroscopic growth factors over rural area near Beijing mega-city" *by* X. L. Pan et al.

Anonymous Referee #2

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The work published by Pan et al. reports observational results from the hygroscopic behaviour of atmospheric aerosol in the vicinity of Beijing mega-city. The dependence of the aerosol scattering coefficient on relative humidity is investigated, and potential links to the aerosol source region and to aerosol chemical composition are studied. The impact of aerosol chemistry and the resulting hygroscopic behaviour and particle optical properties still requires a broadening of the experimental data base although research started in the early 1970s and 1980s (Covert et al., 1972; Fenn et al., 1981).

The paper reports results from multi-stage impactor analyses on particle chemical composition restricted to a particle size range PM 2.1. Aerosol scattering properties are reported from a humidified nephelometer operated at RH = 80%. The nephelometer sampled from the total aerosol (PM 11). The authors used the term aerosol hygro-

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scopic growth factors although they analysed modifications of the aerosol scattering coefficient with humidity. A more precise terminology is required here. Furthermore, a more detailed description of the experimental procedure is needed.

Aerosol humidification function values for the aerosol scattering coefficient vary from values reported in the literature. The authors identified this deviation without giving potential explanations. In particular, high values of the order of 2.2 were found for two episodes which are assumed to have a strong urban aerosol impact, however without showing higher ratios of organic matter to ammonium sulphate. Such high humidity growth function values at RH = 80% are neither found in laboratory and field studies on aerosol hygroscopic growth (McFiggans et al., 2006; Gysel et al., 2007; Massling et al., 2007), nor in a recent numerical analysis of humidification effects on aerosol optical properties in the Pearl River delta in China (Cheng et al., 2008). The authors should revisit this discrepancy.

A general difficulty concerning this publication is the fact, that chemical composition and aerosol scattering coefficients are reported for completely different size ranges which makes a consistent data interpretation almost impossible. Following Table 1, mass concentrations between PM 2.1 and PM 11 varied by a factor of 2.6 on average, and by a factor of 3.9 at maximum.

In Table 5, the authors expand the relationship between chemical composition and aerosol light scattering. This table requires further explanation because in particular the column on PM 2.1 / PM 11 is found confusing. In general, no significant correlation is found between composition and optical properties modification by humidity growth.

In its current form, the results presented in the paper are not very valuable. The major limitation arises from the fact that chemical composition and aerosol optical properties are reported for different particle size ranges. Furthermore, no particle size distribution information is reported although it should be available from the impactor data. Having at least the mass size distribution available for different chemical species should al-

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low performing model calculations on the expected variation of aerosol scattering with relative humidity based on the chemical composition. The authors are encouraged to conduct this step of theoretical interpretation of observational data in order to make their case stronger.

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