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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Impact of the East Asian summer monsoon on long-term variations in the acidity of summer precipitation in Central China" *by* B. Z. Ge et al.

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It is an interesting paper trying to quantify the relative importance of changing weather pattern and emission changes to the observed pH. In addition, it is very important to get more paper with measurement data from China in international journals. However there is a few items that needs to be discussed more carefully:

It is interesting that you may find a "teleconnection" between pH and summer monsoon. Though maybe it is possible to use a simpler correlation, i.e. is it the monsoon itself or actually just a relation between pH and precipitation volume? Higher pH with more



precipitation since more diluted acidification. This doesn't need to be shown with eigenvectors etc, though changing precipitation volume may be because changing weather pattern. It is always a danger to use very complicated statistics which the reader may have difficult to follow. At least some of the data used as input for the statistical analysis need to be better presented.

The representativety of the data from CMA-ARMN network need to be discussed more carefully, because this has an effect on both the spatial and temporal analysis: I.e.:

1)How are these measured: bulk or wet only samplers; daily, weekly or monthly samples; which components are measured, only pH?? Why not the ion content? What is the site characteristic? Is it a mixture of urban and rural sites? Only rural wet only samples should be used.

2)74 sites are used. Have all these sites data for the whole period 1992-2006, or is some of the site for shorter time periods? If not the sites with less data should be excluded.

It is not clear how the averaging is not for each region. Is it volume weighted mean for all the sites lumped together in each region? If so, it would be interesting to know about the spread/variability and the representativity as mentioned above.

How is the map of the measured pH been done? Is it volume weighted averages for each sites for the whole time period that has undergone statistical kriging?

When you discuss significantly change between the two periods (end of point 3.1.1), how is that done. Is it and average for each period which is compared? You have used the Mann Kendall test for trend analysis? And if so you need more points, at least 4 to define confidence interval?

The CMAQ model may be ok –it seems like it is quite well documented for ozone and NO2, but for sulphate deposition the references are not well documented for external readers, i.e. Ohara (2010) is difficult to access. Further, the correlation between the

model results and what is measured in the urban EANET sites Hongwen and Guanyinqiao is not very useful. The sites are not representative for the large scale model with a grid of 50x50km or 100x100km (should be specified). As seen in figure 1, nitrate gives very poor correlation, and a log scale y axes hide some of the large biases. These sites may reflect the general emission changes in China, but they are not very good for spatial resolution. It would have been much more useful if the model could have been compared to rural sites, like the EANET sites Jinyuanshan and Xiaoping. Further on, more than two sites are needed to verify the model for whole of China.

As I see it the NO3 and SO4 deposition is mainly a model excersise, which is ok, but should be adressed more like that. I have some problems to see the relative importance of sulfate and nitrate to pH. In central China sulfate is much more dominant than nitrate to the pH, but in this paper these are treated as equal importance. Some discussion of which trend (SO2 and NOx emission) has had largest impact on the changes in pH could be interesting to include.

An additional relevant paper that could be used in the introduction could be: Larssen, T., Lydersen, E., Tang, D., He, Y., Gao, J., Liu, H., Duan, L., Seip, H.M., Vogt, R.D., Mulder, J., Shao, M., Wang, Y., Shang, H., Zhang, X., Solberg, S., Aas, W., Økland, T., Eilertsen, O., Angell, V.M., Liu, Q., Zhao, D., Xiang, R., Xiao, J., Luo, J., 2006. Acid rain in China. Environmental Science and Technology, 15, 418–425.

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