

Interactive comment on “Atmospheric trace gas measurements using ion mobility spectrometer” by A.-K. Viitanen et al.

Anonymous Referee #2

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General comments

The manuscript presents ion mobility spectrometer (IMS) measurements of ambient air and attempts to relate them trace gas concentrations. Although the idea might be appealing, the investigation reported in the manuscript lacks from scientific rigor and provides no new atmospheric or instrument development information. The state of the instrument development as reported, if this were the goal, is immature. Developing or adapting an analytical technique to atmospheric measurements requires deep understanding of the controlling mechanisms, comprehensive characterization of the instrument response under controlled laboratory conditions, detailed calibration, and finally field tests, including inter-comparison with established techniques. As reported in the

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manuscript, the authors skipped most of these steps and went directly to a test field. Neither calibration data, nor positive identification of any of the species nor strong correlation between IMS peak intensities and ambient trace gas concentration time series is presented. The manuscript is not suitable for publication in AMT.

Specific comments

Measurement techniques are characterized by sensitivity, dynamic range, linearity, comparability, accuracy, precision, stability and time response. By the exception of implicit comments on dynamic range and time response, none of these characteristics is properly discussed in the manuscript. The correlation with other measurements is weak and circumstantial.

[P4959, L14] Vacuum is not a real problem for most of real-time atmospheric composition measurement techniques. In fact, most techniques require tight control of pressure in the measurement volume in order to obtain high precision measurements. The “no vacuum” argument is quite weak.

[P4960, L17; P4965, L9; P4971, L14; P4973, L5] Is the technique suitable for remote atmospheres only? What are the reasons? What species could theoretically be measured? Are natural source species considered “pollution” in the context of the instrument? Please define “cleanness”.

[P4961, L23] Why purified air was not used in order to reduce instrumental variability for a technique in its development stage? In addition, no effort was made to characterize the instrument response variation associated with filter performance. How we can distinguish this effect from ambient composition variation?

[P4962, L28] What is the reason for a 10-min averaging time?

[P4963, L3; P4971 L9] Instead of relying on software “solutions” to hardware issues, one should have measured the sample humidity and correct the IMS spectra “apparent” reduced mobility from laboratory measurements of the shift associated to humidity. The

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same holds for temperature control.

[P4964, L11] There is no positive identification of any of the species that are claimed to be measured. The discussion is based only on assumptions.

[P4966, L6] A qualitative comparison of the simultaneous measurements by the 2 IMS operating side by side is not enough, particularly in the development phase of the technique. Moreover, the discussion on this is rather shallow. A quantitative analysis could have throw light on the environmental and operational factors affecting the measurements, and eventually provide estimations of linearity and detection limits. [P4967, L13] No data in the manuscript supports the “increasing trace gas concentrations” claim.

[P4969, L3] Due to the lack of calibration, we actually do not know what the IMS is measuring! In this context, poor correlations of IMS measurements with criteria pollutant concentration and meteorological time series should not be interpreted. “Ion mobility peaks” are not “formed” locally.

Technical corrections

The syntax must be thoroughly reviewed. The meaning of some sentences is not clear. Figure 3 is unnecessary.

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 4957, 2011.