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Atmospheric Measurement Techniques Discussions

Interactive comment on "Towards imaging of atmospheric trace gases using Fabry Perot Interferometer Correlation Spectroscopy in the UV and visible spectral range" *by* Jonas Kuhn et al.

Anonymous Referee #2

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This paper mostly presents a theoretical investigation of the applicability of Fabry Perot interferometers (FPIs) for the fast imaging of atmospheric trace gases, of high relevance for the visualization and quantitative assessment of localized emission sources of molecules such as SO2, BrO and NO2. The study is essentially a follow-up from study by Kuhn et al. (2014) already published in AMT and where the principle and advantages of the approach are described. Here, the authors concentrate on simulations aiming at demonstrating the selectivity of the FPI correlation spectroscopy for three potential target gases: SO2, BrO and NO2. In comparison to more traditional atmospheric trace gas imaging techniques which generally only use a set of band pass filters, the FPI correlation spectroscopy is found to be highly selective, allowing to dras-

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tically reduce cross interferences with other absorbing species while maintaining high sensitivity. In short, the method seems to be very promising. The approach used for the simulations is convincing and clearly described.

In my opinion, the manuscript is overall of excellent quality, well written and concise. However, the proof of concept presented at the end of the study is a bit disappointing. One would have expected to see first results from real images. Instead only a one-pixel prototype is shown, and only applied to SO2 retrieval (which arguably is the easiest case). It is claimed that the one-pixel prototype can "easily" be transferred in a full-frame imaging instrument, however this is not demonstrated. At minimum, the authors should explain why this transfer was not attempted in the present study and what are the possible difficulties that may need to be addressed.

Despite this weakness, I think that the study remains very interesting, show a good degree of innovation (first demonstration of the potential of the technique for other species than SO2) and therefore it should be published in AMT.

In fact, my only serious reservation, concerns the estimation of the added performance of the FPI correlation spectroscopy in comparison to a traditional hyperspectral imaging system (as used for imaging DOAS). Based on existing CMOS or CCD detectors coupled to grating spectrometers (commonly used in the DOAS community), and assuming hyperpixels of 100 micron size, experience shows that typically 1.5 Me-/sec/pixel can be accumulated in the visible range under normal illumination conditions. On this basis, one can estimate that a full image of 100 x 100 spatial pixels (or even 200 x 200) could potentially be recorded in a few seconds of time (using e.g. an integration time of 50 msec/hyperspectral line) leading to a S/N ratio of approximately 250 (corresponding to a NO2 dSCD uncertainty of about 5e15 molec/cm2). This level of performance is in fact very close to the performance announced in Table 3, and therefore I believe that the factor 100 announced in the text is rather optimistic (at least for a FPI system using a telecentric optics as assumed here). Of course the real proof will have to wait for actual measurements and I look forward to see more of such measurements being

attempted and published in the near future.

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