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## ***Interactive comment on “Trends of HCl, ClONO<sub>2</sub>***

**and HF column abundances from ground-based  
FTIR measurements in Kiruna (Sweden) in  
comparison with KASIMA model calculations” by  
R. Kohlhepp et al.**

**Anonymous Referee #2**

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### **GENERAL**

This short paper presents measurements of the HF, HCl, and ClONO<sub>2</sub> columns performed by FTIR technique at Kiruna between 1996 and 2009. Long-term trends are derived and compared to those obtained over the same period with a 3D model. This is a useful contribution to the monitoring of the chemical composition of the stratosphere and of the consequences of the Montreal protocol, which should be accepted for publi-

cation after consideration of the specific comments listed below. The scientific value of the paper could however be improved if some interesting results presented here were more thoroughly discussed and interpreted. In particular, there is no tentative explanation for the much larger negative trend of CIONO<sub>2</sub> with respect to HCl. The validity of the scenario of halogen emissions in the model could also be more discussed in light of the difference noted between the FTIR and model long-term trends.

#### SPECIFIC

page 1491, introduction

To put things in perspective it would be appropriate to mention the long series of measurements carried out at the Jungfraujoch alpine station with the same type of instrument as used here (+ relevant references).

page 1491, line 19

Please mention the average stratospheric lifetime of HF.

page 1493, line 11-21

FTIR measurements are much less sensitive in the troposphere than they are in the stratosphere, as shown in Figure 1. The proper way of doing the observation/model comparison would be to convolve the Kasima profiles by the sensitivities plotted in Figure 1. However, I understand from what is said in page 1498 (line 15) that the troposphere is completely ignored below 7 km in the model. This is a source of error that should be quantified (for instance by assuming a constant mixing ratio between the ground and 7 km, and by convolving by the FTIR vertical sensitivity).

page 1495, line 5

Please rephrase the first sentence, which is unclear. What are these "relaxation terms"? Is this an experiment nudged towards the ECMWF analysis ? but then, what does the 18 km-altitude refer to? this whole paragraph is rather confusing. Also, an im-

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portant missing information is the scenario of emission of long-lived species (including chlorine- and fluorine-bearing species) which has been used in the Kasima simulation. Long-term series of measurements of HCl and CIONO<sub>2</sub> provide a very good test of the validity of scenarios of emissions. It is therefore important to describe precisely the scenario used in this study.

page 1495, paragraph 5.1

It would be useful to the reader to explain in a few sentences what is the origin of the strong seasonal cycle of HF.

page 1496, line 13

Why are the months of June and July not included in the so-called "summer" period ?

page 1497, third paragraph

Why is the trend for CIONO<sub>2</sub> so much larger than that of HCl ? how does this compare to similar measurements performed at Jungfraujoch for instance ?

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, 11, 1489, 2011.

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