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Interactive comment on “Long-term in situ measurements of NO_x and NO_y at Jungfrauoch 1998–2009: time series analysis and evaluation” by S. Pandey Deolal et al.

Anonymous Referee #1

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The paper of Pandey Deolal describes more than 10 years of continuous in-situ measurements of NO_x and NO_y at the Jungfrauoch. Based on this data set, a trend analysis is performed and diurnal cycles are discussed. The data set itself is unique and deserves publication, but in order to deduce reliable trends more emphasis should be paid to the evaluation of the data quality in particular for NO_y. Although an intercomparison with a second NO_y measurement device is performed, the results are rather inconclusive. Therefore, I recommend that the paper is revised before finally published in ACP. In particular the following questions/criticism should be addressed:

The quality of the NO_y measurement depends strongly on its capability to account for

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HNO₃, which is affected by sampling line losses and the conversion efficiency of the NO_y converter itself. The authors claim to address the line loss problematic by comparing their NO_y measurement to a second measurement using an externally mounted converter. The comparison showed rather good agreement in the October and December, while later comparisons yielded very poor results. The authors argue that most likely NO_x emission from a snow covered inlet tip of the external converter is responsible for the strong deviation in January/February. In the experimental section 2.2 the authors state, that the inlet line (20 cm Teflon tubing) is heated to 25°C and protected against snow and rain by a Teflon hood. So how does the inlet accumulate snow, and why only in January and February? Was there no snow fall in December? One way to address this last question would be to extend Figure 13 to the whole period. Additionally, comparing Fig. 10 and 11 it seems that the agreement between the two NO_y measurements is good for high NO_x/NO_y ratios (e.g. most of October and December) and poor for low NO_x/NO_y ratios (e.g. Jan. 12 – 25).

The authors concede that the conversion efficiency for HNO₃ might differ from NO₂ and that a degradation of the conversion efficiency could be more severe for HNO₃. Nevertheless, all information on the quality assurance for the EMPA instrument is very limited, actually it is restricted to one sentence, indicating that the conversion efficiency of the gold EMPA converter mostly ranged between 95 and 100 %, based on NO₂ measurements. I consider this as insufficient, in particular if the authors aim to address potential trends. More information (e.g. a time series) of conversion efficiencies for NO₂ AND HNO₃ is mandatory to judge on the data quality and exclude instrument artifacts as a potential cause for long term trends as presented in Fig.4. Also, the authors should provide details about maintenance procedures for the EMPA converter (procedure and frequency of converter cleaning). Some of those details (time series of conversion for NO₂ and information on cleaning) are only provided for the ETH measurements. Without a better characterization of the EMPA NO_y data quality I consider the conclusion drawn by this paper (at least for the trend analysis) as highly superficial.

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Specific Questions:

In the time series of NO_y it is shown that the year 2003 is exceptional, which is explained by the authors as being due to the 2003 summer heat wave, causing high pollution levels over Europe, but Figure 7 indicates that the NO_y enhancement reach far into the fall and winter of this year. I have a hard time to believe that these are remnants from the 2003 summer pollution. Additionally, the authors should extend Figure 4 by inclusion of a NO_x/NO_y trace. It seems that there is a strong trend for younger air masses (higher NO_x/NO_y) after 2003, which might indicate a shift in local pollution or a trend in the instrument performance (e.g. decreasing HNO₃ conversion).

NO_x/NO_y ratios would also be helpful in the discussion of the seasonal variation. Convective transport as a cause of higher NO_y in spring and summer should be characterized by higher NO_x/NO_y ratios, but Figure 5 (small panel) seems to indicate quite the opposite, with lowest (oldest, most processed air) NO_x/NO_y ratios in summer. This is in contradiction to the statement on page 2186, line 1, that only in summer the lifetime of NO_x is long enough that rapid upward transport to JFJ can generate large NO_x pollution events giving rise to large NO_y enhancements.

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