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***Interactive comment on* “Significant variations of trace gas composition and aerosol properties at Mt. Cimone during air mass transport from North Africa – contributions from wildfire emissions and mineral dust” by P. Cristofanelli et al.**

Anonymous Referee #3

Received and published: 28 April 2009

General:

A 5 day period of observations of trace gases and aerosol composition at the Monte Cimone observatory is analysed and interpreted in terms of transport of i) regional scale anthropogenic pollution from the Po valley atmospheric boundary layer and ii) north African dust and biomass burning products. Back-trajectories are used to identify the source regions and in combination with MODIS fires counts to estimate the age of biomass burning emissions. The study is well organized and suitable for publication in ACP after further highlighting on one hand the uniqueness of the observed event and

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on the other hand the importance of such events.

Major Comments:

While the analysis of the event is sound in itself and leaves little space for discussion of the processes controlling the observed concentrations, the authors do not spend enough time on the question of how important such events are for the Mediterranean region. Only the introduction and the last paragraph of the manuscript try to highlight the importance of such transport events in a very general manner. In this context it would be very valuable to discuss the frequency of Sahara dust and biomass burning events at the site but also at other sites in the region. What is special about the event reported here is the combination of concurrent transport of dust and biomass burning emissions, but how frequent are such events and can you really assume that increased dust transport due to ongoing and future desertification and increased biomass burning will go hand in hand for extended periods of time?

The list of references is rather comprehensive (>110) which makes it sometimes hard to follow the text. While for the discussion section, where the obtained results are discussed in the context of other observations, this is certainly adequate, the authors should try to limit the citations in the introductory section, where they tend to support their line of thinking by multiple citation like (e.g. Novelli et al., 2003; Kasische et al., 2005; Lapina et al., 2006). In such a case a single reference should be sufficient unless important additional aspects on the subject are only discussed in a second manuscript.

Minor Comments:

The official GAW ID of Monte Cimone is CMN. Why do you use MTC?

The use of FLEXTRA trajectories is mentioned in the methods section but in the results only BOLAM trajectories are discussed. Did you not use FLEXTRA at all? How do these very differently derived trajectories compare?

P 7830, L 10: As for many other high altitude observatories worldwide I would suggest

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that you don't consider your day-time measurements as being free tropospheric. The mountain venting regime prevailing during summer day-time hours certainly destroys the free tropospheric character of the observations as you yourself show later on, while the night-time measurements might still represent free tropospheric conditions. Please rephrase this introductory statement.

P 7830, L 12f: "The accuracy and quality ... " change "are guaranteed" to "were". Also specify the GAW requirements and mention your external reference scale.

P 7833 f: Trajectory description: You mention that you started clusters of back-trajectories centred around the location of MTC. According to the manuscript you used a box with an extension of 2 degrees in East-West direction but with only 0.5 degrees in the North-South direction. Explain the wider East-West extent. Furthermore, give the pressure level of the model surface at MTC and the difference to the average station pressure level.

P 7834: Here you use ER as abbreviation for enhancement ratio, while in the abstract you used it for emission ratio. I guess in the context of your study it should always be enhancement ratio!

P 7834, L 25: FLEXTRA is often driven by ECMWF analysis fields with a grid resolution of 1° by 1°. Why did you use 1.25°?

P 7834: At which altitude or pressure level did you initialize the FLEXTRA calculations? From the total number of cases I assume that you used several initial altitudes.

P 7836, L 5: Could you mark the selected background level measurements in Figure 1? The figure gives the impression that a number of measurements (especially at the beginning of the period) represent clean, background conditions.

P 7836, L 11: Would it be possible to include the dust mobilization temporal development over Northern Africa as obtained from the NAAPS simulations in Fig 5 in parallel to the fire count development?

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P 7838, L 27: Which fit technique did you use? Did you consider uncertainties in both x and y as recommended by Parrish et al. 1998.

P 7840, L 20: How were the average travel times calculated? Did you consider multiple intersections with fire pixels at different times on the trajectory and different fire intensities (fire counts are not directly proportional to CO emissions!) ?

P 7845, L 19: I would not conclude that the age of the air mass is confirmed by the ER study. Since ER will be largely determined by the emission ratio NO₂ to CO and this varies largely between wild fires, the event analysed here only adds to the range of reported ER, but its ER should not be used to estimate the age of the plume. Your trajectory analysis is certainly more precise in determining the age of the plume. Simply remove the "in good agreement with the ER analysis" from the sentence.

P 7845-46: To my knowledge, there is at least one other case of an advected biomass burning from northern Africa reported in the literature (Henne et al., ACP, 2008, 3119-3139.) which reports dO₃/dCO of 0.23 for a plume age of 3.7 days. However, this plume was traced back to savannah burning and not to the coast.

Table 1: Background Selection, Mean O₃: I assume this should read 6x ppbv ?

Fig 1 and 6: These figures repeat each other. I suggest to combine them by showing a single plot with the parameters and selected periods in Fig 6 but for the extended time section of Fig 1 and for 30 min averages only.

Fig 2: If the dots represent 5th and 95th percentile they should not be called outliers! Simply write: the dots represent the 5th and 95th percentile.

Fig 3: It is not possible to identify the vectors for the lower plot. The scale for the wind vectors is also not given.

Fig 4: It would help to identify area of the MODIS image if you could display its extension on a map of the Mediterranean in a small insert at the upper left corner of the image.

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Fig 7: Please add if the scatter plots are based on 1 or 30 minute aggregates.

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9, C386–C390, 2009

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