

## ***Interactive comment on* “CIAO: the CNR-IMAA advanced observatory for atmospheric research” by F. Madonna et al.**

### **Anonymous Referee #1**

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#### General comments

This paper presents the atmospheric observatory CIAO near Potenza in Italy where a number of state-of-the-art remote sensing and in-situ measurements are carried out in an operational way.

The paper is well written and contains a lot of useful information. The potential that lies in the synergy of using different remote sensing techniques in a complementary and redundant way at one site is impressively demonstrated. Therefore the paper should be published. My biggest concern is that there are too many individual sub-topics treated in a very detailed way and papers overarching intention is sometimes out of sight. Therefore I wonder if it wouldn't make more sense to streamline this

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manuscript and focus on its main objective, which could be operative practice and the strategy of the observatory in general. The detailed description like the Raman Lidar and Kalman filtering techniques might be placed into a separate publication? However, this decision should be left with the editor.

### Specific comments

#### Chapter 2.1:

The description of the lidars is very detailed can already be found in some of the referenced articles. It would be more useful in this chapter to explain more clearly why there are three LIDAR systems, which one is used for what and how they interact according to the principles of “redundancy and complementarity”.

#### Chapter 2.2.

The radar is obviously not related to the microwave profiler and deserves its separate chapter.

#### Chapter 3

My feeling is that it would be better to have this chapter in front of chapter 2 since it describes the overarching principles of the observatory's strategy. The descriptions in chapter 2 can then refer to this chapter and describe which data products are retrieved from each instrument, which quality assurance procedures apply, etc.

#### Chapter 4.1 and 4.2e

Which are the criteria that make an agreement “optimal”? (p. 5271, line 12). On the same grounds: what means “accurate” on page 5273, line 8?

#### Chapter 4.3

I am not able to follow these equations and to provide a judgment on whether this makes sense or not. I am sure it does. However, from my point of view, it would

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be more useful to explain only the purpose and basic principle of the Kalman filtering in this chapter. The mathematical formalism can be provided in an appendix to the manuscript or in a separate publication

In line 12-15 of page 5275 the main goal is presented. This sentence needs more explanation.: again: what is “accurate”? In the presence of clouds and during daytime, the lidar data in the upper-atmosphere are not available. I wonder what the Kalman filter can do about this situation other than simply rely on the microwave retrieval only? To what extent does it make sense to talk about “integration of two techniques” in this respect.

It is not clear to me what the sentence in line 18 on that page tries to say: “Kalman scheme basically moves from using two equation groups. ”

On page 5278 line 8 and 9 you say twice that “ the case study is relative to the measurement” and I still don’t understand what you mean by this.

## Chapter 5

In line 12 you mention that the observatory is one of the first in Europe. It would have been useful to find a short overview of the history of CIAO somewhere in the manuscript, e.g. in chapter 2.

Line 19-20: I am not sure if you have shown the “good performance of the calibration” . . . at least not in this paper. It might be a good idea to emphasize at this point that the extraordinary infrastructure of the site allows to demonstrate, and to validate, the performance of such advanced techniques.

### Technical Corrections:

p. 5254 line 9: “ radiometers, and a radar”

p. 5255 line 1: “ . . . water vapour, and clouds.”

p 5267 line 11: the link provided is no longer valid,

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it seems the corresponding page is now found here:  
<http://www.vaisala.com/en/products/soundingsystemsandradiosondes/radiosondes/Pages/referenceradiosonde.aspx>

p. 5275 line 25: probably: "Here, A is an identity matrix" ?

Tab.1 is too small and hardly readable

Fig 4: the lines of the graph d) should be thicker and of more clearly separable color.  
All the axis labels need to be larger for legibility.

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Interactive comment on Atmos. Meas. Tech. Discuss., 3, 5253, 2010.

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