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Interactive comment on "The HD(CP)2 Observational Prototype Experiment HOPE – An Overview" *by* Andreas Macke et al.

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General Comments

(Note, I have referenced sections in the paper using Page (P) and Line (L) position throughout this review).

This article provides an overview of the HD(CP)2 Observational Prototype Experiment (HOPE). This paper does not appear to present new work but rather, provides an extensive summary of work that has been done using the HOPE experiment to date coupled with the experiment description. Given the complexity and breadth of HOPE, there is definitely value in an overview like this to help the science community understand the experiment and to make good use of the data it produced. Generally, I like the structure with a description of the physical layout of the campaign followed by science results and application to model evaluation. I have a few relatively minor concerns.

However, I think there are certain aspects of the paper that could be improved to make it more useful.

The two most significant issues I have with the paper are regarding the motivation and some of the description in section 2. At a high level, the authors have explained the goal of HOPE and what measurements will be provided. However, ultimately, there is little motivation provided beyond stating that the measurements from HOPE will be used for the initialization and evaluation of the ICON model. It would have been helpful, for example, to hear if there were particular areas of concern – or types of numerical experiments that were planned for this coupled observation/model system. Also, while I understand that this is an observation paper, not a modeling paper, I would have expected a bit more with regard how these data are intended to be used for model evaluation. At least pointers to model planning. In the introduction (P3,L1) it is stated that "Key to this effort was the provision of modeled scenarios at 100 m grid resolution over thousands of kilometers, . . ." But I do not subsequently find any mention of those modeled scenarios or work being done toward their development. There is a modeling section (4) but it is mainly a list of a few evaluation studies. It is not even clear if all of these studies make use of the ICON model which the introduction indicates is the target for this work. ICON is mentioned toward the end of section 4 (P17,L25) but it is not clear if the other studies mentioned earlier in that section are using ICON or some other more established model(s). In short, I don't get a sense of an overall set of goals either for the science applications or for linking the observations to models.

My other main issue is with the description of the measurements in section 2. Throughout, the authors are trying to present a lot of material and I appreciate that. As noted earlier, I think this will provide a valuable reference. And for the most part, I think the structure works well for the discussion of Results (section 3). But in section 2, particularly the discussion of HOPE-Julich in section 2.1.1, I was struck by the very long lists of instruments presented in text without any sub-organization. I think this section would be easier to read and to use if it were organized in some way – either with sub-

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headings for sites – or sub-headings for major classes of instruments. As it is – it is difficult to take away a clear picture of how the instruments are coordinated.

I would also say that similar to my earlier comments about motivation for science and the modeling – more could be done here to explain why this particular set of measurements was chosen. It is stated at a high-level that there is a goal "to derive the atmospheric state of water vapor, temperature, wind and cloud and precipitation properties with 100-m resolution for an area of about 10x10x10 km ..." (P4,L6-7). The list of instruments is impressive and certainly it provides some spatial representation of these parameters. However, I am sure that these instruments cannot provide all of those parameters over the full domain. It would be helpful to understand how close to achieving this goal HOPE came, how instrument configurations were chosen to get as close to this goal as possible, and if there are any thoughts regarding how to get closer to the goal of full sampling of the stated domain. Why was this particular set of instruments chosen – and how do they enable achieving core goals of the activity?

Finally, before I move on to mentioning more specific issues, I suggest it would be helpful to comment somewhere in the Summary and conclusions if there are any specific plans for using the observation data set or particularly, for applying the data set to the ICON model.

More specific science issues

P1,L38: what does it mean to operate the sun photometers in synergy? Or does the operation in synergy refer to all the previously mentioned instruments (lidars, radars etc)? Either way – does this just refer to the spatial placement of instruments? Or are instruments being scanned in such a way to optimize their co-collection of observations?

P2,L16: The text says "It is a coordinated initiative ...". This is confusing because the previous sentence was specifically talking about the HD(CP)2 model – but I presume the sentence beginning on line 16 is referring to the larger HD(CP)2 initiative – not

specifically the model. In any case, I found the sentence to be confusing.

P2,L29-32 – the newly developed ICON model is mentioned. Is this the same as the HD(CP)2 model mentioned on line 15 of this page? Not clear.

P2,L30-31 – mentions that the observation datasets are intended to provide both initialization and evaluation of the ICON model. This is mentioned again on P16,L22-23. I can see that these data would be excellent for model evaluation – and a few example are given in section 4 (p16-17); however, I don't see any discussion of using these data for model initialization or how that might be done. I could imagine that these data could be used for that as well – but given that the point is made that these data are ideal for that purpose – it would be preferable to have some discussion on what the authors have in mind for that application – or what others have done or are planning in this area.

P5-6 – in this portion of section 2, the instrumentation of HOPE-Julich are described. I think this section really needs some sub-sections. This could be done by supersite or by instrument class or both. But as it is – this section comes across as a very long list of instruments that is very difficult to digest. Some structure would help get clear how these instruments are arranged.

P9, L2-3 – the HD(CP)2 data archive center is mentioned. I think it would be good to provide a link to this center. I think I was able to find it – but it would be helpful to provide the actual link here.

P9,L8 – indicates that an "essential regime" observed during HOPE was the turbulent structure of the atmosphere. I don't think I have ever seen the word "regime" used this way before. I think of "regime" as referring to a meteorological state – not the general distribution of a physical attribute.

P15,L5: The text indicates that the "LWC agrees well with the in-situ and remote sensing observations". First of all, this should be reworded along the lines of "the LWC de-

rived from remote sensing observations agree well with in-situ measurements". However, I also have some concerns about this statement. The phrase "agrees well" is generally subjective, but in this case, I would argue that the two are diverging near cloud top and that deserves some mention.

P16,L26-30. The text refers to activities related to the grey zone and characterizes this as conditions "where the parameterization of turbulence in the convective ABL may not be necessary". I think this is not a good representation of the issues posed by the grey zone. The issue as I understand it – is that in this spatial resolution zone (∼1km – ∼10 or 20 km) the resolution is too coarse to explicitly resolve certain features (e.g. eddies associated with shallow convection) but the resolution is too fine for traditional parameterizations to work. So I don't think the issue is so much that the parameterizations aren't necessary is that traditional parameterizations break down – because the assumption that the domain is much larger than the phenomena being sampled is no longer true.

P17,L16-17. The text states that the LES simulations "qualitatively reproduce the observed boundary layer heights within the observation uncertainties". This is not obvious. First of all – saying they agree within the uncertainties is a quantitative statement. And it appears that while they do agree well at sometimes, at others they clearly diverge. So – indicating that they agree seems like a simplification of what is going on.

Typographic/syntax

P3,L15: builts should be "builds"

P11, L29: the wording "that are highly resolved" is awkward or incorrect. I suggest changing this to something like "that are more highly resolved"

P11, L32: I think "lays the ground for . . ." should be "lays the groundwork for . . ."

P12, L6: I think that "it infers that Doppler lidars. . ." should be "it implies that Doppler lidars . . ."

P14,L2: I think the wording "Figure 9 exemplary shows the aerosol..." should be re-worded/reordered as "Figure 9 shows an exemplary aerosol ..."

P16,L4: "state of the measured polarization state" seems redundant. I would think you could just say "measure