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## ***Interactive comment on “Observing ice clouds in the submillimeter spectral range: the CloudIce Mission proposal for ESA’s earth explorer 8” by S. A. Buehler et al.***

### **Anonymous Referee #1**

Received and published: 23 March 2012

[Overview of review] This paper described the overview of satellite mission that measures the ice cloud by using submillimeter spectral range. This mission will be first mission that can observe the cloud vertical structure including the ice part of cloud and rain (extending to the upper and lower layers of cloud) on higher horizontal and temporal resolution than the previous satellite instruments (e.g. Odin-SMR, EOS MLS), but the relatively coarse vertical resolution. Although focusing largely on ice clouds, the mission has possibility to understand the cloud life cycle and the retrieved data will be useful to validate the numerical forecasting through the assimilation (Class 4 as described in the manuscript). Although this mission can cover the relatively thick ice cloud located at middle troposphere probably, the measurement of cirrus cloud located at the

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upper troposphere (below a few km to tropopause) may be lack, the cirrus cloud near the tropopause is quite important on the radiative balance and the numerical model is difficult to simulate the cirrus cloud. Therefore, it is concerned that this mission is not enough to cover the gap of knowledge about ice cloud.

As mentioned above, although there are some spaces to discuss the gap between the mission objective and the actual observing cloud (In other words, the scientific objective should be more clear, for example the target of this mission is ice cloud associated with the convective system and then the totally knowledge of cloud system and radiation impact would be developed.).

This manuscript is useful to discuss about the near future satellite mission to investigate the ice cloud feature. This reviewer hopes the author's comment about the gap (or more precise aim of this mission) described above and the a few minor comments below.

Subsection 2.3: p.1107, l.21: In Table 2, how does the accuracy of IWP (10-50%) derive? The explanation is not clear in Buehler et al. (2007). Also how much the dynamic ranges of IWP and effective radius of cloud particle are expected from this mission? For example, IWP is 1-1000 g/m<sup>2</sup>, the effective radius is 1-1000um.

Subsection 3.2/ Table 3: Because the 874GHz can capture the smaller particles, why isn't the 874GHz channel included? Please explain the reason in addition to the description in Buehler et al. (2007), especially the difficulty of retrieval.

Subsection 3.3/Table4: Is the overpass time 9:30 local time at Eq. enough for getting the ice cloud feature? And what is the expected feature of ice cloud at this time? Over ocean the convection is active early morning, on the other hand the convection over land is early evening.

Sub-subsection 4.2.2- 4.2.4: It is helpful for reader the additional explanation about the retrieval algorithm and assimilation method, the reader is not familiar with the satellite measurement with the submillimeter.

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