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Interactive comment

Interactive comment on "Dissecting effects of orbital drift of polar-orbiting satellites onaccuracy and trends of cloud fractional cover climate data records" *by* Jędrzej S. Bojanowski and Jan P. Musiał

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In this paper, the authors quantified the uncertainty and magnitude of spurious trends induced by satellite orbit drift in the AVHRR-based cloudiness records. The authors estimated that the mean monthly cloud fractional cover of individual NOAA/MetOp satellites reach ±10%, and the spurious trends reaches ±7% per decade. For the combined data record, biases of mean and trends is 3% and 1% per decade, respectively. The authors suggest that the AVHRR-derived cloud fraction cover do not comply with the GCOS temporal stability requirement of 1% CFC per decades just due to the orbital

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drift effect before 2002, while this requirement is fulfilled after 2003. In general, the paper is well written, and the results are useful for climate studies.

The paper might be accepted after addressing the following comments:

(1) In this paper, effect of orbital drift on diurnal cycle has been fully considered. However, the orbital drift could affect cloud cover through other ways, such as changes in solar zenith angle, satellite viewing angle, and orbit altitude. If a same cloud retrieval algorithm is used during the entire satellite operation period, changes in these geometric parameters would result in artificial cloud cover trends. The title of the paper is "Dissecting effects of orbital drift of polar-orbiting satellites", so effect of orbital drift on geometric parameters should also be discussed.

We agree that both satellite orbital drift and sampling at different local times can affect the accuracy of CDRs due to varying sun zenith angle, viewing angle, etc. However, these factors impact the performance of the retrieval, which we intentionally left out of scope of the paper, not to limit to a specific CDR. We used CLARA CDR to derive the NOAA overpass times. Moreover, what we emphasize in the paper is that the quantified errors and spurious trends add up to the errors of the cloud retrieval (line 219). This means that even if the perfect retrieval was developed (i.e. also not sensitive to changing SZA, VZA, etc.), its application to the AVHRR time series would produce a CDR revealing the errors we show in our study.

(2) The authors might compare the new algorithm in this paper with methods in previous papers, and discuss the ad-vantages and disadvantages of this approach.

To our knowledge, the concept we used to quantify the errors and spurious trends in AVHRR CDRs was not used before. The main reason for that is probably the novelty introduced by the CM SAF COMET – a long-term, stable and climatologically homogeneous CFC CDR with the resolved diurnal cycle. The method in which the true CFC observations are sampled by the exact AVHRR overpass times is the empirical way to measure the effects of orbital drift and under-sampling on AVHRR-derived CDR. We

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would prefer to avoid introducing the comparisons with other theoretical methods, because this could distract attention of the reader from the main findings we would like to communicate.

(3) Line 15: "the time series starting in 2003 is shorter than 30 years that voids climatological analyses." Climatological analyses involve studies of various timescales, so records shorter than 30 years do not void climatological analyses

We agree that may be an overstatement, because there are surely climatological studies that employ shorter time series. However, we refer here to the GCOS requirements that a 30y+ CDR is required to draw a realistic conclusions on the long-term trends. We rephrased this sentence accordingly.

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