

## ***Interactive comment on “A comparison of Loon balloon observations and stratospheric reanalyses products” by Leon S. Friedrich et al.***

### **Anonymous Referee #2**

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Review of “A comparison of Loon balloon observations and stratospheric reanalysis products” by Friedrich et al.

<General comments>

The authors compared zonal and meridional winds of ERA-Interim, MERRA, MERRA-2 and NCEP CFSv2 reanalyses with those derived from X Project Loon. The goal of this study is to test the potential for the Loon to be used in the evaluation of reanalyses. Because the Loon data is not assimilated in each reanalysis, the Loon should provide a useful independent test of atmospheric reanalysis winds.

The purpose of this study is well written. This paper includes very new results contributing to reanalysis communities. X Project Loon might have large potential to improve reanalyses in the future. I believe this paper is suitable for the publication in ACP. I

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have a few comments written below.

<Specific comments>

(1) Abstract: “All reanalysis data sets accurately describe the winds, with biases in zonal winds of less than 0.37m/s and meridional biases of less than 0.08m/s. The standard deviation on the differences between Loon and reanalyses zonal winds is latitude dependent, ranging between 2.5 and 3.5 m/s increasing equatorward”

P3L2–3: “Both analyses accurately represented the winds with biases of less than 0.3 m/s and standard deviations ranging from 2.3 to 2.7 m/s”, and also P3L8, P3L14, P3L18, P4L3–5 etc.

The bias and standard deviation depend on time scales analyzed (i.e., hourly, daily, monthly). The authors should indicated output intervals analyzed in each case. In addition, as the authors sometimes speculate differences due to gravity waves, differences between reanalyses and observations also depend much on their vertical resolutions. More careful explanations are needed.

(2) Kawatani et al. (2016) may be useful for this paper, which shows the standard deviations calculated by monthly mean data among several reanalyses show large values in the equatorial stratosphere, and their geographical distributions in the lower stratosphere are closely related to the density of in-situ radiosonde observations.

Kawatani, Y., Hamilton, K., Miyazaki, K., Fujiwara, M., and Anstey, J. A.: Representation of the tropical stratospheric zonal wind in global atmospheric reanalyses, Atmos. Chem. Phys., 16, 6681-6699, doi:10.5194/acp-16-6681-2016, 2016.

(3) P4L21: The authors mention the balloons is considered to be undergoing an altitude control whenever a pressure change greater than 5 hPa occurs within one hour.

Providing height information of Loon flights in Fig. 1 should be useful for reads to imagine.

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(4) P4L29–31: “The upper bound on the pressure sensor uncertainty is rather large and could potentially lead to uncertainties when vertically interpolating the reanalyses data sets to the balloon locations”

I guess uncertainties depend much on the wind profiles as the vertical resolutions of reanalyses are coarse. Could you specify uncertainties more quantitatively?

(5) Table 1: As the top boundary of each reanalysis is different, showing layer numbers between 30 and 70hPa (i.e., the varying pressure levels of the balloon flights) should be useful.

(6) P6L31–33: How the phases of the Quasi-Biennial Oscillation play the role of difference between this study and Podglajen et al. (2014)? The authors could provide their speculation in more details.

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