RESPONSE TO REFEREE #1:

We thank Referee #1 for taking the time to review the manuscript and provide valuable and constructive feedback. The referee's comments are reproduced in bold; excerpts from the revised manuscript are in red type.

P2, line 41: "Lidar can detect wind velocity in clear air, but cannot work during precipitation." In fact, it has been well demonstrated that horizontal wind speed can be correctly measured in rain.

We have modified the manuscript as follows:

Emitted laser light is scattered by fine aerosol particles in the atmosphere; the back-scattered light is condensed by telescopes and received by an optical transceiver. Since the wavelength of the received light varies according to the velocity of the aerosol particles due to the Doppler effect, wind speed can be calculated by comparing this wavelength with that of the received light (Inokuchi and Akiyama, 2019). However, when rain is too heavy, the backscattering signal is weakened due to strong attenuation by raindrops and a decrease in aerosols (Wei et. al 2019), making it difficult to measure the wind velocity at a distance.

P7, line 193: the authors should list the possible physical origins of the random noise sources in their proposed lidar observation method.

We have modified the manuscript as follows:

The random noise is caused by the reduced intensity of the received light due to the thin aerosol concentration in the sky. A general Lidar signal consists of random noise superimposed on the spectral signal. If the signal intensity is low, random noise may be detected by peak search. (Additional randomness caused by environmental factors and data processing in Lidar is considered here as randomness of the wind-speed values.)

P21, line 428: "Flight demonstrations are to be performed in 2021. The results of this research will be applied to this flight demonstration." If possible, it would be useful and interesting if the authors can provide some more detail of their proposed experimental campaign.

We have modified the manuscript as follows:

Currently, the Lidar system is being modified to be smaller and lighter in order to suit small experimental aircraft. The onboard Lidar system and real-time airflow-vector estimation will be validated by flight experiments in 2021; the whole gust-alleviation system, including preview control, will be demonstrated in 2022. The results of this research will be applied to this flight demonstration.

P3, line 95: "Lidars are assumed to be compliant..."

We have modified the manuscript as follows:

The Lidars are assumed to be compliant with the specifications for preview control currently under development by the JAXA.

P4, line 121: "the estimation accuracy of the vertical wind velocity is required to be lower than 2.6 ms-1 in the LOS distance of 500 m" – I suggest use of the word "better" rather than "lower".

We have modified the manuscript as follows:

... the estimation accuracy of the vertical wind velocity must be better than 2.6 m s^{-1} ...

P11, line 258: "opening size of optical antenna" – specify radius or diameter?

We have modified the manuscript as follows:

The Lidar sensor is shown in Fig. 2; its specifications are given in Table 1 (Inokuchi and Akiyama 2019). Laser pulses generated by an optical transceiver are amplified by optical amplifiers (Sakimura et. al. 2013) incorporated into an optical antenna and radiated into the atmosphere from optical telescopes. The heat generated by the optical amplifiers is dissipated by a chiller unit using water as a coolant. The optical antenna is equipped with a 150 mm large-aperture telescope for long range observations and a 50 mm small-aperture telescope for vector conversion of short-range observations.

The approach of combining lidar returns from different times does have some similarities with a method previously demonstrated by the ZHAW group and it is worth citing the following presentation, slide 51:

https://presentations.copernicus.org/EMS2017/EMS2017-322_presentation.pdf

We have modified the manuscript as follows:

Neininger, B.: Trends in airborne atmospheric observations, European Meteorological Society Annual Meeting 2017, 14, EMS2017-322, 2017