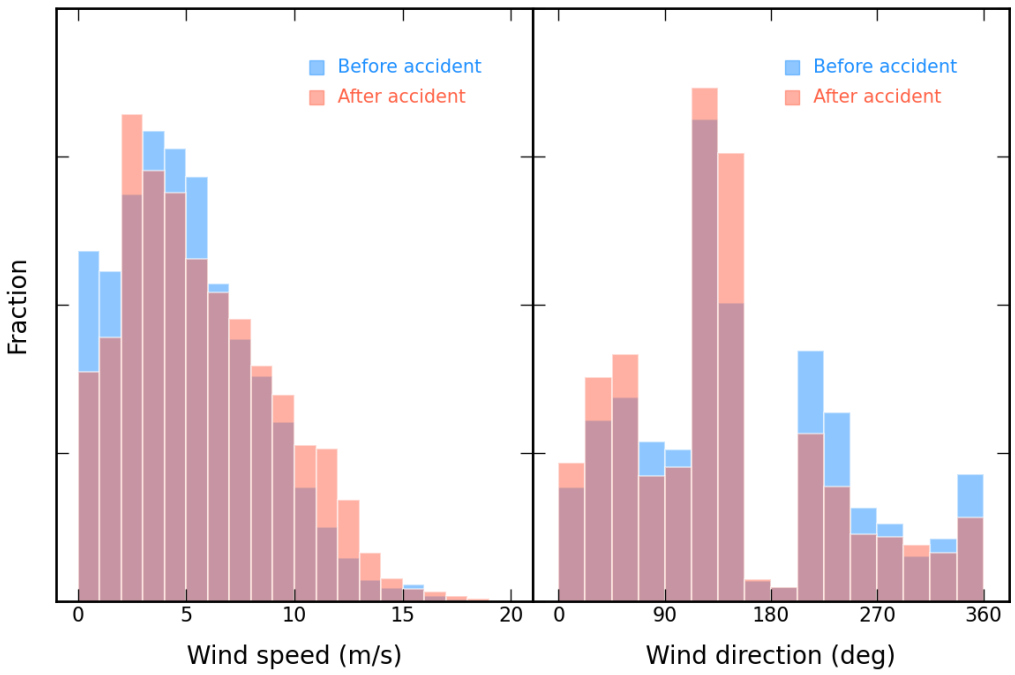
The effects of winds on HSC image quality

T.Terai (Subaru Telescope)

January 2023

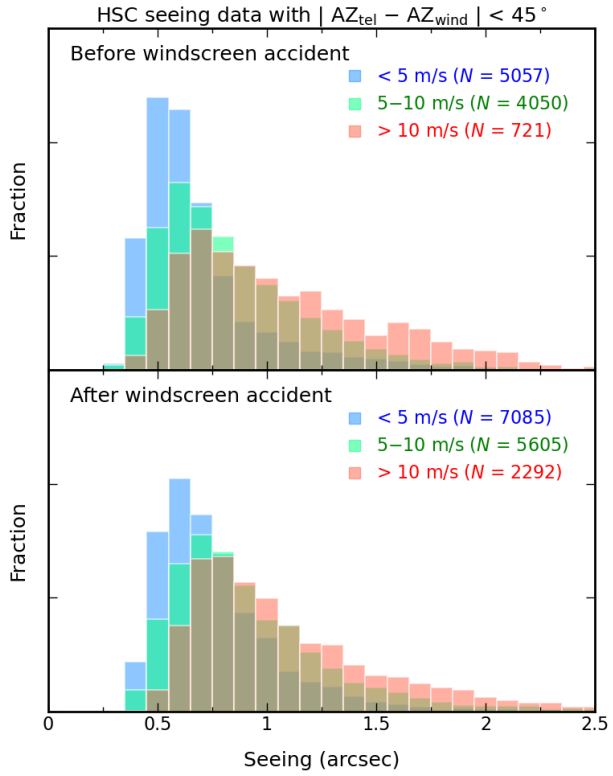
- We statistically investigated the effect of winds on HSC image quality using the seeing data measured by the on-site analysis system (see Furusawa et al. 2018, PASJ, 70, S3) and the dome outside wind data monitored at Subaru's weather tower. We also compare the HSC seeing distributions before ans after the lack of the windscreen due to an accident occurred on April 10, 2017 (see Okita et al. 2020, Proc. SPIE, 11445).
- The above data sets indicate that the HSC seeing constantly deteriorates with wind speed under head winds irrespective of the windscreen availability.
- The seeing deterioration is very limited under cross winds less than 10 m/s before the windscreen accident, while it is not negligible after the windscreen was lost.
- It is clearly seen that the HSC seeing values after the windscreen was lost are about 0.05−0.1 arcsec worse than those before the accident unless wind speed is over 10 m/s.
- When a wind coming from the front exceeds ∼15 m/s, the HSC seeing is extremely deteriorated if the windscreen is not available.
- Although the seeing is generally better at high elevation or low airmass, the situation reverses under strong head winds before the windscreen accident, which is likely to be due to telescope vibration. After the accident, however, there is almost no difference in the seeing distributions under such wind circumstances between low and high elevations. This may be because the effect of primary mirror deformation (Okita et al. 2020) became more significant at low elevation.

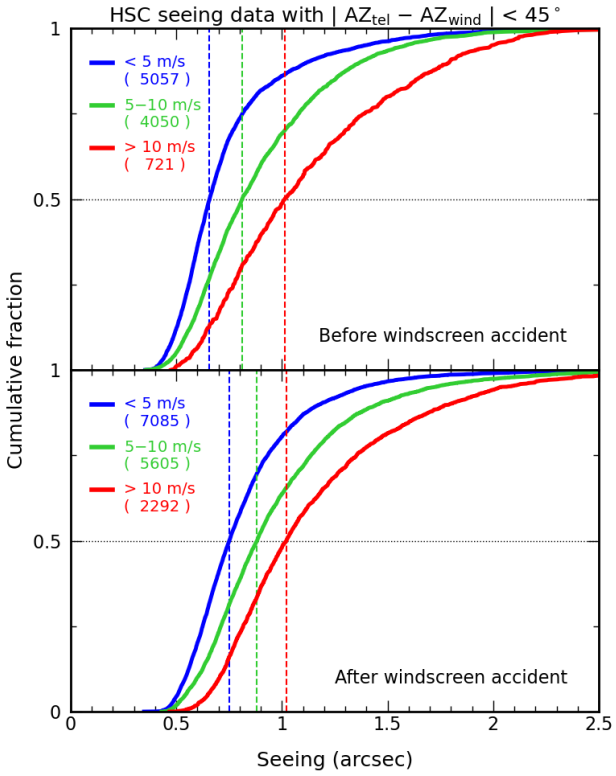


Speed and direction (AZ) distributions of the dome outside wind measured at Subaru's weather tower
→ There is no clear difference between these distributions before and after the windscreen accident.

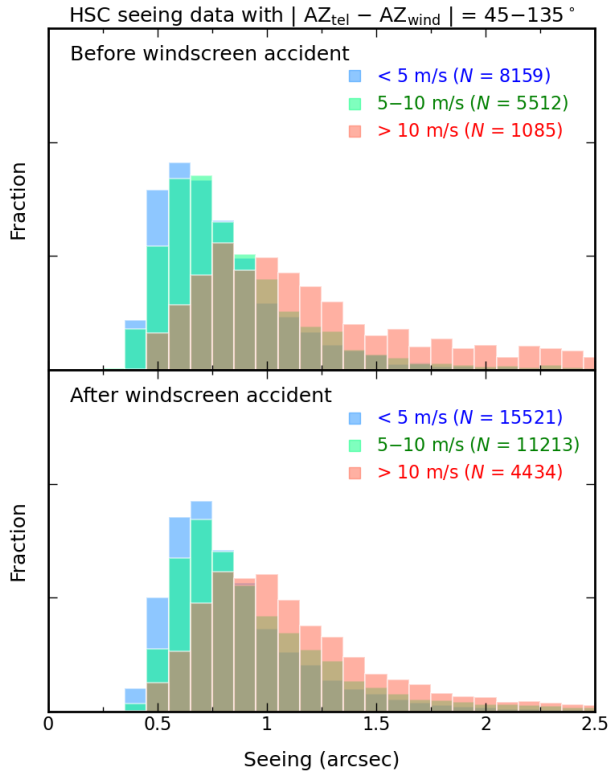
Relationships between seeing size and wind speed

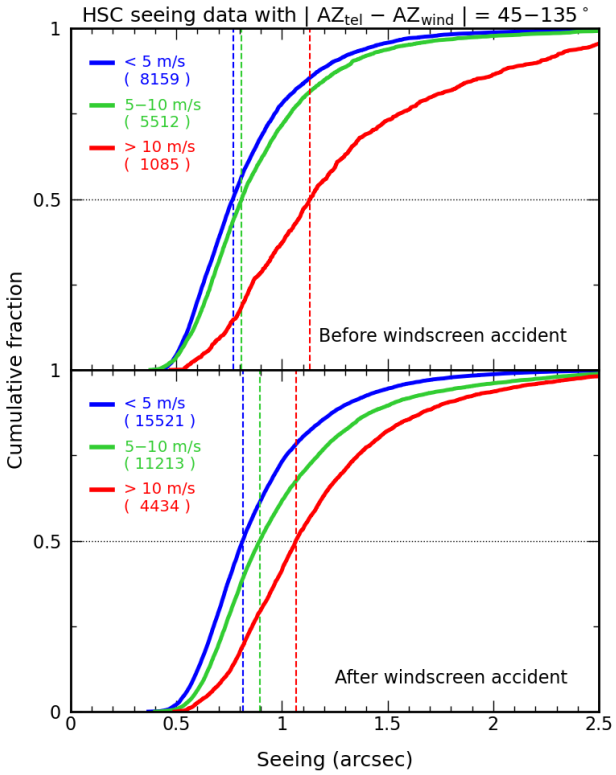
- Head winds ($|\mathrm{AZ_{tel}} - \mathrm{AZ_{wind}}| < 45^\circ$)





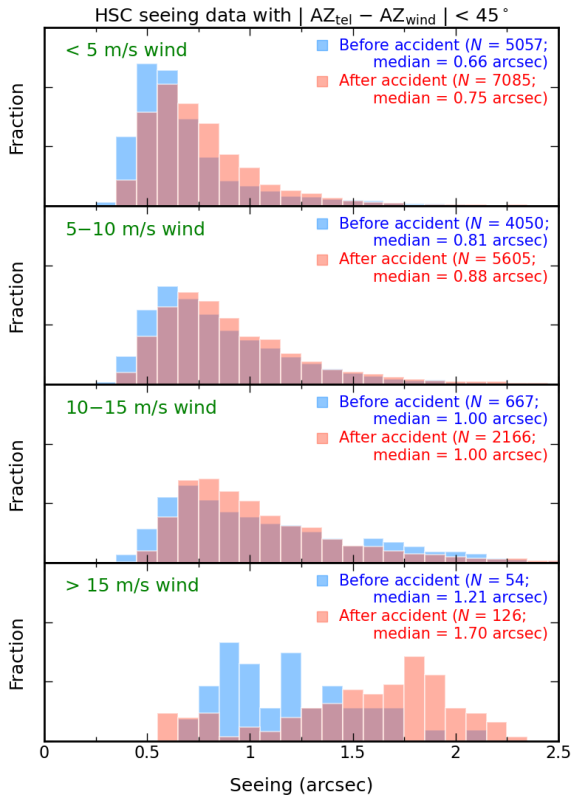
- Cross winds ($45^\circ < |\mathrm{AZ_{tel}} - \mathrm{AZ_{wind}}| < 135^\circ$)

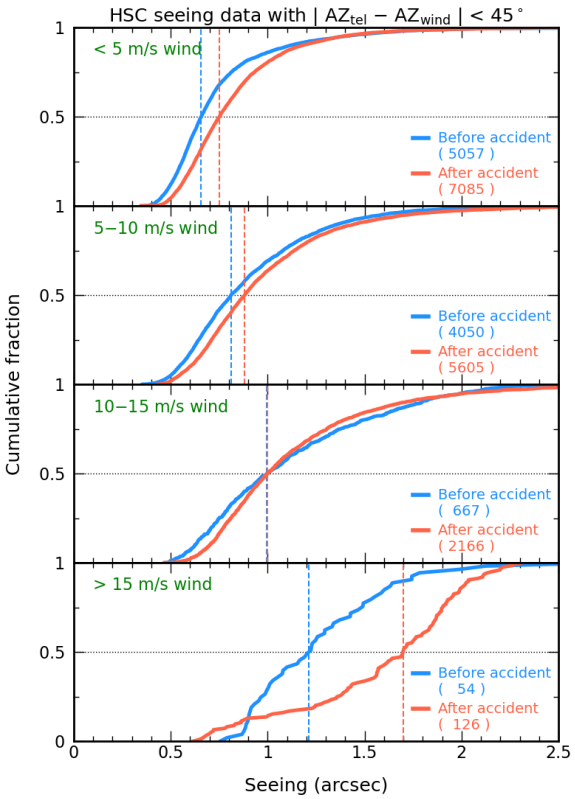




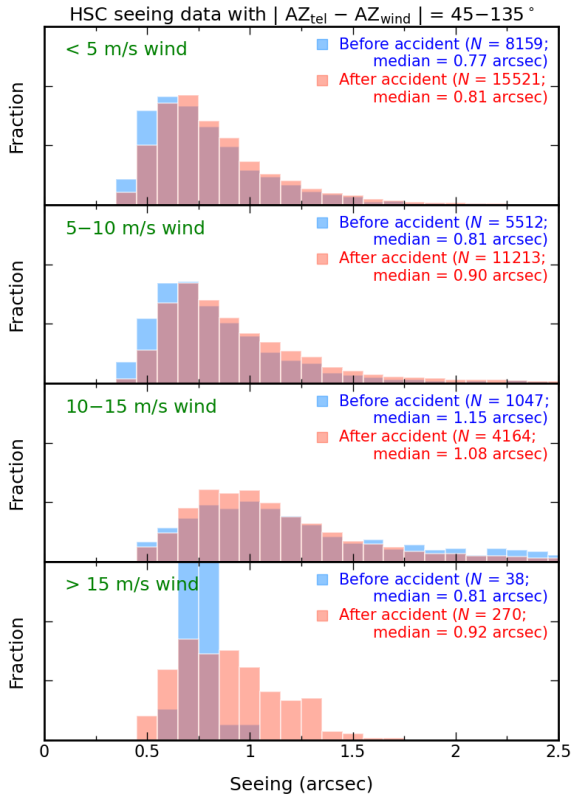
Comparison before and after the windscreen accident

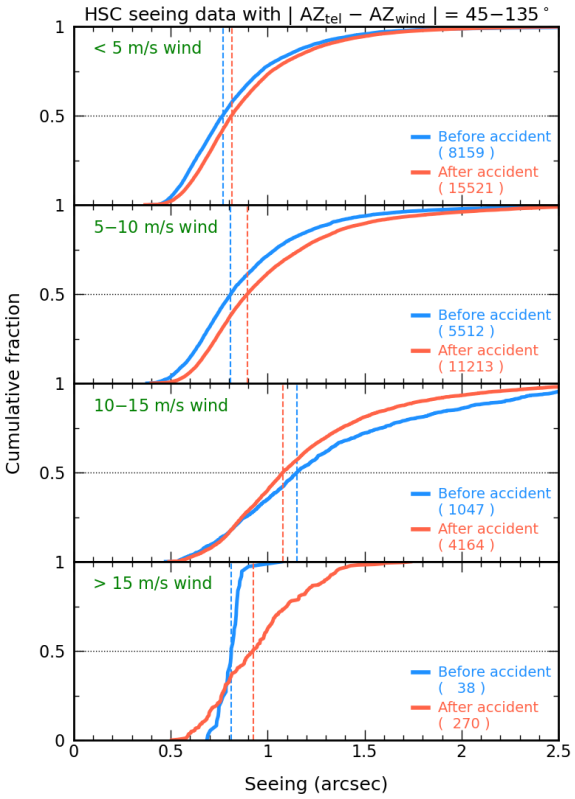
- Head winds ($|\mathrm{AZ_{tel}} - \mathrm{AZ_{wind}}| < 45^\circ$)





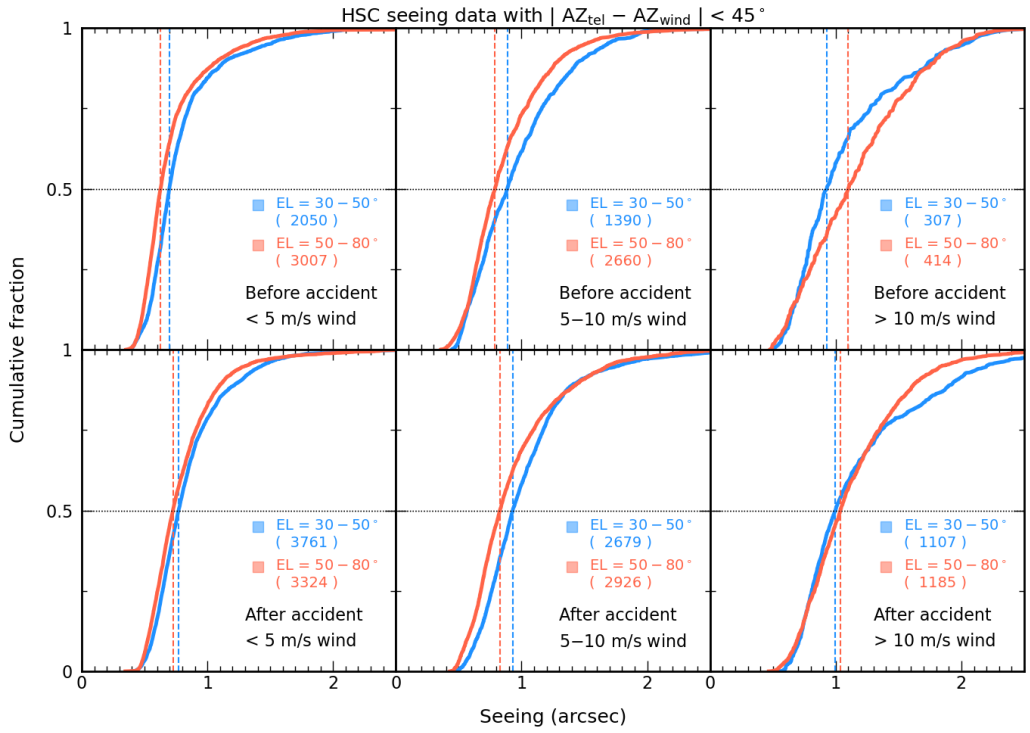
- Cross winds ($45^\circ < |\mathrm{AZ_{tel}} - \mathrm{AZ_{wind}}| < 135^\circ$)





Dependency of the telescope elevation

- Head winds ($|\mathrm{AZ_{tel}} - \mathrm{AZ_{wind}}| < 45^\circ$)



- Cross winds ($45^\circ < |\mathrm{AZ_{tel}} - \mathrm{AZ_{wind}}| < 135^\circ$)