

A China-Japan Collaborative Site Survey : Sky Clearness at Oma in West Tibet

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Abstract. The high plateaus in west China may provide suitable sites for astronomical observations with institute's middle-range telescopes and possibly with larger telescopes. Under China-Japan collaborations on site survey in west Tibet, we have been conducting to search for good sites and monitor their characteristics for several years at Karasu (Xinjiang Uighur) and Oma (Tibet). Recent results of our site survey show sites in west Tibet are revealed with high possibility of good astronomical observations. We present the characteristics at Oma with its high clear-sky ratios especially in winter, which is comparable to Mauna Kea, Hawaii.

1. Monitoring sites in west China

As west China is indicating its importance to pay a role for the global astronomical observation network, we have conducted astronomical site monitoring since 2007 under China-Japan Astronomical Collaboration at two sites in west China; Karasu in Xinjiang Uighur and Oma in west Tibet.

2. Site monitoring instruments

To evaluate astronomical observation characteristics at candidate sites, we have been conducting, (1) to monitor weather conditions, (2) to observe cloudiness using a mid-infrared(MIR) camera[1] to estimate clear sky ratios, (3) to measure atmospheric turbulence in the ground-boundary layer to estimate seeing conditions using C_7^2 sensors. (see the book "Seeing Clearly", 2011 [2])

3. Sky clearness at Oma and Karasu

Whole sky had been observed every 1 min to detect clouds in the sky with MIR Cloud Monitor Camera at Oma during 2008 and 2009 and at Karasu during 2007 and 2008. Clear sky ratios at Oma, except summer monsoon season, were around 70%, which are comparable to at Mauna Kea, Hawaii, and much better than at Okayama, Japan (Fig.1). Karasu showed lower clear sky ratios than at Oma.

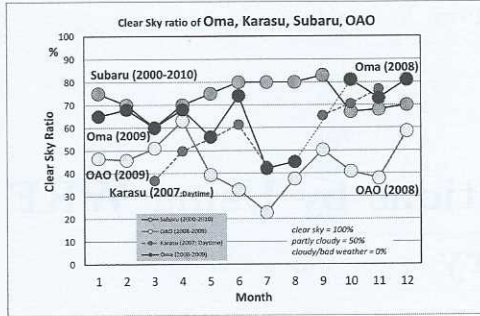


Figure 1. Clear sky ratios at Oma, Karasu, Subaru and Okayama. Oma shows clear sky ratios, except summer monsoon season, around 70% comparable to at Mauna Kea, Hawaii.

Weather Conditions at Oma/Tibet (2009/10/30)

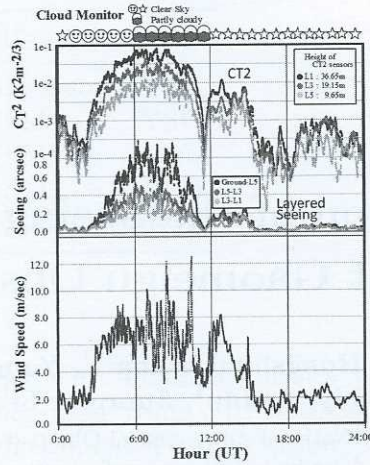


Figure 2. C_T^2 variations and wind speed at Oma on 2009/10/30, and derived layered seeing with hourly distribution of clouds.

4. Image degradation in a boundary layer estimated with C_T^2

Temperature differences were measured with two nickel-wired C_T^2 sensors at three heights on the 40m tower to derive a temperature structure coefficient, C_T^2 , (T in Kelvin and r a separation of two sensors in meter) as

$$C_T^2 = \langle |T(r_1) - T(r_2)|^2 \rangle \cdot r^{-2/3} \quad \text{K}^2\text{m}^{-2/3} \quad (1)$$

C_T^2 is used to derive layered seeing between height z_1 and z_2 as shown in Fig.2.

Atmospheric turbulence was high reasonably in daytime and low in nighttime. Seeing degradations were estimated with C_T^2 to be around 0.4 arcsec and 0.1 arcsec, respectively. Seeing through the whole atmosphere was reported less than 1 arcsec during the same period (Yao et al., S7P08 in this proceedings).

Seeing degradation seems to be correlated to wind speeds at the site. Under blown-in winds, seeings were degraded much up to higher air.

5. Future monitoring at the new site Ali

A new site, Ali, has been established. The Cloud Monitor Camera has been moved from Oma. C_T^2 sensors are soon settled. We hope continuous monitoring keeps going on at Ali more than one year and characterize the Ali site for future telescope(s) for Asian astronomers.

References

- [1] Sukanuma, M. et al., 2007, PASP, 119, 567
- [2] Businger, S. and Cherubini, T. (eds), "Seeing Clearly: The Impact of Atmospheric Turbulence on the Propagation of Extraterrestrial Radiation", ISBN 978-1-60264-698-8, 2011