金星 O2 大気光層温度変化の地上観測

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Ground-based observations of temperature variation in the Venus O2 night airglow layer

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The Venus 1.27-um O_2 airglow was discovered by Connes et al. (1979) and since then the behavior of the night airglow has been investigated by ground-based observations. Allen et al. (1992) observed airglow enhancements on the morning side of the anti-solar point. Crisp et al. (1996) found that the airglow shows complicated distributions and variations of more than 20% on time-scales as short as 1 h. Since the spatial variations of O_2 night airglow resemble those of NO night airglow, the standard scenario for O_2 airglow based on the case of the NO airglow (Bougher et al., 1990) was proposed; the oxygen atoms generated by the UV photolysis of CO_2 in the dayside upper atmosphere are transported to the night hemisphere, and recombine to form excited oxygen molecules at around 95–100km in downward flow (Allen et al., 1992; Zhang et al., 1996). A positive correlation between the O_2 brightness and the rotational temperature has been expected as a result of adiabatic heating by the downward flow. Recent ground-based observations measured the brightness and the rotational temperature (Ohtsuki et al., 2005, 2008a, 2008b; Bailey et al., 2008). Some instruments on board the Venus Express (VEX) spacecraft also measured the airglow and temperature profiles (Drossart et al., 2007; Gerard et al., 2008; Huseo et al., 2008; Mahieux et al., 2012).

Imaging spectroscopic observations of the Venus oxygen night airglow were conducted in Japan and Hawaii before or after the Venus inferior conjunctions in October 2002, June 2004, January 2006, August 2007 and October 2010. Spatially resolved spectra were taken and used to derive maps of the airglow and its rotational temperature. O_2 rotational temperature has been derived from each observed spectrum by using the HITRAN2000 molecular spectroscopic database, its high- temperature analog HITEMP and an empirical model of the Venus atmosphere VIRA1985.

In most cases, the intensity distributions have the brightest patch at around the anti-solar point and some warmer regions overlapping bright regions. A correlation between the airglow intensities and temperatures is positive but very weak. Moreover the intensity distributions vary drastically day by day. Our monitoring observations have detected variations in the airglow and the rotational temperature. We investigate trends of those variations and the relation.