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Daily monitor of Sagittarius A* at 22 GHz with the Japanese VLBI Network

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Abstract. We have been monitoring the flux density of Sagittarius A* (Sgr A*) at 22 GHz since DOY=42 (11 Feb. 2013) with a sub-array of the Japanese VLBI Network in order to search the increase of 22-GHz emission from Sgr A* induced by the interaction of the G2 cloud with the accretion disk. The flux densities observed until DOY=322 (18 Nov. 2013) are consistent with the previously observed values before the approaching of the cloud. We have detected no large flare during this period.

Keywords. Galaxy: center — galaxies: active — galaxies: nuclei

1. Introduction

The approaching of the G2 cloud to Sagittarius A* (Sgr A*) is a capital chance to explore the vicinity of the Galactic center black hole using a test probe (Gillessen *et al.* 2012). There are some predictions of increase in radio emission from Sgr A* induced by the interaction of the G2 cloud with the accretion disk (e.g. Sadowski *et al.* 2013). If the increase begins, it is very important for study of the mechanism of the event to observe the initial raising phase.

2. Observations

We have been monitoring the flux density of Sgr A* at 22 GHz since 2013 February 11 with a sub-array of the Japanese VLBI Network (Tsuboi *et al.* 2013a, Tsuboi *et al.* 2013b, Tsuboi *et al.* 2013c,) in order to search for a sign of the increase. The sub-array mainly consists of the Mizusawa 10-m radio telescope (RT), the Takahagi 32-m RT,

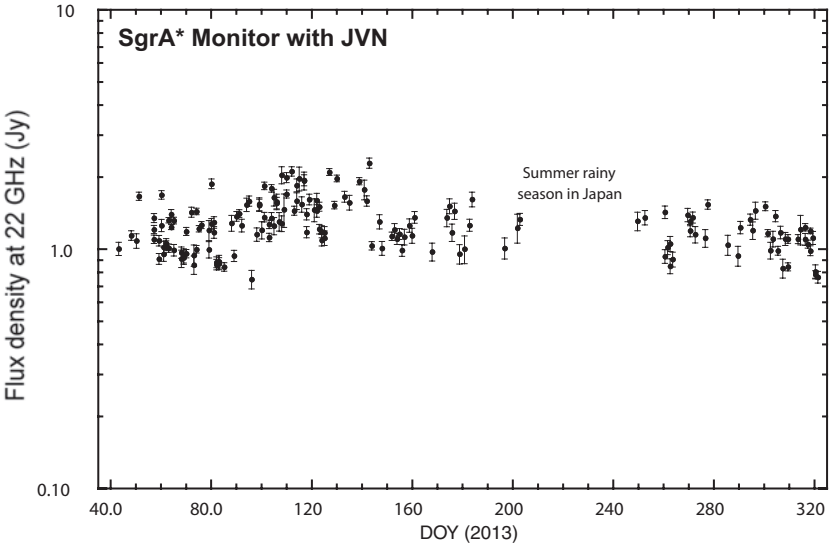

Figure 1. The light curve at 22 GHz of Sgr A* from DOY = 42 (11 Feb. 2013) to DOY = 322 (18 Nov. 2013) with the sub-array of the Japanese VLBI Network. We have detected no large flares during this period. The observed flux densities are consistent with the previously observed values before the approaching of the G2 cloud.

and the Gifu 11-m RT, which are located in the central region of Japan. Some other antennas in the area had joined it occasionally. As known well, the angular size of Sgr A* changes according to $\Delta\theta[\mathrm{mas}] = 1.3\lambda^2$ (Lo *et al.* 1985). The size at 22 GHz is expected to be about 2 mas. The projected baselines of the sub-array are in the range of 90-140 km or the beam size (fringe spacing) is about 25 mas. The array can observe the flux density of Sgr A* itself suppressing the flux density decrease by partially resolving it out. On the other hand, Sgr A* is embedded in the strong extended emission surrounding Sgr A*. The spatial resolution of the array can selectively observe the flux density of Sgr A* itself suppressing the contamination from the surrounding structure. In addition, the observation frequency of 22 GHz is expected to be fairly available even in summer of Japan. Therefore, the sub-array is suitable for the daily flux density monitoring of Sgr A*.

3. Results

The fringes of Sgr A* have been detected almost daily except for rainy days although the on-source observation time is only 10 minutes per day. Figure 1 shows the result of the flux monitoring at 22 GHz of Sgr A*. The flux densities observed until DOY = 322 (18 Nov. 2013) range around $S_\nu = 1.3 \pm 0.3$ Jy (preliminary). They are consistent with the previously observed values before the approaching of the G2 cloud. We have detected no significant variations in the period from DOY = 42 to DOY = 322. The daily monitor will be continued until the end of May 2014 even if there is no sign of a change.

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