Abstract. In February 1997 the Japanese radio astronomy satellite Halca was launched to provide the space-borne element for the VSOP mission. Approximately twenty-five percent of the mission time has been dedicated to the VSOP Survey, a 5 GHz survey of bright, compact AGN. We present the results from the ongoing analysis. Both the final, calibrated, high resolution images and plots of visibility amplitude versus $uv$ distance for the first 102 of the sources have been prepared and has been submitted. Papers on the methods and the models from fitting the cumulative $uv$ amplitudes will also be submitted. The analysis of the second half is well underway.

1. Introduction

The radio astronomy satellite HALCA was launched by the former Institute of Space and Astronautical Science (now part of Japanese Aerospace eXpoloration Agency (JAXA)) in February 1997 to participate in Very Long Baseline Interferometry (VLBI) observations with arrays of ground radio telescopes. It was placed in an orbit with an apogee height above the Earth's surface of 21,400 km, a perigee height of 560 km, and an orbital period of 6.3 hours. HALCA provides the longest baselines of the VLBI Space Observatory Programme (VSOP), an international endeavor that has involved over 25 ground radio telescopes, five tracking stations and three correlators (Hirabayashi et al. 1998; 2000a).

HALCA has now passed the end of the Guaranteed Observing Time period, and with the completion of the Memorandum of Understanding in February 2002 the NASA tracking and orbital calculation support ceased and the observation program has turned to completing the Survey. The orbital determination and spacecraft tracking are now completely indigenous to Japan and ISAS.

2. The Observations

VSOP Survey observations use ~3 ground telescopes and HALCA, co-observing for up to ~6 hours. Ground radio telescopes that have made significant contributions to Survey Program observations include Ceduna (Australia), the (no longer operational)
Green Bank 43 m (USA), Hartebeesthoek (South Africa), Hobart (Australia), Kalyazin (Russia), Kashima (Japan), Mopra (Australia), Noto (Italy), Shanghai (China), Torun (Poland), and Usuda (Japan). As in all VSOP observations, two 16 MHz bandwidths of two-bit sampled, left-circular polarization data are recorded (Hirabayashi et al. 2000). Data are usually correlated at either the Penticton correlator or the Mitaka correlator. After correlation, the data are sent to ISAS for distribution to the Survey Reduction Team members. The reduction of Survey observations is described in Moellenbrock et al. (2000) and Hirabayashi et al. (2000).

As of January 2004, over 230 of these sources had been observed. At the currently sustainable rate (since October 1999, when one of HALCA’s four reaction wheels stopped working) of ~2 observations per week, the remaining Survey observations are expected to be completed in mid 2004.

3. Data Reduction

Analysis of the data has been well described elsewhere (e.g. Lovell et al. 2004) and hence will only be briefly outlined here. The data is imported into AIPS, amplitude calibrated (with the system temperature and, if needed, autocorrelation normalised) then fringe fitted. After satisfactory delay and rate calibration it was summed to a single channel and exported to DIFMAP for model fitting and self calibration.

4. Sample Results

4.1. The Cumulative Visibility Amplitudes

Horiuchi et al. (2004) model fitted the cumulative observed visibilities to explore the structure of a ‘typical’ AGN. This was found to have a resolving component, a jet and a residual non-resolved core component. See Figure 1.

4.2. Images of all the sources

Scott et al. (2004) covered the data reduction carried out for over 102 sources. The first detailed paper of results (“The VSOP 5GHz AGN survey: III imaging results the first 102 sources”) has been submitted. A typical survey source is J1837-71, a very recently discovered GPS source (Edwards & Tingay 2004) that had not been imaged previously. It was observed with HALCA, HartRAO, Hobart & Mopra. See Figure 2.
5. Conclusions

The satellite continues to make survey observations, and will do so while the satellite is functioning. These observations are being analysed cumulatively and individually and providing interesting results.

These results are not only important for the understanding the target sources, mainly AGN’s, but also for the planning of future space-VLBI missions such as the VSOP-2 mission, which will have a resolution of nearly a magnitude better.

References

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