

Report of the Expert Panel on Tropospheric Turbulence (EPTT)

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PRELIMINARY EXECUTIVE SUMMARY

The summary conclusions of the expert panel on tropospheric turbulence are as follows:

- The site test interferometer (STI) data obtained at both sites are robust, of good quality and of comparable accuracy to phase stability data obtained at other sites.
- The data are of insufficient duration to allow firm conclusions about the long-term viability of the sites for observations requiring high dynamic range imaging. We have less than one year of data, so not all seasons are covered, and multi-year data is needed for a good statistical analysis. Consequently, all of the following results are tentative.
- The STI data from the candidate SKA sites were compared with data from similar instruments at other sites. The data suggest that neither SKA site is as good as the ALMA, VLA, or Goldstone (DSN) site, all of which are at higher altitudes and in desert climates, and that both are slightly better than the Canberra DSN station.
- After adjusting for small differences in the observing geometry, the median RMS delay fluctuations were about 17% larger at the Murchison, Western Australia (MWA) site than at the Karoo, South Africa (KSA) site during the overlapping monitoring period, June through October 2011 (mostly winter).
 - The difference was 3% for nighttime measurements, and 28% for daytime measurements.
 - It is not known whether these differences would persist, become larger, or be reversed if the monitoring covered a full year or multiple years.
 - In any case, these differences are small and the EPTT considers them insignificant for determining the suitability of the sites for high dynamic range imaging.
- The STIs at the candidate SKA sites are of identical design and similarly installed, but they necessarily used different geostationary satellites as their signal sources. Their antenna separations were close to the same (199.1 m at MWA and 205.9 m at KSA). Because the vertical distribution of turbulence is not measured, an accurate adjustment for the geometrical differences is not possible, so a reasonable model was used. The ratio of the adjustment factors (MWA/KSA) was 0.79.
 - An alternative model gives an adjustment factor ratio of 0.94, which would increase the median difference during the overlap period from 17% to 38%.
 - The geometries were sufficiently similar that the adjustment (for either model) is insignificant for determining the suitability of the sites for high dynamic range imaging.
- The EPTT attempted to estimate the imaging dynamic range available at each site due to tropospheric turbulence in the absence of any other errors. This is difficult because it depends on calibration strategy and other imaging techniques. However, in the opinion of the EPTT, if the SKA had been operating at either of the subject sites during the period of monitoring, the tropospheric turbulence would not have been a significant limitation on high-dynamic-range imaging for nighttime observations at 3 GHz, but it would have made such observations difficult at 30 GHz.