

Characterization of the atmosphere above a site for millimeter wave astronomy

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Abstract The Sardinia Radio Telescope (SRT) is a challenging scientific project managed by the National Institute for Astrophysics (INAF), it is being developed at 30 km North of the city of Cagliari, Italy. The goal of the SRT project is to build a general purpose, fully steerable, 64 m diameter radio telescope, capable of operating with high efficiency in the centimeter and millimeter frequency range (0.3–100 GHz). In portions of this frequency range, especially towards the high end, astronomical observations can be heavily deteriorated by non-optimal atmospheric conditions, especially by water vapor content. The water molecule permanent electric dipole in fact, leads to pressure broadened rotational transitions around the 22.23 GHz spectral line. Furthermore, water vapor's continuum absorption and emission may influence higher frequency observations too. To a lower degree, cloud liquid black body radiation can also affect centimeter and millimeter observations. In addition to this, inhomogeneities in water vapor distributions can cause signal phase errors which introduce a great amount of uncertainty to VLBI mode observations. The Astronomical Observatory of Cagliari (OA-CA) has obtained historical timeseries of radiosonde profiles conducted at the airport of Cagliari. Through the radiosonde measurements and an appropriate radiative transfer model,

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