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Title:Millimetre and submillimetre atmospheric performance at Dome C combining radiosoundings and atm synthetic spectra
Authors:De Gregori, S. (1); De Petris, M. (1); Decina, B. (1); Lamagna, L. (1); Pardo, J. R. (2); Petkov, B. (3); Tomasi, C. (3); Valenziano, L. (4)
Author affiliation: (1) Univ Roma La Sapienza, Dept Phys, I-00185 Rome, Italy; (2) Inst Nacl Tecn Aeroespacial, Ctr Astrobiol CSIC INTA, Madrid 28850, Spain; (3) CNR, Inst Atmospher Sci & Climate, I-40129 Bologna, Italy; (4) Natl Inst Astrophys, Inst Space Astrophys & Cosm Phys, I-40129 Bologna, Italy
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Abstract:The reliability of astronomical observations at millimetre and submillimetre wavelengths closely depends on a low vertical content of water vapour as well as on high atmospheric emission stability. Although Concordia station at Dome C (Antarctica) enjoys good observing conditions in this atmospheric spectral windows, as shown by preliminary site-testing campaigns at different bands and in, not always, time overlapped periods, a dedicated instrument able to continuously determine atmospheric performance for a wide spectral range is not yet planned. In the absence of such measurements, in this paper we suggest a semi-empirical approach to perform an analysis of atmospheric transmission and emission at Dome C to compare the performance for seven photometric bands ranging from 100?GHz to 2?THz. Radiosoundings data provided by the Routine Meteorological Observations Research Project at Concordia station are corrected by temperature and humidity errors and dry biases and then employed to feed Atmospheric Transmission at Microwaves (atm) code to generate synthetic spectra in the wide spectral range from 100?GHz to 2?THz. This approach is attempted for the 20052007 data set in order to check its feasibility. To quantify the atmospheric contribution in millimetre and submillimetre observations we are considering several photometric bands, largely explored by ground-based telescopes, in which atmospheric quantities are integrated. The observational capabilities of this site at all the selected spectral bands are analysed considering monthly averaged transmissions joined to the corresponding fluctuations. Transmission and precipitable water vapour statistics at Dome C derived by our semi-empirical approach are consistent with previous works. It is evident the decreasing of the performance at high frequencies. We propose to introduce a new parameter to compare the quality of a site at different spectral bands, in terms of high transmission and emission stability, the site photometric quality ratio. The effect of the instrument filter bandwidth is involved on the estimate of the optical depth performed by the water vapour content knowledge.
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