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ORIGINAL ARTICLE

Reduced ambiguity calibration for LOFAR

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Abstract Interferometric calibration always yields non unique solutions. It is therefore essential to remove these ambiguities before the solutions could be used in any further modeling of the sky, the instrument or propagation effects such as the ionosphere. We present a method for LOFAR calibration which does not yield a unitary ambiguity, especially under ionospheric distortions. We also present exact ambiguities we get in our solutions, in closed form. Casting this as an optimization problem, we also present conditions for this approach to work. The proposed method enables us to use the solutions obtained via calibration for further modeling of instrumental and propagation effects. We provide extensive simulation results on the performance of our method. Moreover, we also give cases where due to degeneracy, this method fails to perform as expected and in such cases, we suggest exploiting diversity in time, space and frequency.

Keywords Instrumentation: interferometers · Techniques: interferometric · Methods: analytical

1 Introduction

Self calibration is essential for radio interferometers such as LOFAR (The Low Frequency Array: http://www.lofar.org) to obtain high quality results under the presence of corruptions. In this paper, we focus most of our attention on propagation effects caused by the ionosphere. The ionosphere is an active

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