

# ***Interactive comment on “Level 0 to 1 processing of the imaging Fourier transform spectrometer GLORIA: generation of radiometrically and spectrally calibrated spectra” by A. Kleinert et al.***

## **Anonymous Referee #3**

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### General comments

The paper addresses the processing steps applied to GLORIA instrument data to convert these to calibrated spectra. The authors consider both the characterisation and calibration of the instrument, with corresponding algorithms, as well as the computer implementation of the algorithms, including performance aspects of the processor.

In general, a single paper is too brief to sufficiently describe all relevant aspects of Level 0 to 1 processing of an instrument as complex as an imaging spectrometer. However, the authors seem to have succeeded in covering the essence of the calibration aspects

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relevant to GLORIA, and have produced a clearly written paper which is accessible also to readers who are not familiar with the intricacies of Fourier transform spectrometers.

Due to the finite length of a paper of this type, a lot of details could not be covered. The specific comments below reflect this fact, and are mostly intended as an encouragement to consider inclusion of these topics in the appropriate project documentation (e.g. Algorithm Technical Baseline Documents, or Technical Notes) of the GLORIA instrument.

### Specific comments

One could consider a measurement as the projection of the information of the real world onto the measurement dimensions of the instrument, limited by the sampling and resolution (noise) of the instrument.

The relevant dimensions in the real world seem to be the 2-D and 3-D spatial information of the atmosphere, including its dynamics, and the spectral information and radiometric properties of the light.

The instrument data consists of detector row and column dimensions, a signal level dimension, and a time dimension.

Thus, the 5 to 6 real world dimensions are projected on 4 instrument dimensions, using time-multiplexing to gain access to the remaining 1 to 2 dimensions in the real world.

The authors explicitly consider:

- \* the relationship between the radiometric atmospheric information and signal reported by the instrument (Radiometric calibration, including gain, offset and non-linearity correction)

- \* the relationship between the spectral information of the atmospheric light and the wavelength assigned to each sampling point in the Level 1 data (Spectral calibration)

Topics not covered in the paper are:

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\* the relationship between the 2- and 3-D position of the observed scene and the spatial coordinates assigned to the Level 1 data

\* timing-related information (except delay of time stamps of the reference laser data)

\* a systematic approach to cross-terms of the projections affecting data quality, such as the drift of radiometric gain and offset (which is covered in section 7.1; likely due to mixing of the real world dimension "instrument temperature" into one or several of the instrument output dimensions), scattered light and alignment of the detector (mixing of radiometric signal over spatial dimensions), residual image on the detector (mixing of radiometric signal over the time dimension), etc.

As the paper is now, only a brief and mostly qualitative introduction is given of the coupling between the scientific requirements (Level 2 and higher) and the required accuracy of the Level 1 data. It would be very interesting to see the flow-down of the scientific requirements through the Level 2 algorithms to the Level 1 data quality. This is - of course - an extensive exercise and well beyond the scope of the paper. However, without quantitative goals for the Level 1 accuracy, it is difficult to assess the quality of the Level 0 to 1 processing.

The non-linearity correction (section 3.2) covers only the case of constant brightness of the light source with variable integration time. During normal operation of the instrument, a variable brightness input signal will be recorded. We recently characterised an infra-red detector where we initially made the assumption that the of non-linearity as function of integration time or input brightness would be identical. However, the check of this assumption failed and a specific input brightness and integration time dependent non-linearity correction was called for. Depending on the radiometric requirement on the Level 1 spectrum, you may want to check whether the implicit assumption on non-linearity for GLORIA is justified.

Technical corrections

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None

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Interactive comment on Atmos. Meas. Tech. Discuss., 7, 2827, 2014.

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