The Radio Occultation Processing Package (**ROPP**)

*To provide users with a comprehensive **software package** containing all necessary functionality to **pre-process RO data** from Level 1a, Level1b or Level2 and components to assist with the **assimilation of these data in NWP systems***

The EUMETSAT Network of Satellite Application Facilities

GRAS SAF
GRAS Meteorology

To register and download the latest released version of ROPP visit http://www.grassaf.org

- ROPP is a collection of inter-related software modules, supporting build scripts, data files and documentation.
- Users may wish to integrate a subset of ROPP code into their own software applications, modifying or replacing components to suit their requirements.
- Alternatively, users may use the tools provided as part of each module as stand-alone applications for RO data processing.

ropp_io

Support for reading and writing RO files.

- RO internal data structures,
- netCDF interfaces,
- BUFR encoder/decoder tools,
- UCAR, GFZ data format converters
- Range and unit checking,
- Profile thinning algorithms.

ropp_utils

Low-level utility routines used by other modules

- Geodetic coordinate conversion,
- Height conversion,
- Date and time conversion,
- Array manipulation,
- Error messages

ropp_pp

Pre-processor to generate bending angle and refractivity profiles from excess phase and amplitude data.

- Abel transform,
- Statistical optimisation,
- Ionospheric correction,
- Open-loop pre-processing
- Geometric optics,
- Radioholographic analysis,
- Canonical transform (CT2) wave optics

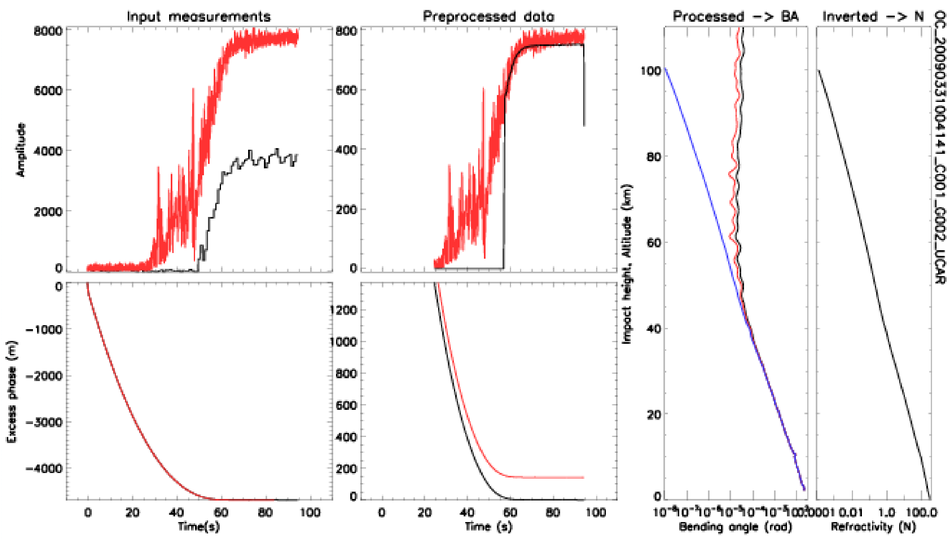

Figure 1: Refractivity as a function of height computed from ionospheric corrected bending angle as a function of impact parameter. L1 and L2 bending angle profiles are computed from pre-processed open loop amplitude and phase data using a wave optics (CT2) algorithm.

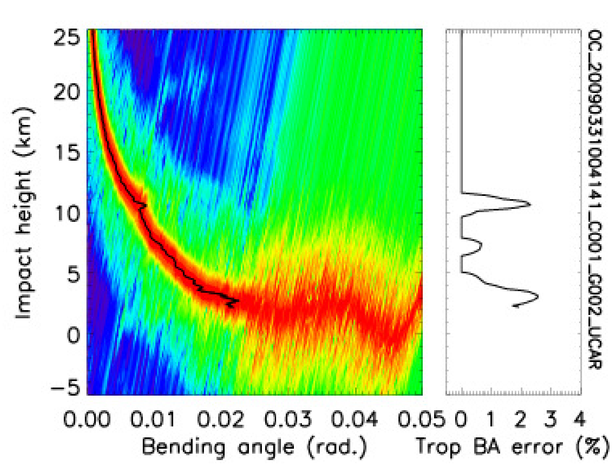

Figure 2: Radioholographic analysis provides local spatial spectra. Tropospheric bending angle error is estimated from spectral width.

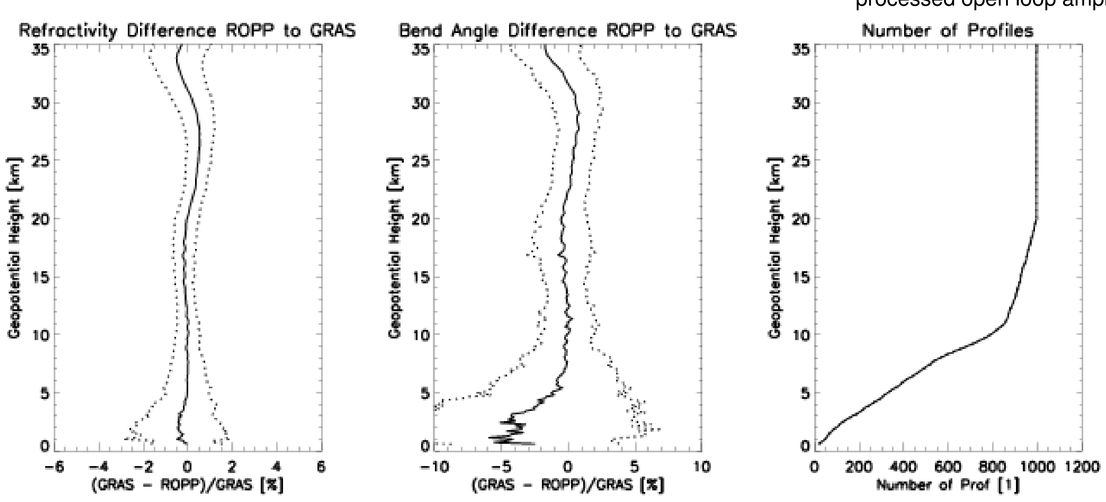

Figure 3: Difference between GRAS observation and Met Office background forward modelled to refractivity and bending angle using ROPP for 1000 GRAS profiles.

ropp_fm

Forward models to compute refractivity and bending angle from background p, q, T data.

- Bending angle and refractivity forward operators
- tangent linear and adjoint codes,
- 1d operator (profile), 2d operator (plane) routines
- Supports hybrid-sigma (e.g. ECMWF, HIRLAM) and geopotential (e.g. Met Office) based vertical model levels.

ropp_1dvar

1dVar retrieval of p, q, T using GPSRO observables and background data.

- Assimilate refractivity or bending angle,
- Quality control methods (e.q. bgqc, PGE)
- Minimisation algorithms (LevMarq, Quasi-Newton)
- Preconditioning
- Error covariance handling routines,
- Diagnostic output.

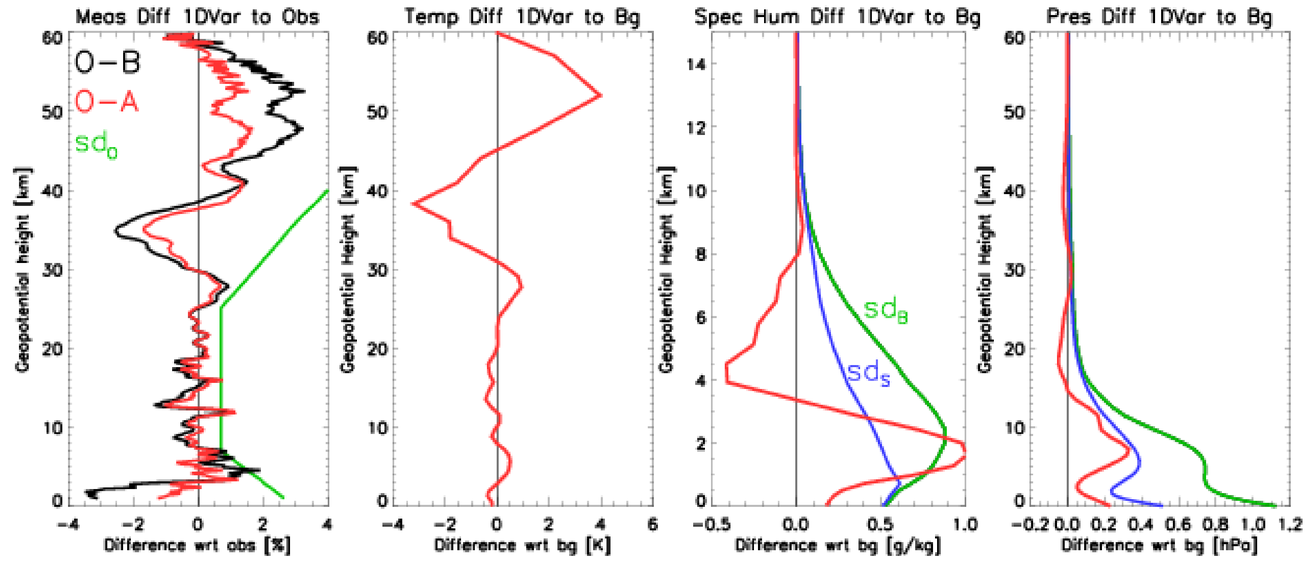

Figure 4: Example application of 1dVar solution using refractivity observation and Met Office background

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