



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, Level 1b or Level 2 and components to assist with the assimilation of these data in NWP systems

The EUMETSAT Network of Satellite Application Facilities



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

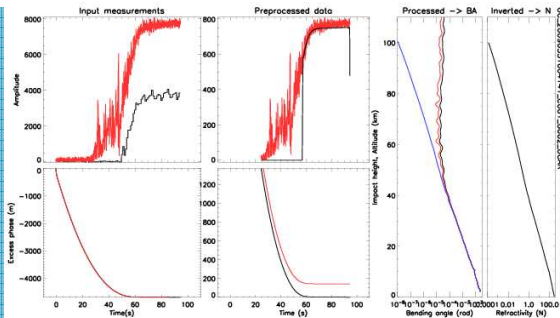


Figure 1: Refractivity as a function of height computed from ionospheric corrected bending angle as a function of impact parameter. L1 and L2 bending angle profiles are computed from pre-processed open loop amplitude and phase data using a wave optics (CT2) algorithm.

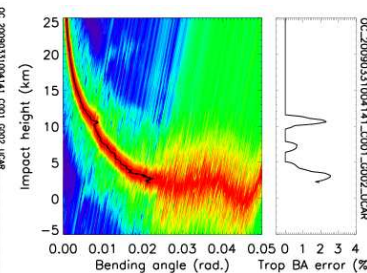


Figure 2: Radioholographic analysis provides local spatial spectra. Tropospheric bending angle error is estimated from spectral width.

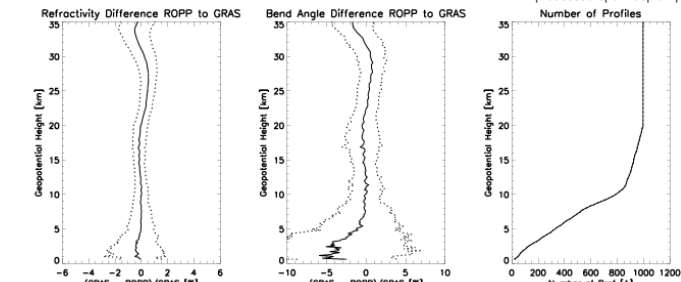


Figure 3: Difference between GRAS observation and Met Office background forward modelled to refractivity and bending angle using ROPP for 1000 GRAS profiles.

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

- Bending angle and refractivity forward operators
- Stangent 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.g. bgqc, PGE)
- Minimisation algorithms (LevMarq, Quasi-Newton)
- Preconditioning
- Error covariance handling routines,
- Diagnostic output.

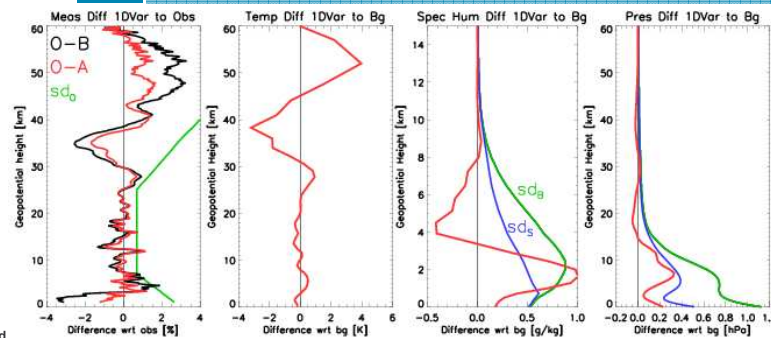


Figure 4: Example application of 1dVar solution using refractivity observation and Met Office background