Critical Analysis of Different Methods to Retrieve Atmosphere Humidity Profiles from GNSS Radio Occultation Observations

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The huge amount of GPS Radio Occultation (RO) observations currently available thanks to space mission like COSMIC, CHAMP, GRACE, TERRASAR-X etc., have greatly encouraged the research of new algorithms suitable to extract humidity, temperature and pressure profiles of the atmosphere in a more and more precise way. For what concern the humidity profiles in these last years two different approaches have been widely proved and applied: the "Simple" and the 1DVAR methods. The Simple methods essentially determine dry refractivity profiles from temperature analysis profiles and hydrostatic equation. Then the dry refractivity is subtracted from RO refractivity to achieve the wet component. Finally from the wet refractivity is achieved humidity.

The 1DVAR approach combines RO observations with profiles given by the background models with both the terms weighted with the inverse of covariance matrix. The advantage of "Simple" methods is that they are not affected by bias due to the background models.

We have proposed in the past the BPV approach to retrieve humidity. Our approach can be classified among the "Simple" methods. The BPV approach works with dry atmospheric CIRA-Q models which depend on latitude, DoY and height. The dry CIRA-Q refractivity profile is selected estimating the involved parameters in a non linear least square fashion achieved by fitting RO observed bending angles through the stratosphere. The BPV as well as all the other "Simple" methods, has as drawback the unphysical occurrence of negative "humidity". Thus we propose to apply a modulated weighting of the fit residuals just to minimize the effects of this inconvenient. After a proper tuning of the approach, we plan to present the results of the validation.