

Interactive comment on “UV Raman lidar measurements of relative humidity for the characterization of cirrus cloud microphysical properties,” by P. Di Girolamo et al. (MS No.: acp-2009-347)

General comments

This manuscript discusses Raman lidar measurements performed by the BASIL Raman lidar system with a focus on relative humidity and cloud geometric and microphysical property characterization in the presence of cirrus clouds. Data obtained during the Italian phase of the EAQUATE field experiment, conducted during September 2004, are utilized to enable synergistic use of other coincident sensors such as the NAST-I airborne spectrometer to assess the temporal evolution of the atmospheric cooling/heating rates due to the presence of cirrus clouds.

The paper is well written and within scope of topics addressed within ACP. Cirrus cloud property characterization is of scientific importance standalone, so the synergistic analysis addressing cirrus cloud impacts on atmospheric cooling/heating rates broadens the interest in this manuscript and its justification for publication within ACP. However, some suggestions will be given below on needed corrections and issues to be addressed prior to publication in an attempt to further improve this manuscript.

Specific comments

Page 14737, line 24-25. Manuscript states “Measurements reported in this paper represent to our knowledge the first Raman lidar measurements of relative humidity (RH) inside cirrus clouds.” Is this really true? I am under the impression this has been done by other groups in the past, and already reported in international conferences and published in peer-reviewed journal articles. For example, consider work done by the NASA GSFC Scanning Raman Lidar group by D. Whiteman et al., e.g., “Scanning Raman Lidar Measurements of Atmospheric Water Vapor and Aerosols,” R. Ferrare et al., 2004. Also, see, e.g., Immler, F., K. Krüger, S. Tegtmeier, M. Fujiwara, P. Fortuin, G. Verver, and O. Schrems (2007), Cirrus clouds, humidity, and dehydration in the tropical tropopause layer observed at Paramaribo, Suriname (5.8°N, 55.2°W), *J. Geophys. Res.*, 112, D03209, doi:10.1029/2006JD007440.

Page 14739. Nominal Basil measurement uncertainties are given for nighttime measurements at 8 km; how do these vary for other altitudes and conditions assimilated in this case study?

Page 14739. It is mentioned that the Lidar temperature and water vapor profiles reported were calibrated using radiosonde data. How are the corresponding study results impacted from potential radiosonde dry bias artifacts commonly reported elsewhere for upper tropospheric regions?

Page 14741. What time is local “sunset” for the case study data reported? And, if there is any day/night transition among discussed data, please discuss Basil max altitude and uncertainty differences for these two different regimes.

Page 14742. It is mentioned that GPS data are not contained with radiosondes for the referenced experiment. How does this impact usage of these radiosondes for calibration of the Lidar temperature and water vapor profiles? Significant horizontal drift can occur during radiosonde ascent and this can cause huge errors in the above-referenced calibration in the presence of geophysical gradients.

Page 14750, first paragraph. Is lack of exact co-location of synergistic measurements another factor in not correctly capturing the cloud layer evolution?

Technical corrections

Page 14736, line 4. Add “the” prior to “Italian phase”

Page 14736, line 10. Consider adding “,” after “measurements”

Page 14736, line 18. Change “allows to determine” to “allow determination of”

Page 14736, line 20 (and at many places throughout manuscript). I am questioning the use of the term “cirrus cloud anvil” here and throughout paper. Used in this context generally refers to the cirrus cloud formed at the top of thunderstorms, from horizontal divergence of air where further vertical motion is constrained. Whereas in this case study, I believe, the cirrus clouds under evaluation are not associated with thunderstorms. If this is correct, I would suggest considering dropping the word “anvil.”

Page 14736, line 22. Change “indicates” to “indicate”

Page 14736, line 28. Change “appears” to “appear”

Page 14737, line 7. Change “understanding” to “understanding of”

Page 14737, line 15. Change “with humidification” to “with a humidification”

Page 14738, line 9. Add “(NPOESS)” between “System” and “Airborne”

Page 14738, line 11. NAST-I is reported elsewhere as being 0.25 cm⁻¹ resolution.

Page 14738, line 13-18. In reference to the radiance computations, it would be helpful to add a parenthetical note at this first occurrence regarding the approach or a pointer to the manuscript section where more detail is provided. Also, wherever the detail is provided, please add information on how the surface (e.g. temperature and emissivity) is handled.

Page 14740, line 14. Change “indicate” to “indicates”

Page 14740, line 22. Change “data is” to “data are”

Page 14740, line 24. Move “from” away from current location to after “measurements”

Page 14742, line 9. Change “At this purpose, radiosondes” to “For this purpose, radiosonde”

Page 14742, line 12. Change “thescloud” to “the cloud”

Page 14743, line 21. Change “an horizontal” to “a horizontal”

Page 14744, line 13. Change “provides also” to “also provides”

Page 14744, line 14. Change “tha” to “the”

Page 14744, lines 19-22. In 3 places, change “; [“ to “ [“

Page 14745, line 3. Move “sets of” to in between “spaced” and “FOVS”

Page 14745, line 5. Change “retrived” to “retrieved”

Page 14745, line 7. Change “; [“ to “ [“

Page 14745, line 17. Change “ratiative” to “radiative”

Page 14746, line 26. Add “the” before “next”

Page 14747, line 22. Add “the” before “same”

Page 14748, line 2. Change “descent” to “descending”

Page 14748, line 3. Change “to gravitational” to “with gravitational”

Page 14748, line 17. Delete “that”

Page 14748, line 19. Change “data available to us.” to “available data.”

Page 14749, line 5. Add space “ “ before “are” and after “obtain”

Page 14750, line 4. Change “to capture” to “capturing”

Page 14750, line 6. Change “through out” to “throughout”

Page 14750, line 15. Change “radio sondes” to “radiosondes”

Page 14752, lines 8 & 19. Suggest changing “synergic” to “synergistic”

Page 14752, line 24. Change “indicates” to “indicate”

Page 14753, line 7. Change “Eumersat” to “Eumetsat”

Page 14758. Average values given in Table are not equal to the averages of the specific IFOV values listed in Table.

Page 14766. In caption, change “firsts” to “first”. Is “3” correct in caption or should it be “4 panels”? Change “widow” to “window”. Make font size of “OD=” larger in bottom two panels (i.e. like upper two).

Page 14767. Colors too similar for the dark curves and are hard to distinguish. What is the purpose of the arrows shown within the figure? Please label if they need to remain.

Page 14768. How are “idealized” profiles formed?