Implementation of Micropulse Lidar at 4.5 µm and 1.5 µm for Aerosol and Cloud Study

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Summary:
- Results of aerosol and cloud backscattered signal are presented showing that these laser types can be suitable for atmospheric study in the infrared spectral range.
- The signal to noise ratio obtained on measured signals is in good agreement with the simulated SNR.
- The system is planned to be implemented with an existing Raman-Mie lidar operating in the UV, visible and near infrared wavelength for further studies on urban aerosols as well as cloud base dynamic.

Instrumentation Design:
4.5 µm and 1.5 µm LiDAR
- All carbon fiber lightweight design
- High tensile strength and modulus of elasticity
- Thermal stability
- Laser sources
  - 1.5µm laser: Energy per pulse = 28 µJ, rep rate: 20 kHz
  - 4.5µm laser: Energy per pulse = 0.9 µJ, rep rate: 50 kHz – 100 kHz
- Newtonian telescope with f/3 10'' primary mirror

Introduction:
- Aerosols are solid or liquid particles varying in size and chemical composition, suspended in air or other gaseous environments. The study of aerosols is important in order to better understand the effects on health and climate.
- The contribution of aerosols to the Earth’s radiative budget is still subject to large uncertainties and in need of further studies as can be seen from the figure below (IPCC).

Radiative forcing of climate between 1980 and 2011
Forcing agent

Radiative Forcing (W m⁻²)
- Well Mixed Greenhouse Gases
- Stratospheric water vapour from CH₄
- Ozone
- Stratospheric NOx
- Surface Albedo
- Contras
- Air-Cloud Interc:
- Total anthropogenic
- Solar irradiance
- Natural

Preliminary Results:

References:
- Stocker, T. F., D. Qin, G. K. Plattner, M. Tignor, S. K. Allen, J. Boschung, B. M. Midgley, 2013: Climate change 2013: the physical science basis. Contribution of working group I to the fifth assessment report of the Intergovernmental panel on climate change, IPCC.