

VLIDORT Model Quick Overview

- VLIDORT is a vector multiple-scatter multilayer discrete-ordinate radiative transfer model with 1-D plane-parallel scattering for polarized RT.
- Pseudo-spherical approximation (incident solar attenuation in curved geometry); separate single-scatter treatment in full-spherical manner.
- Solar & thermal/surface emission sources, BRDF & surface-leaving (ocean/SIF) supplements, "planetary problem" feature, isotropic sources at TOA/BOA.
- Three multiple geometry modes (lattice, "doublet" or observational "triplet" inputs), output at any level. Integrated quantities (fluxes)
- Fully linearized → simultaneous output of analytic Jacobians w.r.t. to any (bulk/profile) atmospheric quantity (e.g. total ozone or ozone profile weighting functions), and/or surface property (albedo, wind-speed....)
- Publicly available F90 code, currently at Version 2.8.3.
- Contact Point: R. Spurr at rtsolutions@verizon.net.
- Spurr, R. J. D., and M. Christi. *The LIDORT and VLIDORT Linearized Scalar and Vector Discrete Ordinate Radiative Transfer Models: An Update for the last 10 Years. Light Scattering Reviews, Volume 12, ed. A. Kokhanovsky, Springer, January 2019.*

VLIDORT 2.8.3 new features

VLIDORT Version 2.8.3, recently released 01 May 2021.

1. Green's function RTE solutions (see green box);
2. Sphericity corrections to allow multiple scatter sources to vary along line-of-sight paths in a spherical atmosphere (blue box);
3. Updates to the BRDF (snow reflectance model) and SLEAVE (extended water-leaving treatment) supplements;
4. "Doublet geometry" option for linked VZA/AZM input pairs;
5. Several performance enhancements, including solving for Fourier-0 RTE solutions with NSTOKES = 2 (25% speed-up).

In the works....(Version 2.8.3a).

- Sphericity correction for the planetary problem.
- Airglow emission layering model, with linearization.

VLIDORT Version 2.8.3. A summary of the latest release.

Robert Spurr(1) and Matt Christi(2)

(1) RT Solutions Inc. , 9 Channing Street, Cambridge MA 02138; (2) Fort Collins, CO 80524
TEMPO Science Team Meeting, 2-3 June 2021

Green's function solution for NSTOKES= 3, alternative to the "classical" exponential-substitution method for solving RTE.

- Slightly faster and more robust (analytic RTE solutions, no linear algebra, no degeneracy).
- Green's function method is essential for new VLRRS code (vector model with first order rotational Raman scattering).
- Fully linearized, consistent now with the Green's function LIDORT treatment.

Sphericity correction for TOA upwelling or BOA downwelling scenarios

- Standard VLIDORT calculation does not allow LOS zenith angle to change along the LOS path.
- 2-point sphericity correction – computes layer MS source terms for two geometrical setups at TOA and BOA; interpolates MS source terms [against cos(VZA) along the LOS path].
- 3-point and Multi-point sphericity corrections also available; all sphericity corrections are fully linearized with Jacobians.
- Important correction for off-nadir viewing; from LEFT plot with SZA 81, MS differences ~4% @ 70 VZA → 1.5% total (MS+SS)
- Validated successfully against MYSTIC spherical Monte-Carlo code for Rayleigh/absorber atmospheres; multi-point correction agrees at the 0.5% level (at least for low albedos), with VLIDORT having a slight high bias (RIGHT plot); SS results are very close
- Korokin et al., JQSRT, 254, 107181 (2020).

