# University of Saskatchewan Group Experience/Interests

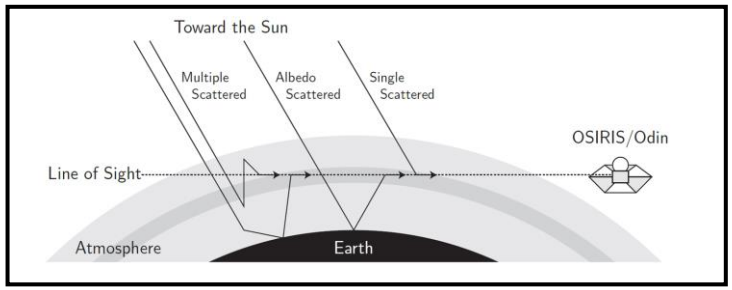
- **OSIRIS operations and science team leadership (2001-present)**
  - Limb scattered sunlight and emission measurements (upper troposphere to mesosphere)
  - Retrievals of O3, NO2, BrO, stratospheric aerosol extinction and particle size profiles plus other research level products
  - Contributions to IPCC, WMO ozone assessment, CMIP6 input data records


- **OMPS Limb Profiler product development**
  - Contract with NASA-Goddard to process 2D ozone and aerosol products
  - Uses Univ. of Sask. RT model and retrieval algorithms

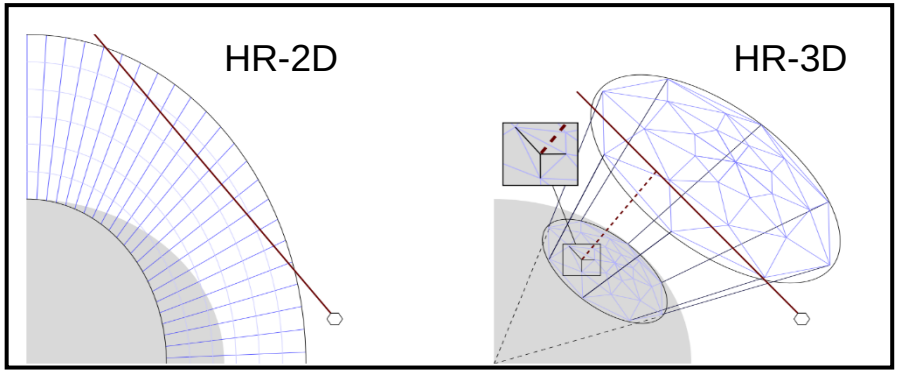
- **New instrument/mission development**
  - Canadian Atmospheric Tomography System (CATS)
    - OSIRIS follow-on with high spatial resolution for 2D retrievals
    - Enhanced spectral resolution and SNR for improved NO2 and BrO
  - Spatial Heterodyne Observations of Water (SHOW)
    - Tomographic profiling of UTLS water vapour with 1.3 micron limb scattered sunlight
    - Concept demonstration on stratospheric balloon, 2014
    - Scheduled aircraft ER-2 science flight, 2017
  - Aerosol Limb Imager (ALI)
    - Hyperspectral acousto-optic limb imager for UTLS aerosol and cloud, 500-1500 nm
    - Concept demonstration on stratospheric balloons, 2014 and 2017
  - Raven mission proposal to ESA Earth Explorer 9 opportunity
    - Canadian-led with Swedish contribution
    - Focus on high resolution UTLS observations
    - Includes CATS, ALI, SHOW and the Swedish STEAMR sub-mm radiometer

# University of Saskatchewan Group Experience/Interests

- Radiative Transfer capabilities: The **SASKTRAN** RT Model
  - Fully spherical, multiple scattering code developed for UV-vis-NIR limb scattering
  - Main stream retrieval code
    - 1D, scalar, successive orders with optimized resolution for speed




  - Research codes
    - Monte Carlo (MC), fully 3D, vector or scalar solution
      - Developed for benchmarking
    - High Resolution (HR), 2D (orbit plane) or 3D, successive orders
      - Developed for tomography, analytic Jacobians, polarized solution optional
    - HR and MC agree within 0.2% across wide range of limb geometries



# University of Saskatchewan Group Experience/Interests

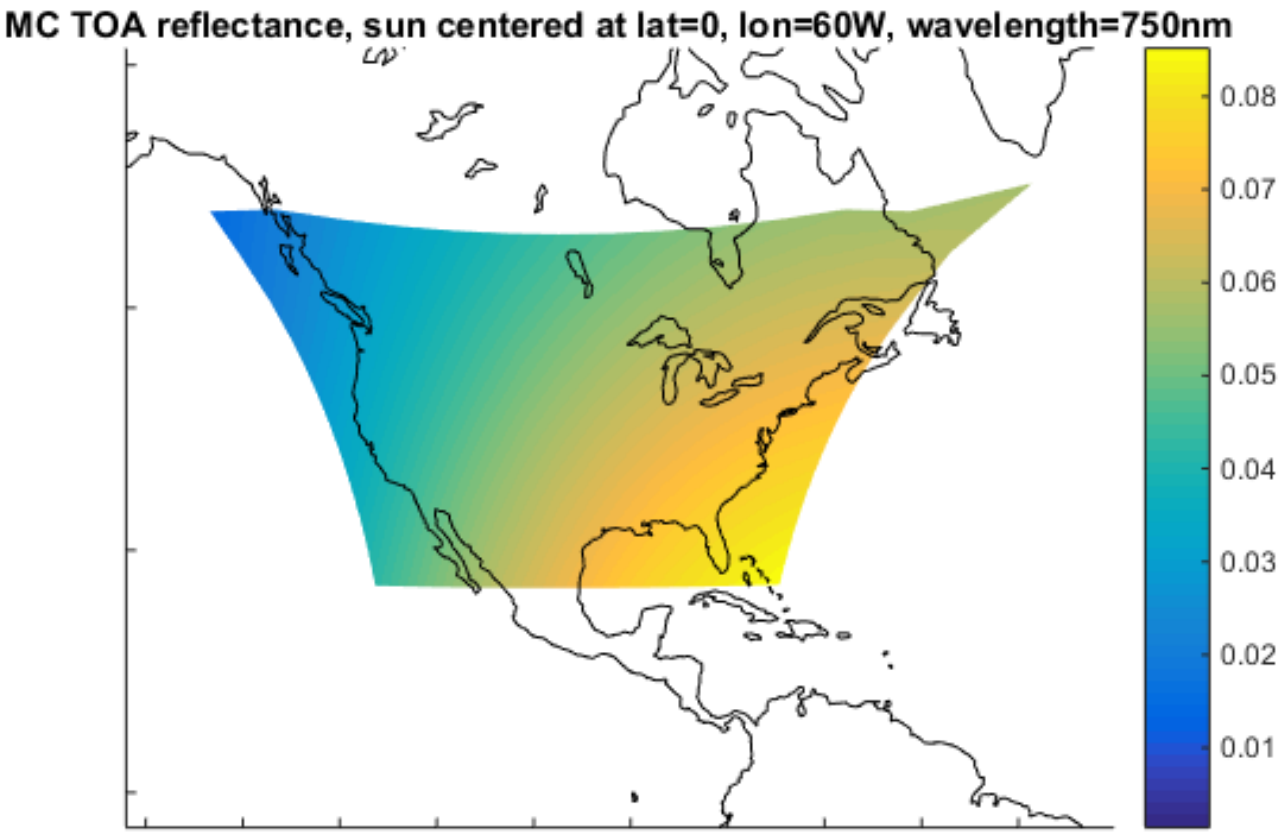
- **New SASKTRAN RT Solver: DISORT implementation**
  - Faithful representation of distributed DISORT V2.0 (agreement to 5 decimal places)
  - Fully integrated into SASKTRAN framework:
    - Atmospheric state
    - Species concentration profiles
    - Optical scattering/absorption properties
  - Not yet implemented:
    - Delta-M, linearization, polarization

→ Allows for robust comparison with spherical SASKTRAN solution in "difficult" nadir geometries, i.e. over northern Canada

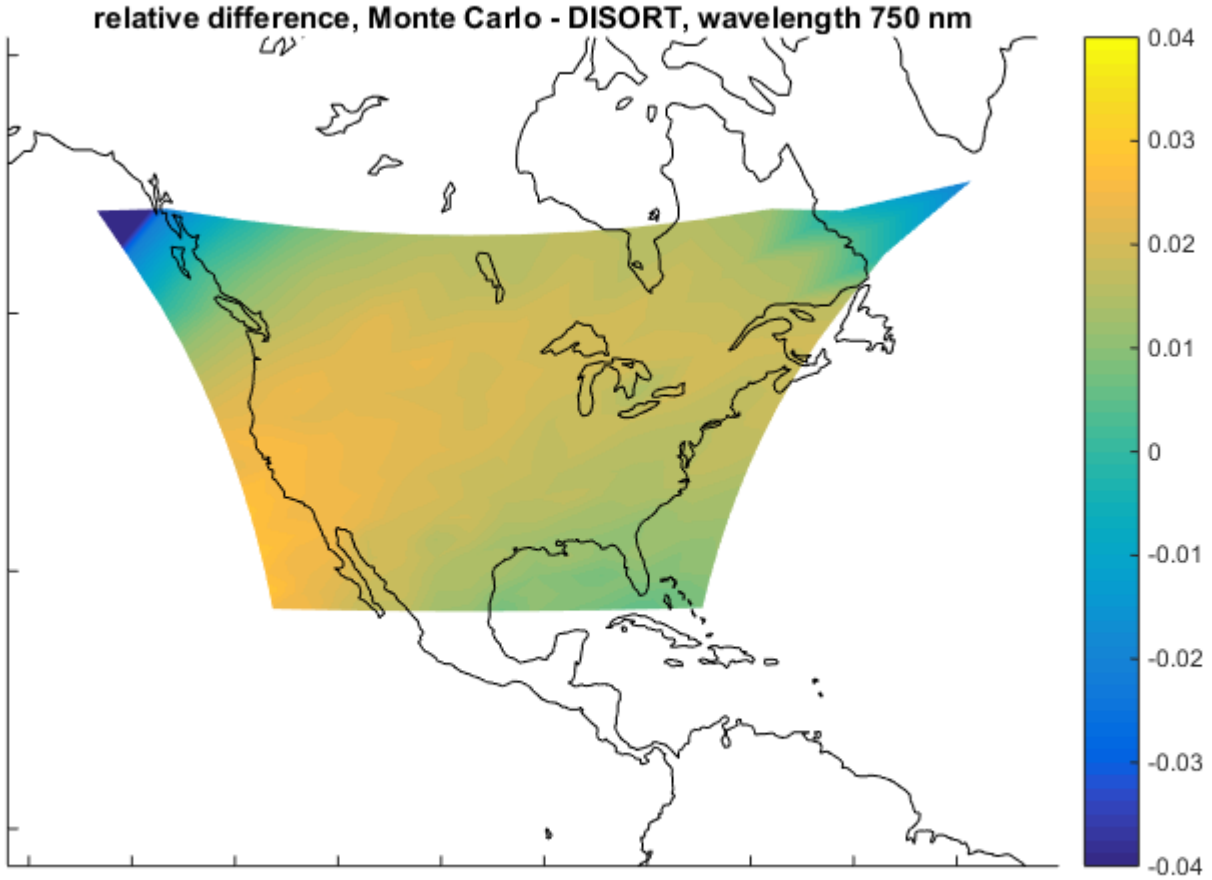
- ***Preliminary*** comparisons of TOA reflectance over TEMPO Field of Regard

- Future work: VLIDORT comparison, implementation of TEMPO measurement simulation, direct inversions, systematic testing of inversion and RT model robustness over Canada

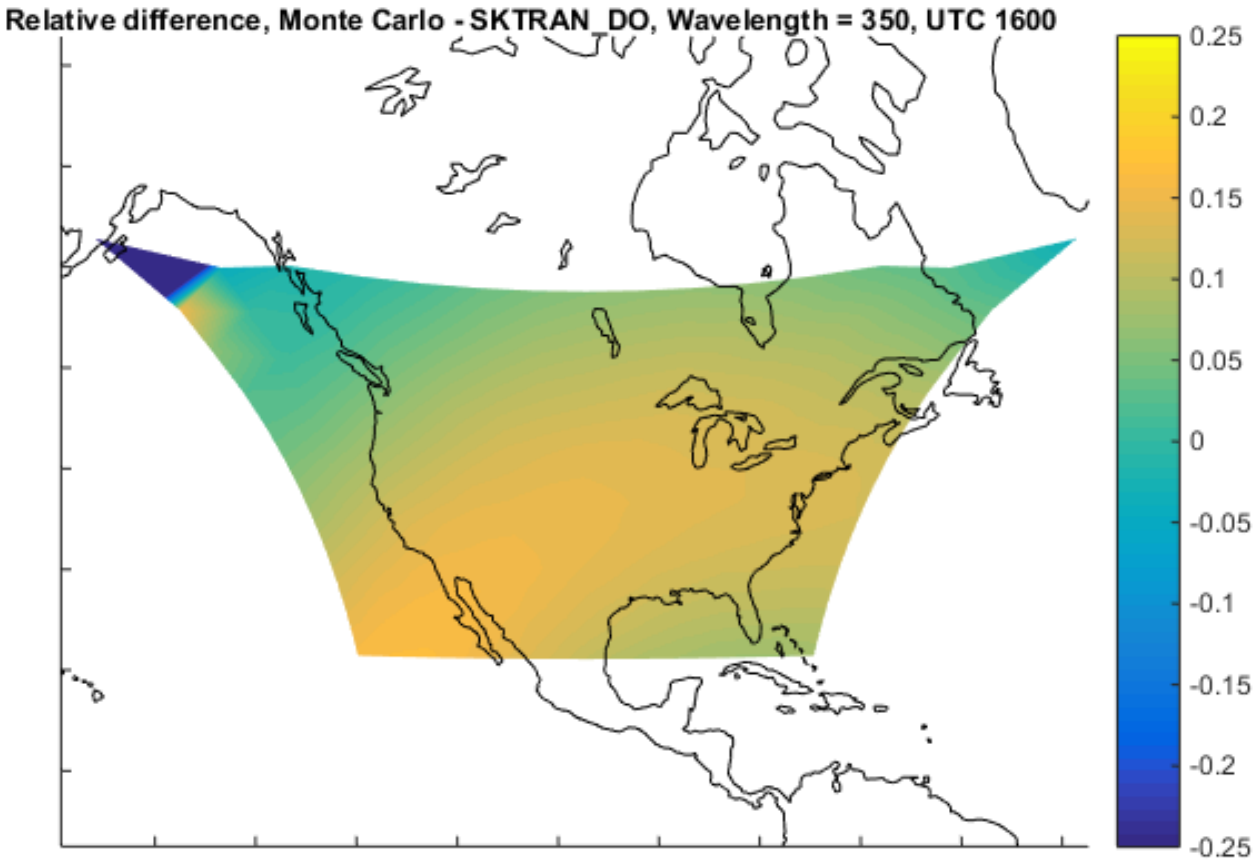
- Example: SASKTRAN Monte Carlo simulation of 750 nm TOA reflectance
- Agrees with SASKTRAN High Resolution to within <1% across the FOR



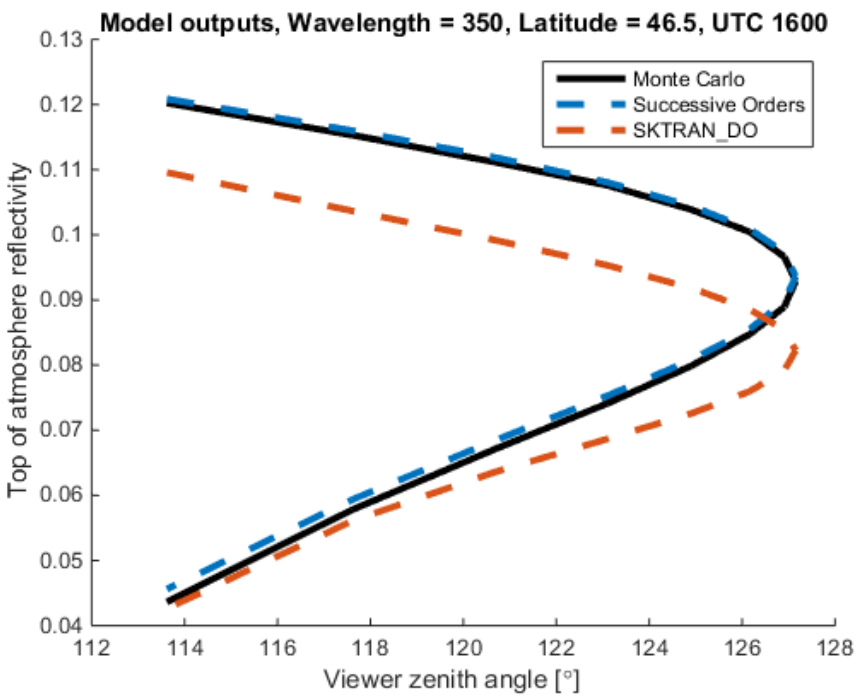
- Example: Relative difference between DISORT solution and SASKTRAN Monte Carlo
- Systematic differences across the FOR depending on albedo, wavelength, VZA, SZA

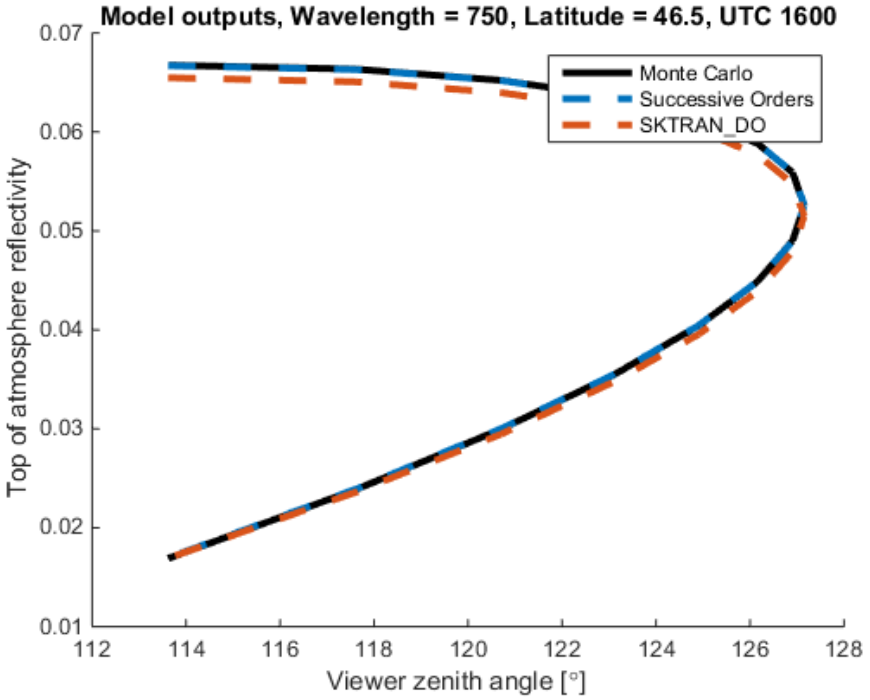


- Example: Same scenario but for 350 nm showing much larger deviations and a negative bias in TOA reflectance across much of the FOR



- TOA reflectance as a function of viewing zenith angle for three different SASKTRAN solution approaches: Monte Carlo, High Res Successive Orders, and DISORT (DO)




- Future work: VLIDORT comparison, implementation of TEMPO measurement simulation, direct inversions, systematic testing of inversion and RT model robustness over Canada