Fast method for computing the scattered radiation in the O_2A-band using the predictor–corrector approach

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Reflected spectra of solar radiation in the O_2A-band (750–780 nm) are used to retrieve cloud and aerosol parameters such as cloud/aerosol optical thickness and top height [1]. Calculations of hyper-spectral data with full-multiple scattering treatment are computationally expensive. Usually, accurate simulations of the measurements in this spectral region require up to several thousands of monochromatic computations. Recently, the dimensionality reduction techniques have been proposed for speeding up radiation transfer computations [2,3]. Essentially, by capturing the most significant information from the spectrum they allow to use the fast two-stream model instead of the multi-stream model without significant loss in accuracy, yet enhancing the performance by several orders of magnitude. The drawback of this approach is that the dimensionality reduction procedure introduces an additional performance bottleneck in the satellite data processing chain [4]. To further accelerate the computations, new approaches are required.

In this talk we summarize recent developments in hyper-spectral computations and present a new approach relying on the predictor-corrector procedure. Essentially, a predictor is computed by using fast approximate radiative transfer models, and then, by means of machine learning, a mapping between the approximate solution and the exact multiple scattering solution is derived. This method is also extended for weighting function computations required by cloud/aerosol retrieval algorithms. The performance of this approach is analyzed for real hyper-spectral instruments and compared against dimensionality reduction techniques.

References

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