Design of an IR Ozone Retrieval Algorithm for NPOESS OMPS

Mary K. Deal, Ronald A. Solomon, and Gregory J. Susskind
Atmospheric and Environmental Research, Inc.

June 2003

Abstract: Provides a national, systematic, point-based retrieval algorithm for the measurement of stratospheric ozone. The AEROMPS (Atmospheric and Environmental Research Ozone Monitoring and Profiling System) algorithm is designed to measure ozone column abundance and vertical profile at high spatial and spectral resolution. This paper describes the algorithm design, including the theoretical foundations and the optimization strategy used to calibrate and validate the algorithm.

Algorithm Design Meets Strict Processing Requirements

- NPOESS requirements: demonstrates that algorithms can meet the requirements imposed by statistical processing
- Requirements: 80% retrieval success 90% of data from non-cloudy conditions (80% SMER, 95% STT)

AER OMPS Responsibility: Use of CRIS for Ozone Sounding

- CRIS-BD:
  - Precision profile through 10 km
  - Measurable ozone below 1 km peak at 1 km
  - Relative precision at 10 km wavenumber at 8 km

OMPS-IR Algorithm Improves Open Heritage Techniques

- Novel algorithms: techniques with clear cut forward model
  - Novel forward model with high accuracy and reasonable assumptions
  - Retrieval performed using advanced calibration algorithm (e.g., background correction, self-calibration, iterative inversion)

OMPS Algorithm Addresses Ozone OCTs (O3, O2, NO2, and sulfuric acid) measurements at 1 km resolution

- Various sensors: performances at all bands relevant to the OMPS instrument
  - Retrieval performed using a linear correction

Other NPOESS Sensors

- Advanced Technology Microwave Sounder (ATMS)
  - Advanced High-resolution Infrared Sounder (AHI)
  - Visible Infrared Imaging Radiometer Suite (VIIRS)
  - Clouds and the Earth's Radiant Energy System (CERES)
  - Dry Radiances (DRAMS)

OMPS System Architecture Derived from Data Requirements

- Global Environmental Data Record (GEDR)- Total column: Total ozone, ATMS (8.7 km)
  - Profiles: O3, NO2, SO2, H2O vapor
  - Total column: 24 hour revisit

OMPS Data Requirements

- Global Data Record (GDR)
  - Total column: Total ozone, ATMS (8.7 km)
  - Profiles: O3, NO2, SO2, H2O vapor
  - Total column: 24 hour revisit

Cr60 Ozone Emission Data

- Global Data Record (GDR)
  - Total ozone: 24 hour revisit
  - Ozone: 24 hour revisit
  - Total column: 24 hour revisit

Conclusions

- AEROMPS-IR will provide high-quality, high-spectral resolution ozone columns under Point AER conditions
- Other retrieval algorithms are suitable for non-pointed conditions
- Initial results using conventional retrieval algorithms are promising
- Future work will focus on improving algorithms for point conditions
- Implementation of a global retrieval capability requires further development
- Future work will focus on improving algorithms for point conditions
- Implementation of a global retrieval capability requires further development

Jean-Luc Moncet (AER)

The following people have made significant contributions to the AER-OMPS effort:

Tom Swissler (Hughes STX; Consultant)

Acknowledgments

This work was supported by the National Aeronautics and Space Administration (NASA) under contract NAS8-03060, awarded to Atmospheric and Environmental Research, Inc. (AER), for the Advanced Technology Microwave Sounder (ATMS), which is part of the NPOESS Pre-Flight Validation Program. The authors would like to acknowledge the contributions of the AEROMPS team, including Jean-Luc Moncet, Tom Swissler, and other members of the AER team who have worked on the AEROMPS project.