5.083 Harnessing long-term meteorological satellite records for atmospheric composition and chemistry research.

Presenting Author:
  Vivienne Payne, Jet Propulsion Laboratory, California Institute of Technology,
  vivienne.h.payne@jpl.nasa.gov

Co-Authors:
  Dejian Fu, Jet Propulsion Laboratory, California Institute of Technology
  Susan Kulawik, BAERI/NASA Ames
  John Worden, Jet Propulsion Laboratory, California Institute of Technology
  Helen Worden, National Center for Atmospheric Research
  Kevin Bowman, Jet Propulsion Laboratory, California Institute of Technology
  Christopher Barnet, Science and Technology Corporation
  Emily Fischer, Colorado State University
  Kelley Wells, University of Minnesota
  Dylan Millet, University of Minnesota
  Karen Cady-Pereira, Atmospheric and Environmental Research
  Joao Teixeira, Jet Propulsion Laboratory, California Institute of Technology
  Daven Henze, University of Colorado Boulder
  Juying Warner, University of Maryland

Abstract:

Space-borne thermal infrared sounding spectrometers such as the NASA Atmospheric Infrared Sounder (AIRS), the NASA/NOAA Cross-track Infrared Sounders (CrIS) and the European Infrared Atmospheric Sounding Interferometers (IASI) have been shown to provide a wealth of information not only on atmospheric temperature and humidity but also on a range of trace gases. Trace gas products available or under development for these meteorological sounders include ozone, carbon monoxide, methane, carbon dioxide, deuterated water vapor, ammonia, methanol, formic acid, peroxyacetyl nitrate and isoprene. The value of thermal infrared radiances for Numerical Weather Prediction has ensured a long-term commitment to resources for these measurements. The AIRS record starts in 2002 and there are commitments in place to continue thermal infrared sounding measurements to 2035 and beyond. Together with previous and ongoing measurements from the Earth Observing System era, the meteorological sounders will provide a multi-decadal record of global atmospheric composition.

It is increasingly necessary to draw on multiple datasets to address key questions at the forefront of atmospheric research. Our atmosphere and its interactions with the anthroposphere, biosphere and lithosphere are sufficiently complex that no one instrument or measurement technique can provide all the answers. In addition to providing an overview of sounder trace gas products, we show examples of ways in which retrievals of trace gases from thermal infrared meteorological sounders are currently being used in combination with other measurements to advance knowledge of the Earth system. We will discuss the use of multi-spectral or multi-satellite retrieval approaches,

including tropospheric ozone retrievals combining information from AIRS and the Ozone Monitoring Instrument (OMI) and retrievals of carbon monoxide information from CrIS and the TROPOspheric Monitoring Instrument (TROPOMI). We will also discuss efforts involving assimilation of sounder trace gas products into chemical transport models.