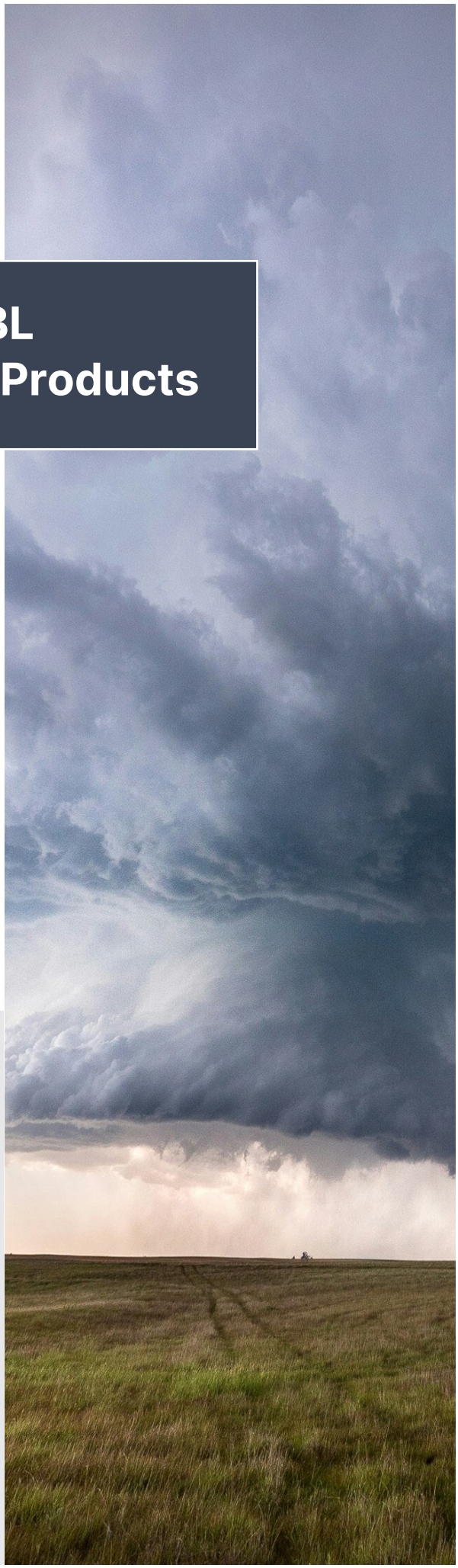
National Aeronautics and Space Administration

Training Resources: Merged PBL Temperature and Water Vapor Products



Summary

Merged Planetary Boundary Layer (PBL) Temperature and Water Vapor Products, a Satellite Needs Working Group (SNWG) solution, provides three-dimensional profiles of temperature and water vapor in the 2-3 km of the atmosphere closest to the Earth's surface by combining hyperspectral infrared and microwave sounder data with Global Navigation Satellite System (GNSS) - Radio Occultation (RO) data into a merged global product.

A number of training resources relevant to this solution are aggregated into four categories (specified below). For more information about this solution, visit the Merged PBL Temperature and Water Vapor Products webpage.

Table of Contents

Fundamentals of Remote Sensing

This category's resources provide an introduction to remote sensing techniques used to develop this solution.

Fundamentals of Remote Sensing	Training modules on the fundamentals of remote sensing provided by NASA's Applied Remote Sensing Training (ARSET) program. This training will support users in understanding the science and technology behind the hyperspectral infrared and microwave observations of the atmosphere used to generate the PBL Products.
Passive Instruments for Remote Sensing	Article providing an overview of passive remote sensing instruments, which detect energy emitted or reflected from the natural environment. These instruments include sounders, the instrument type that collects the infrared and microwave sounding data used to create the PBL Products.
What is Radio Occultation?	Animated video detailing how radio occultation, a remote sensing technique, is used to enhance weather forecasting. GNSS-RO provides measurements of atmospheric temperature and moisture that are combined with hyperspectral sounding measurements to create the global, merged PBL dataset.

Missions and Instruments

This category's resources describe the missions and instruments used to develop this solution.

PBL Products Data Input Source: AIRS	Atmospheric Infrared Sounder (AIRS) instrument page providing an overview of AIRS characteristics, data and product access, and related news. AIRS data provides 3D measurements of temperature and water vapor through the atmospheric column.
PBL Products Data Input Source: AMSU-A	Advanced Microwave Sounding Unit (AMSU-A) instrument page providing an overview of AMSU-A characteristics and instrument specs. AMSU-A provides temperature profiles in the upper atmosphere and a cloud-filtering capability for tropospheric temperature observations.
PBL Products Data Input Source: ATMS	Advanced Technology Microwave Sounder (ATMS) instrument page providing an overview of the ATMS instrument, the platforms that carry the instrument, and links to related data centers for data access. ATMS works with CrIS to provide cross-sections of storms and other weather conditions.
PBL Products Data Input Source: CrIS	Cross-track Infrared Sounder (CrIS) instrument page providing an overview of CrIS characteristics, platforms that carry the instrument, and links to related data centers for data access. CrIS provides global high-resolution profiles of temperature and moisture with an accuracy comparable to that of AIRS.
PBL Products Data Input Source: COSMIC-1	COSMIC-1 mission page providing an overview of the mission, its application areas, and links to data and further information. COSMIC-1 has been retired since 2020.

PBL Products Data Input Source: COSMIC-2	COSMIC-2 mission page providing an overview of the objectives and methods of COSMIC-2 and links to data, introductory videos, and further information. COSMIC-2 utilizes radio occultation to collect near real-time information on atmospheric temperature, pressure, density and water vapor.
PBL Products Data Input Source: GRACE-FO	GRACE-FO mission website with links to news and data access. GRACE-FO primarily tracks Earth's water movement and surface mass changes, but it also uses its GPS antennas to provide atmospheric temperature and water vapor profiles.
PBL Products Data Input Source: Sentinel-6	Sentinel-6 mission page that includes links to its NASA and ESA webpages and instrumentation information. Sentinel-6 is designed to measure the height of the ocean, as well as temperature and humidity in the troposphere.
PBL Products Data Input Source: Spire	Spire website with access to information about the company and its satellite services. Spire GNSS-RO data will be used to provide atmospheric profiles for the PBL Products.

Data Products and Descriptions

This category's resources describe the solution's resulting data products and provide other descriptive materials.

Merged PBL Temperature and Water Vapor Products: SNWG Solution Fact Sheet	SNWG solution fact sheet for the PBL Products that includes an overview of the solution, its scientific and societal benefit, and data specifications such as temporal coverage and spatial resolution.
Planetary Boundary Layer (PBL) Decadal Survey Incubation Program Page	Webpage providing an overview of the Planetary Boundary Layer (PBL) 2017 Decadal Survey Incubation Program that resulted from a high-priority need by the scientific community for improved observations of the PBL. Since this is a longer-term effort to increase readiness for a future PBL mission, the SNWG PBL Products aim to enhance existing PBL observations for agencies in need of improved measurements of PBL variables in the near-term.
Planetary Boundary Layer Incubation Website - Langley Research Center (LaRC)	Website for the NASA PBL Incubation program that currently includes information on program goals, accomplishments, and news.
The NASA PBL Incubation Study Team Report: Toward A Global Planetary Boundary Layer Observing System	Official report from the NASA PBL Incubation Study Team, established by the PBL Incubation Program, that includes content such as the motivation behind the study, the science of the PBL, applications of PBL observations, and the components needed for a future global PBL observing system.

Use Case and Application Examples

This category's resources provide examples of the solution in-use as well as other potential scientific applications of the data.

Applications of Geostationary Hyperspectral Infrared Sounder Observations: Progress, Challenges, and Future Perspectives	Publication providing an overview of geostationary hyperspectral infrared sounder (GeoHIS) applications, including how atmospheric temperature and moisture profiles in the boundary layer can assist with monitoring atmospheric instability associated with the development of severe weather.
Estimation of daytime planetary boundary layer height (PBLH) over the tropics and subtropics using COSMIC-2/ FORMOSAT-7 GNSS-RO measurements	Publication on the use of COSMIC-2 GNSS-RO measurements to estimate PBL height.
PBL Height From AIRS, GPS RO, and MERRA-2 Products in NASA GES DISC and Their 10-Year Seasonal Mean Intercomparison	Publication providing a review of PBL height measurements gathered from AIRS, GPS RO, and Modern-Era Retrospective analysis for Research and Applications-2 (MERRA-2) products available from the NASA Goddard Earth Sciences Data and Information Services Center (GES DISC).

Contact Information

Need additional help using this solution? Let us know what gaps or questions still exist, what tools interest you, and/or how you want to apply this solution. We are happy to connect you with more information and ongoing efforts to fill those gaps. Contact us at info@snwg-impact.net.