Using Cloud Resources to Examine the Sampling Differences Among Boundary Layer Height Data Archived at the GES DISC

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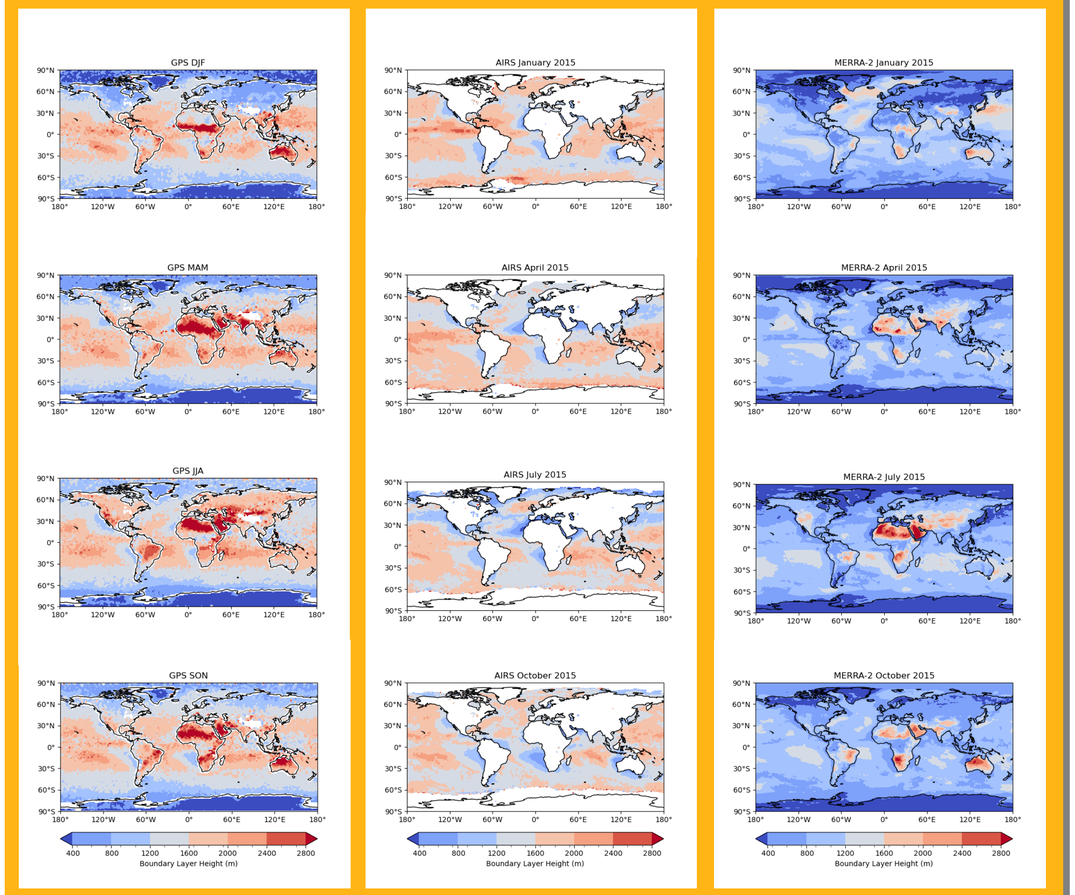
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Current and Future GES DISC Boundary Layer Height Datasets

The figures below show the boundary layer height (in meters) for three different boundary layer height datasets using different techniques that are archived at the GES DISC.

Boundary layer height in **meters**

GPS RO | AIRS | MERRA-2



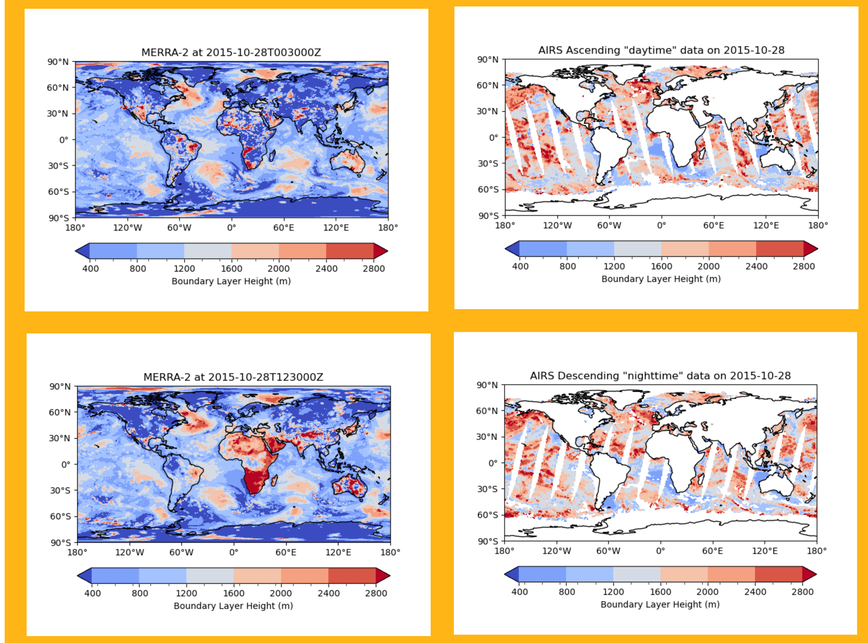
Ding et al. (2021 https://doi.org/10.1029/2021EA001859) have investigated climatologies of the above three datasets and found that, even though they all use different techniques, they produce similar boundary layer height climatologies.

Although the boundary layer height in the MERRA-2 product is lower, when the same boundary layer height definition used by AIRS is applied to the MERRA-2 data it produces a higher boundary layer height which is closer to that of the Global Positioning System Radio Occultation (GPS RO) and AIRS measurements.

As the number of GPS RO measurements increases, the GES DISC will begin to archive boundary layer measurements derived from that type of observation. GPS RO observations are more sparse and have a lower horizontal spatial resolution than Infrared Sounding measurements; however, they have higher vertical resolution and are less affected by atmospheric phenomena such as clouds and precipitation.

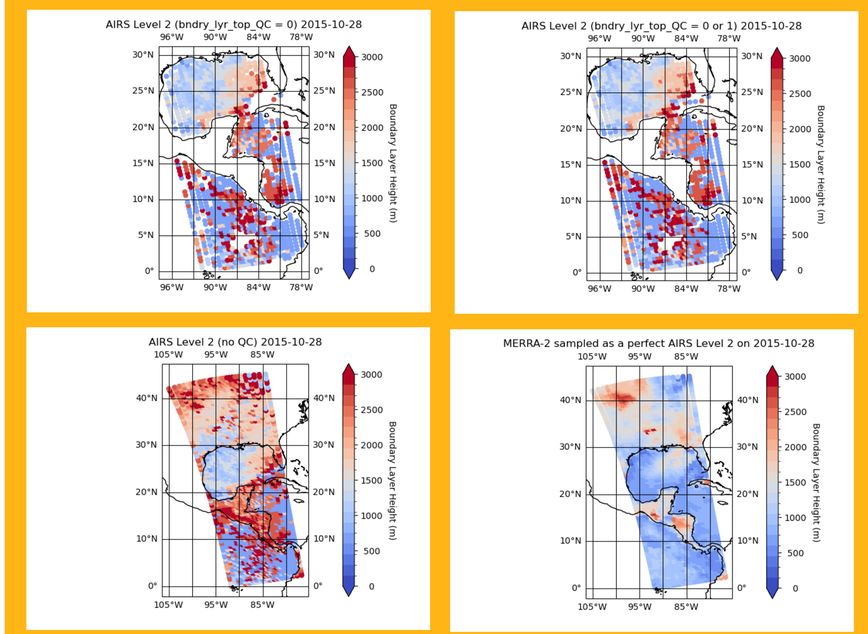
Variability of the boundary layer height

The climatology or monthly data do not capture all of the variability present because of diurnal and synoptic variability. This is seen in the figures below that show different time slices of the the AIRS and MERRA-2 boundary layer height in **meters**. Since the MERRA-2 dataset is stored in the cloud it is possible to perform matchups in time and space with other datasets without having to download large amounts of data (see the panels on the right).



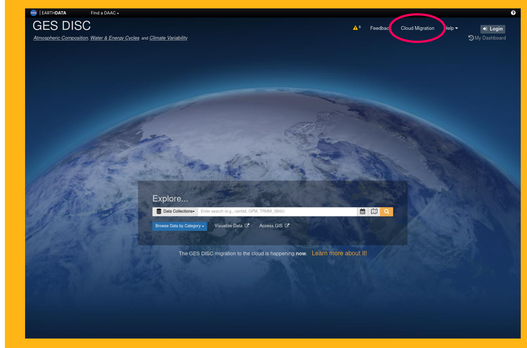
Matching up datasets

The panels below show AIRS Level 2 boundary layer height data with different quality flag selections and MERRA-2 data that has been matched in space and time with the AIRS Level 2 observations. Even after applying the most strict quality control, there still seems to be some anomalously high boundary layer heights in the AIRS Level 2 data. In addition, some of the AIRS boundary layer height data over land may be useful.



Cloud Resources at the GES DISC

Previously the type of analysis described in the previous panels required downloading large amounts of data. However, the GES DISC has developed a number of resources to help users perform this type of analysis in the cloud. More information and turorials for performing analysis with GES DISC datasets in the cloud are available by following the link to “Cloud Migration” on the GES DISC main page (https://disc.gsfc.nasa.gov/).



Additional examples of performing analyses with these and other datasets are available in the GES DISC Tutorials github repository: https://github.com/nasa/gesdisc-tutorials

Dataset Citations

AIRS project (2019), Aqua/AIRS L3 Monthly Support Product (AIRS-only) 1 degree x 1 degree V7.0, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: December 2023, https://doi.org/10.5067/IFFMYHMDBEHW

AIRS project (2019), Aqua/AIRS L2 Support Retrieval (AIRS-only) V7.0, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: December 2023, https://doi.org/10.5067/APJ6EEN0PD0Z

Chi Ao, Peter Kalmus, Matthew Lebsock, Joao Teixeira (2022), GPS Radio Occultation Boundary Layer Depth Seasonal L3 Version 2, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: December 2023, https://doi.org/10.5067/DKDMKV7IOB1P

Global Modeling and Assimilation Office (GMAO) (2015), MERRA-2 tavg1_2d_flx_Nx: 2d,1-Hourly,Time-Averaged,Single-Level,Assimilation,Surface Flux Diagnostics V5.12.4, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: December 2023, https://doi.org/10.5067/7MCPBJ41Y0K6

Global Modeling and Assimilation Office (GMAO) (2015), MERRA-2 tavgM_2d_flx_Nx: 2d,Monthly mean,Time-Averaged,Single-Level,Assimilation,Surface Flux Diagnostics V5.12.4, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: December 2023, https://doi.org/10.5067/0JRLVL8YV2Y4