GEO-GEO Stereo 3D Winds with a Path into NOAA Operations

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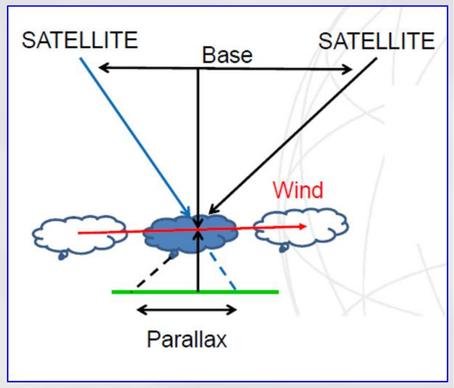
JPSS/GOES-R PGRR Summit

Please Visit Related Poster: Carr, et. al.

Motivation

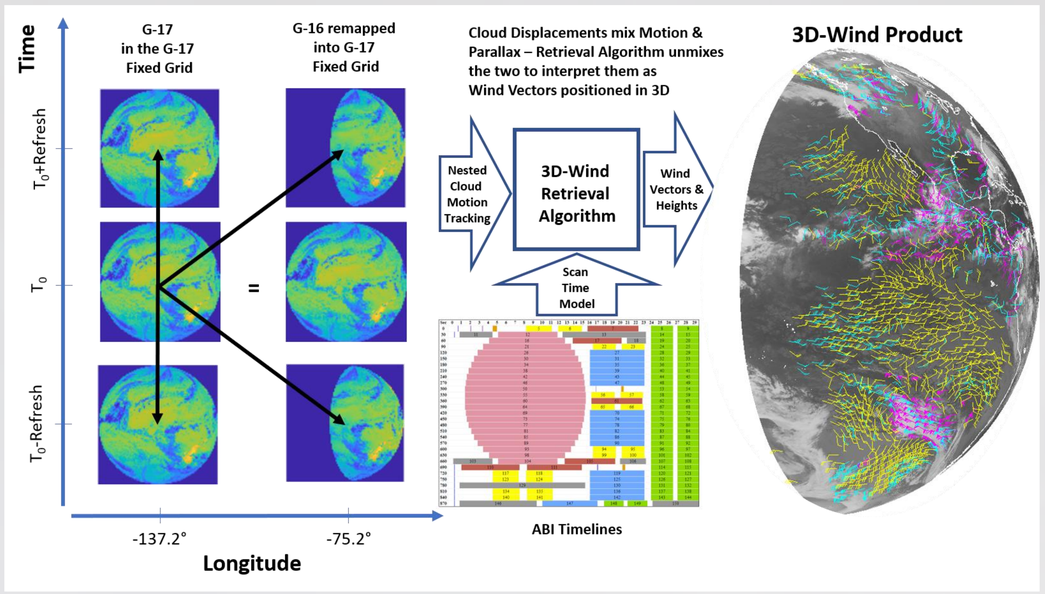
Stereo methods rely on using imagery where target scenes are viewed from different angles to determine cloud heights using the parallax displacement of observed features such as clouds.



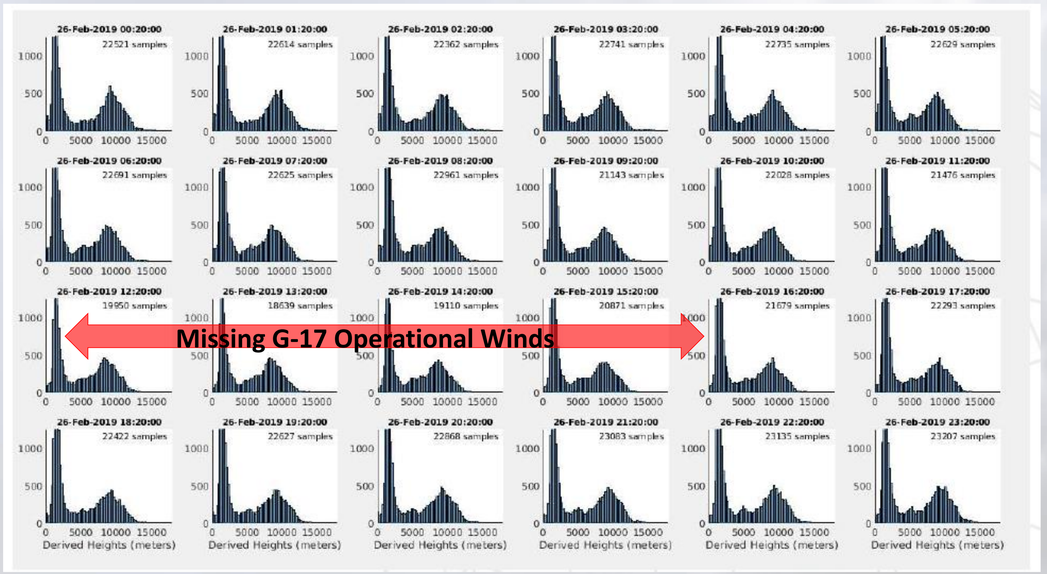
The stereo capability relies on geometry and does not require thermal IR for height assignment making it a valuable tool for mitigating the Loop Heat Pipe (LHP) anomaly of GOES-17: ABI IR channels that are needed for height assignments are not adequately cooled during parts of the night, resulting into partial loss of ABI imagery.

Stereo techniques can be applied to several combinations of GEO-GEO and GEO-LEO satellites.

GEO-GEO 3D-Wind Retrievals



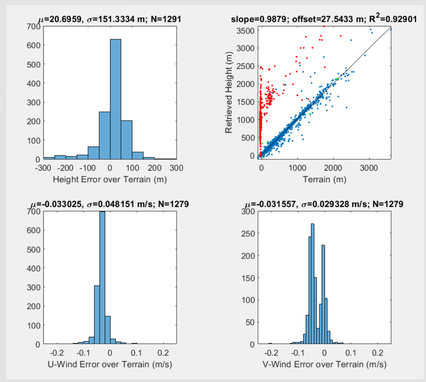
GOES 17 Winds 24/7



This figure shows the heights of winds retrieved for all 24 hours of GOES-17 imagery acquired on February 26, 2019 with Band 14. Heights were retrieved even for the times when the LHP effect is at its worst. The red arrow indicates the times when Operational winds were not generated because heights could not be assigned; however, tracers can still be tracked.

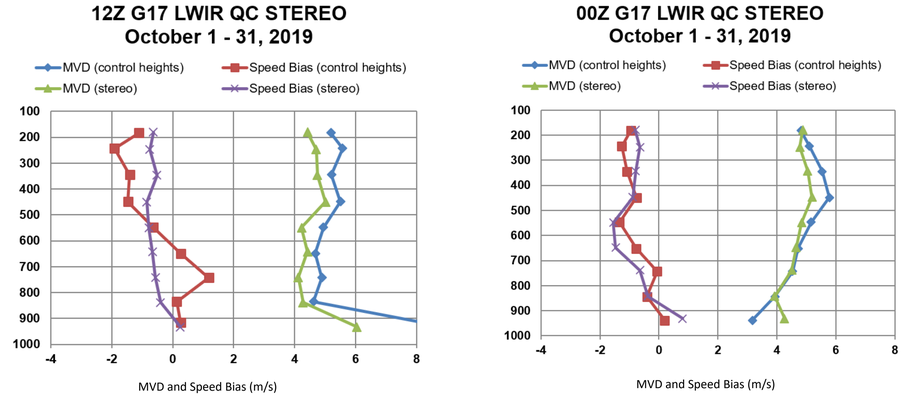
Validation with Ground Heights

We used Visible Band 2 to validate the heights retrieved by the Stereo 3D Winds method over clear-sky ground. Using the visible band allows us to obtain more ground points than we would have obtained with IR bands. Using only ground points from clear sky scenes provides an indication of how accurate the Stereo 3D winds are by comparing to known terrain heights and zero wind speed.



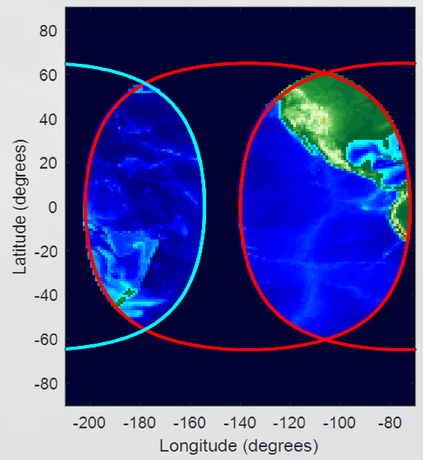
Validation with Radiosonde Data

Good agreement between Stereo 3D product and radiosonde winds is observed as shown by the Mean Vector Difference (MVD) and Speed Bias. An improvement over the baseline wind product is also observed.



Future Applications with HIMAWARI

The HIMAWARI AHI and GOES ABI Imaging bands are almost identical in wavelength and spatial resolution. This enables GEO-GEO stereo winds to be extended to areas where there is overlapping AHI-ABI coverage as shown in the picture.
This method can be extended to other GEO-GEO satellite combinations as well as GEO-LEO combinations, shown in a related poster by Carr, et. al.



Publications

James L. Carr , Dong L. Wu, Robert E. Wolfe , Houria Madani , Guoqing (Gary) Lin and Bin Tan, Joint 3D-Wind Retrievals with Stereoscopic Views from MODIS and GOES. Remote Sens. 2019, 11, 2100.
Carr, J.L.; Wu, D.L.; Kelly, M.A.; Gong, J. MISR-GOES 3D Winds: Implications for future LEO-GEO and LEO-LEO winds. Remote Sens. 2018, 10, 1885.
Madani, H.; Carr, J. L. Stereo Cloud Top Height Products for the GOES-R Era. NOAA Satellite Conference 2015.
Madani, H.; Carr, J. L.; Heidinger, A.; Wanzong, S. Inter-Comparisons between Radiometric and Geometric Cloud Top Height Products. American Geophysical Union 2015