VIIRS POLAR WINDS
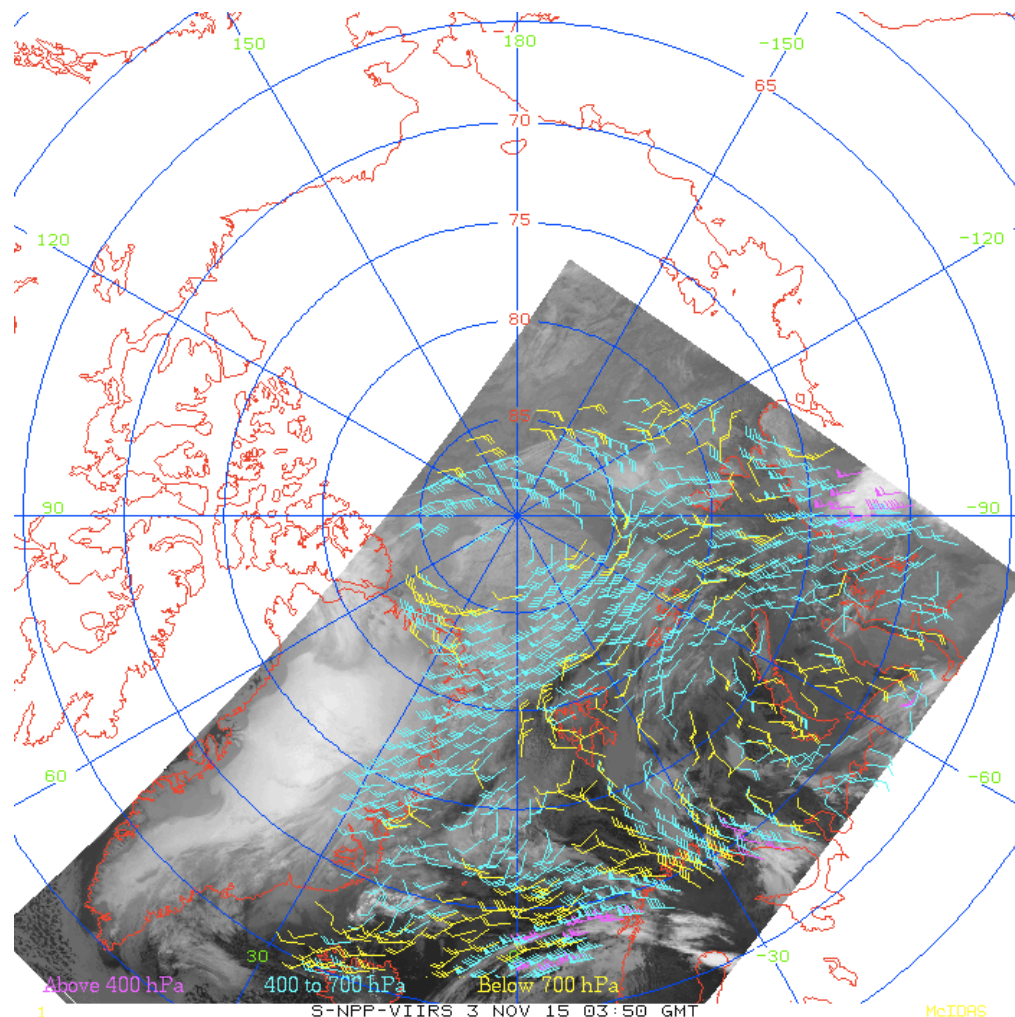
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VIIRS Polar Winds (VPW) in Brief

VIIRS Polar Winds are derived by tracking clouds features in the VIIRS longwave infrared channel

- Wind speed, direction, and height are determined throughout the troposphere, poleward of approximately 65 degrees latitude, in cloudy areas only

- Wind information is generated in both the Arctic and Antarctic regions

- The algorithm utilizes the Enterprise cloud height, phase, and (soon) mask

VIIRS Polar Winds Team

Name	Organization	Major Task
Jeff Key	STAR	Project management, DB winds
Jaime Daniels	STAR	Project management, algorithm development and testing
Wayne Bresky	IMSG	Algorithm development and testing
Andrew Bailey	IMSG	Algorithm development and testing
Dave Santek	CIMSS	Algorithm and product testing
Steve Wanzong	CIMSS	Algorithm and product testing
Hongming Qi	OSPO	Operations
Walter Wolf and others	STAR, AIT	Implementation

Requirements

JPSS L1RD supplement (threshold) requirements versus observed

Attribute	Threshold	Observed/validated
Geographic coverage	~70° latitude to poles	~65° to poles
Vertical Coverage	Surface to tropopause	same
Vertical Cell Size	At cloud tops	same
Horizontal Cell Size	10 km (should be ~19 km, CCR Aug 2015)	same
Mapping Uncertainty	0.4 km (nadir); 1.5km (edge of scan)	0.57 km
Measurement Range	Speed: 3 to 100 m s^{-1}; Direction: 0 to 360 degrees	same
Measurement Accuracy	Mean vector difference: 7.5 m/s	5.7-7.0 m/s (w/raobs)
Measurement Precision	Mean vector difference: 4.2 m/s (was 3.8 m/s)	2.7-3.8 m/s (w/raobs)
Measurement Uncertainty	Not specified	Not applicable

AMV Performance Metrics

AMVs (QI>60) are matched and compared against RAOBS or GFS model analysis winds. Metrics:

$$Accuracy = \frac{1}{N} \sum_{i=1}^{N} (VD_i)$$

$$\text{Pr}\, ecision = \sqrt{\frac{1}{N} \sum_{i=1}^{N} ((VD_i) - (MVD))^2}$$

where:

$$(VD)_i = \sqrt{(U_i - U_r)^2 + (V_i - V_r)^2}$$

U_i and V_i ---> AMV
U_r and V_r ---> "Truth"

Derived Motion Winds Test Plan – Offline Validation: Truth Data

- Radiosonde wind observations serve as a key validation data source for derived motion wind products
  - Used by all operational satellite processing centers that generate satellite derived motion winds

- Aircraft wind observations

- GFS Model Analysis Wind Fields

300 mb Height and Winds (kt) 2230 UTC 06/04/05

Status
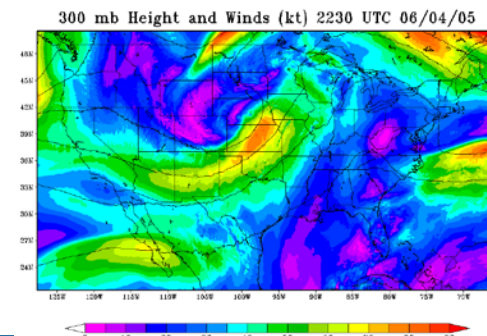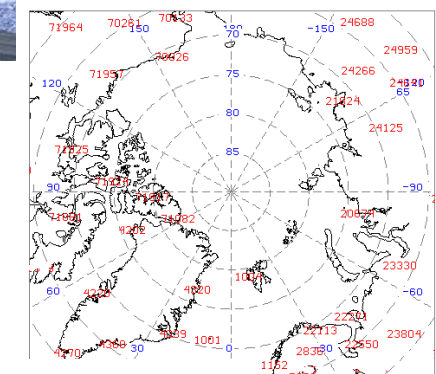
Error Budget:

Attribute Analyzed	L1RD Threshold	Analysis/Validation Result	Meets spec?
Accuracy	7.5 m/s	5.7-7.0 m/s	Y
Precision	4.2 m/s	2.7-3.8 m/s	Y
Horizontal cell size	10 km	19 km (inherent to the algorithm)	N; Change the requirement as it is an error
Mapping uncertainty	0.4 km nadir; 1.5 km EOS	0.57 km	Y

- **The VIIRS Polar Winds product has been operational since May 2014.**

- **Validated Maturity, October 2016**

- VPW is also generated at direct broadcast sites and delivered to NWP centers.

Users

- **13 NWP centers in 9 countries use polar winds** (MODIS, AVHRR, VIIRS); some using VIIRS winds operationally.
- U.S. Users:
  - NCEP (Dennis Keyser)
  - NRL/FNMOC (Randy Pauley)
  - GMAO/JCSDA
- Foreign Users:
  - UK Met Office (Mary Forsythe)
  - JMA (Masahiro Kazumori)
  - ECMWF (Jean-Noel Thepaut)
  - DWD (Alexandar Cress)
  - Meteo-France (Bruno Lacroix)
  - CMC (Real Sarrazin)
  - BOM (John LeMarshall)
  - EUMETSAT (Simon Elliott)
  - Russian Hydrometcenter (Mikhail Tsyrulnikov)
  - CMA (China)

User Feedback

- Over the last decade, model impact studies at >10 major NWP centers have demonstrated that model *forecasts for the NH and SH extratropics are improved when the MODIS polar winds are assimilated. Forecasts can be extended 2-6 hrs, depending on the location.*

- *NWP users have reported similar results for the VIIRS Polar Winds*, as reported at the most recent International Winds Workshop (2016, Monterey) and at other venues.
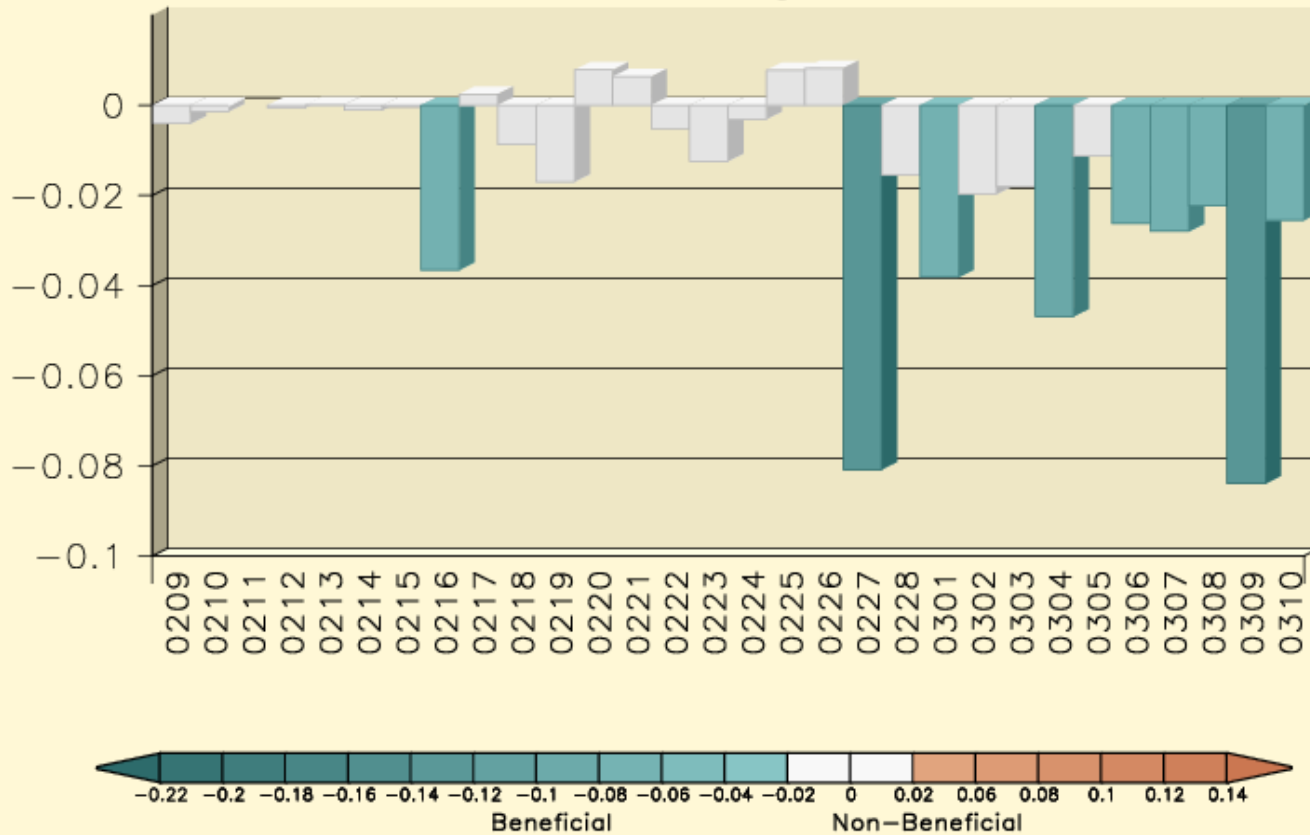
Organization	Use VPW operationally	Currently monitoring	Plan to use?
NCEP		Yes	Yes (2017)
DWD	Yes		
Navy	Yes		
ECMWF	Yes		
Met Office		Yes	Yes
CMC	Yes		
MeteoFrance		Yes	Yes

Awaiting information from the other NWP centers.

Courtesy of Naval Research Lab

Thank you!