The Aerospace Cloud Mask Utility: A New Tool for Pixel-level Cloud Mask Annotations for JPSS VIIRS Satellite Data Spencer L. Farrar, Eric B. Wendoloski, Thómas J. Kopp, Ingrid C. Guch, Kerstyn Auman, Scott M. Adams, Ziping Sun The Aerospace Corporation

Abstract

The <u>Aerospace Cloud Mask</u> (ArCM) utility aids the creation of manually-curated ground-truth cloud masks based on Visible Infrared Imaging Radiometer Suite (VIIRS) moderate-resolution band (M-band) Sensor Data Record (SDR) input. Ground-truth masks produced via ArCM are being used to validate output of the VIIRS Enterprise Cloud Mask (ECM) for particularly challenging scenes. ArCM users are able to define and load M-band RGB composite images and efficiently annotate pixels as cloud or no cloud. Pixels may be annotated via user-defined data filters, via custom-polygon definitions, or at the pixel-bypixel level. To aid in filter design, users may output band values to the screen through point and click functionality. Users may display geolocated or flat single-band images with custom colormaps to better reveal cloud features. Additionally, parameters of the corresponding ECM may be displayed at the image scale and/or on a pixel-by-pixel basis. Final ground-truth is output in an ASCII format that can be easily leveraged for ECM validation purposes. Utility may be extended to other satellite data sources through a back-end modification, and the potential exists to also leverage output as ground-truth for training machine-learning algorithms. Thus far, the ArCM tool has been used to build ground-truth masks, which represent several million annotated cloudy pixels, for several VIIRS granules.

Introduction

- ArCM facilitates the manual creation of ground-truth cloud masks for VIIRS satellite imagery
 - Offers means to effectively annotate O(100K)+ cloudy pixels/granule
- Created to aid VIIRS ECM validation
- Software Requirements:
 - Free MATLAB Compiler Runtime (R2015b)
 - No MATLAB license required
- Inputs: VIIRS SDR M-band imagery
- Cloud masking functionality:
 - User-defined layered data filters
 - User-defined polygons
 - Pixel-by-pixel annotations
 - Zoomable annotation regions
- Analysis functionality:
 - Single-band/ECM views with ground-truth overlay
 - Pixel-level band summaries with decoded ECM
- Output:
 - ASCII cloud-mask representation
 - Binary representation editable by ArCM

ArCM Annotated Granules (Ongoing)

#	Date	Location	ID	Goal
1	28MAR18	So. U.S. / MX	j01_d20180328_t1913562_e1915207_b01851	Test case on initial data pull. Variety of cloud types.
2	28SEP19	Sahel, Africa	j01_d20190928_t1228365_e1229592_b09636	Small, low-clouds, many "probable" results
3	230CT19	Afghanistan	j01_d20191023_t0803132_e0804377_b09988	Cloud over snow
4	08NOV19	Afghanistan	j01_d20191108_t0802025_e0803253_b10215	Cloud over snow
5	14JAN20	AK/B.C./Yukon	j01_d20200114_t2044083_e2045328_b11173	Extreme valley cold



CreateCM_AreaOfInterest

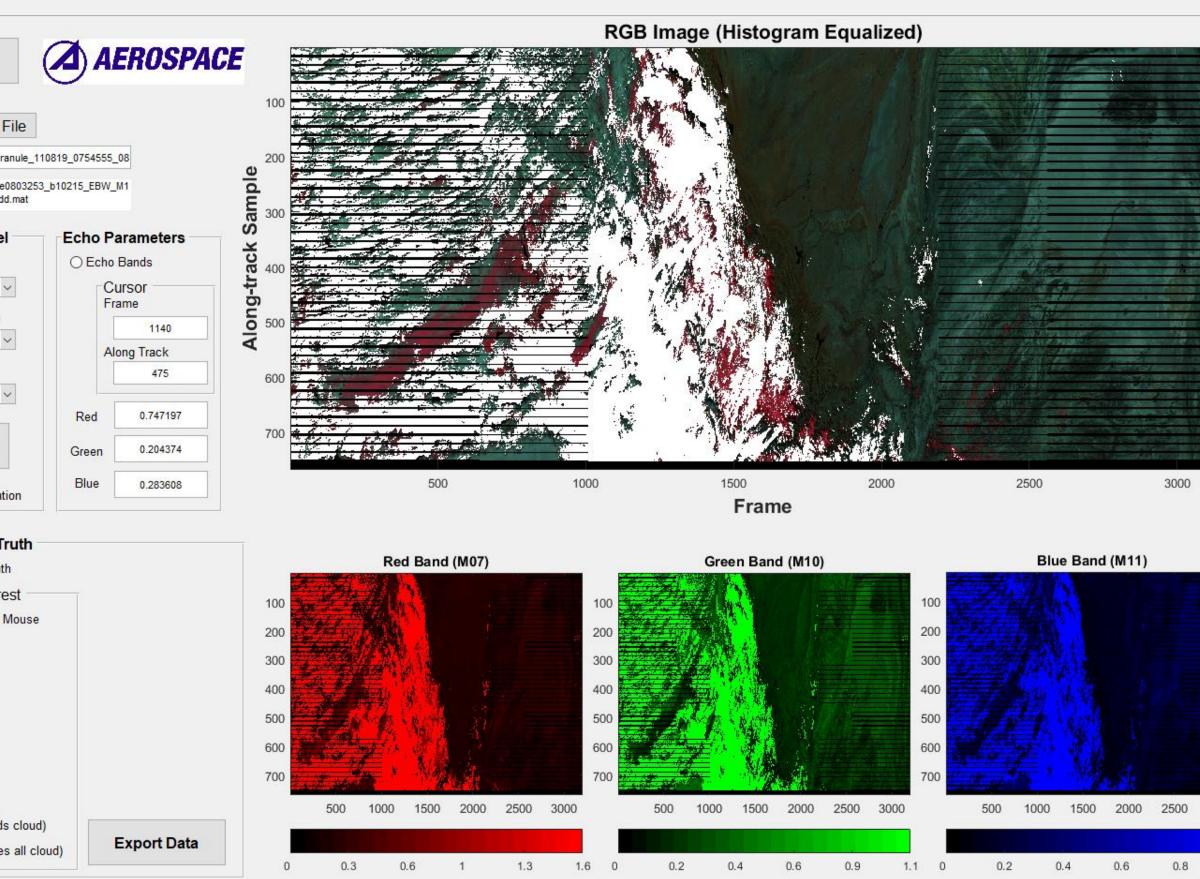
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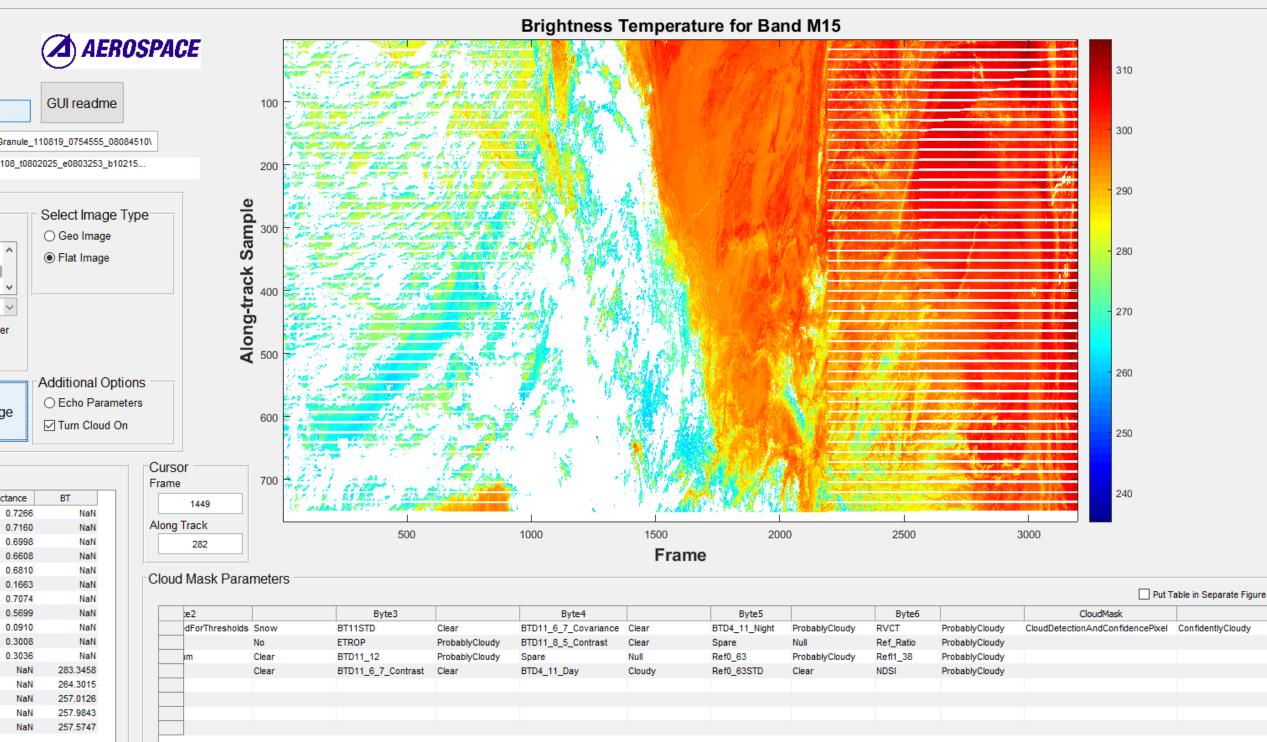
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5	Band Selection Par Band Selection 1 (Red)	ne
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	Original File	
	Select CMT File	•
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ζ	M02 267.1749	
	M03 268.0804 M04 234.0306 M05 199.4161	
	M06 41.0952 M07 130.1873	
	M08 50.3570 M09 6.4451	
	M10 14.5561 M11 4.5358	
	M12 0.1897 M13 0.1663	
	M14 3.7641	

4.6040

ArCM facilitates effective creation of ground-truth cloud masks from VIIRS imagery

*All example imagery/mask results from granule #5 – Afghan mountains; cloud over snow

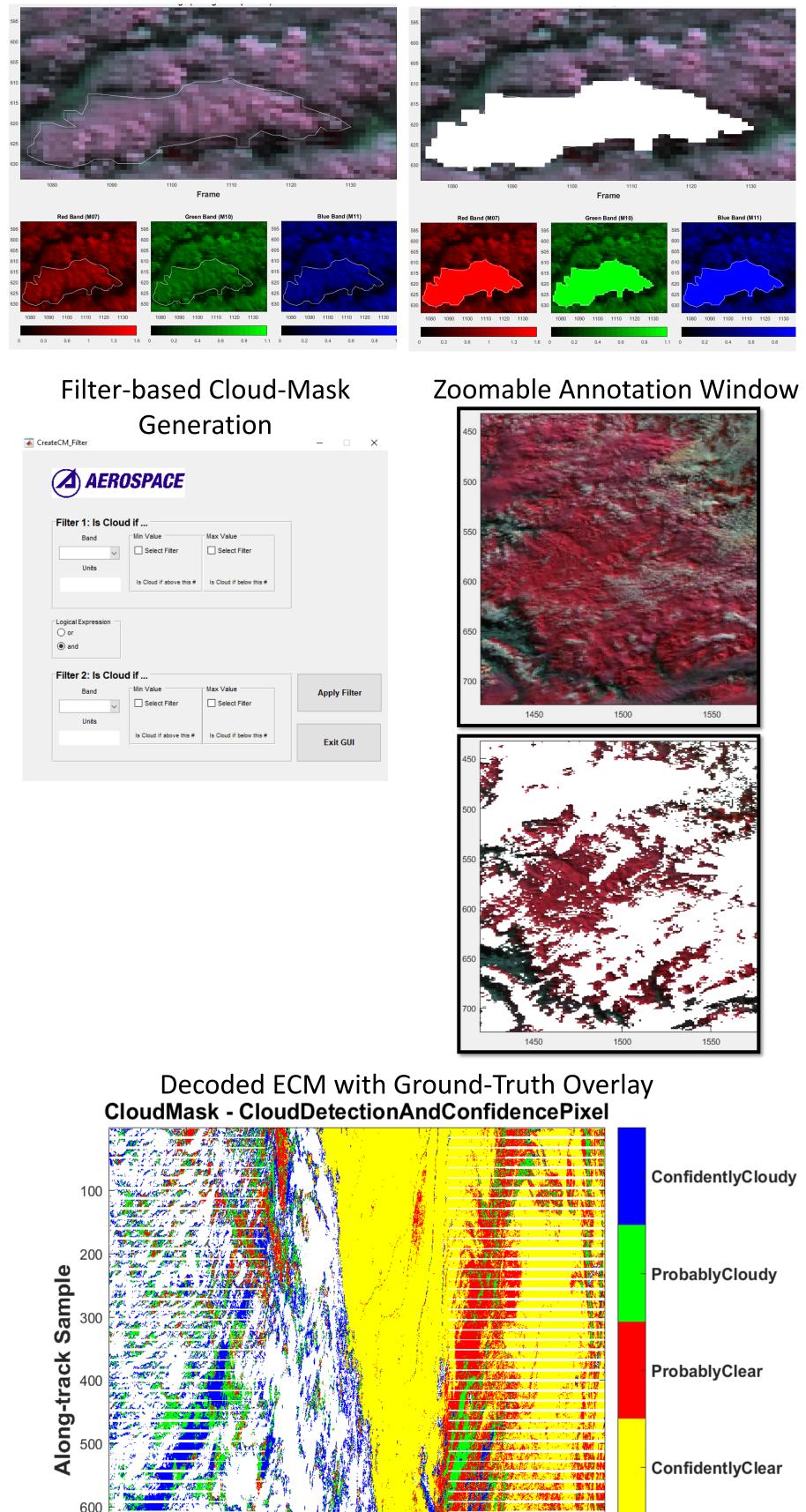






Cloud Mask Annotation/Visualization

Polygon Cloud-Mask Generation



1500

Frame

1000

500

2000

BowTie / Cloud