Office of Satellite and Product Operations

Environmental Satellite and Product Services

The Multi-platform Tropical Cyclone Surface Wind Analysis (MTCSWA) External Users Manual

Version 1.1

January 14, 2021

Prepared by: ERT Inc.

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Environmental Satellite, Data, and Information Service
Office of Satellite Products and Operations

Approval Page

Environmental Satellite and Products Services

The Multi-platform Tropical Cyclone Surface Wind Analysis

GROUP: ESPC Date Liqun Ma (OSPO), MTCSWA Product Area Lead	GROUP: OMS Date Nageswarrao Gopanapalli, Project Manager
GROUP: Date	

Changes/Revisions Record

This document is changed as required to reflect system, operational, or organizational changes. Modifications made to this document are recorded in the Changes/Revisions Record below. This record will be maintained throughout the life of the document.

THE MULTIPLATFORM TROPICAL CYCLONE SURFACE WIND ANALYSIS, V1.1 External Users Manual			
DOCUMENT CHANGE HISTORY			
Revision No.	**Date**	**Revision Originator Project Group**	**CCR Approval # and Date**
1.0	6/5/2020	Original version, product v1r1	
1.1	01/14//2021	Migrate to OSPO	WR10493

LIST OF CHANGES

Significant alterations made to this document are annotated in the List of Changes table.

DOCUMENT TITLE: MTCSWA External Users Manual					
LIST OF CHANGE-AFFECTED PAGES/SECTIONS/APPENDICES					
Version Number	**Date**	**Changed By**	**Page**	**Section**	**Description of Change(s)**
1.1	01/14/2021	L. Ma Y. Zhu			Migrate to OSPO environment

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

ABI	Advanced Baseline Imager
ADT	Advanced Dvorak Technique
AIT	Algorithm Integration Team
AODT	Advanced Objective Dvorak Technique
ARCHER	Automated Rotational Center Hurricane Eye Retrieval
ARR	Algorithm Readiness Review
ASCII	American Standard Code for Information Interchange
ASOS	Automated Surface Observing System
ASSISTT	The Algorithm Scientific Software Integration and System Transition Team
ATBD	Algorithm Theoretical Basis Document
ATCF	Automated Tropical Cyclone Forecast record format
AVHRR	Advanced Very High Resolution Radiometer
AWG	Algorithm Working Group
BHP	Blended Hydro Products
CHOPS	Consolidated High-throughput Operational Products System
CIRA	Cooperative Institute for Research in the Atmosphere
CIMSS	Cooperative Institute for Meteorological Studies
CLASS	Comprehensive Large Array-data Stewardship System
CONUS	Continental United States
CPU	Central Processing Unit
DAP	Delivered Algorithm Package
DDS	Data Distribution Server
DHS	Data Handling System
EMC	Environmental Modeling Center
EPS	Enterprise Processing System
EPSx	Enterprise Processing System Extension
ESPC	Earth System Prediction Capability
ESPDS	Environmental Satellite Processing and Distribution System
ET	Extra Tropical
FD	Full Disk
FLS	Fog and Low Stratus (sometimes referred to as Fog)
FW1.0	Integration team framework version 1.0
FW2.0	Integration team framework version 2.0
GB	Gigabyte
GFS	Global Forecast System
GL	Granule List file
GNU	recursive acronym for "GNU's Not Unix!"
GOES-16/17	Geostationary Orbiting Environmental Satellite 16 or 17
GOES-R	Geostationary Orbiting Environmental Satellite R series
GMI	Global Precipitation Measurement (GPM) Microwave Imagery

GPM	Global Precipitation Measurement
GRIB	Gridded Binary format
GVAR	GOES VARiable
HDF5	Hierarchical Data Format version 5
IDPS	Interface Data Processing Segment
IMS	Interactive Multisensor Snow and Ice Mapping System
IET	IDPS Epoch Time
IFR	Instrument Flight Rule
INS	Ingest Subsystem
IP	Intermediate Product
IPT	Integrated Products Team
IRW	Infrared Window
KB	Kilobyte
LIFR	Low Instrument Flight Rule
MB	Megabyte
MTCSWA	Multi-satellite-platform Tropical Cyclone Surface Wind Analysis
MVFR	Marginal Visual Flight Rule
NDE	NPOESS Data Exploitation
NCDC	National Climate Data Center
NCEI	National Centers for Environmental Information
NCEP	National Center for Environmental Prediction
NCO	NCEP Central Operations
NESDIS	National Environmental Satellite, Data, and Information Service
NetCDF	Network Common Data Format version
NetCDF4	Network Common Data Format version 4
NOAA	National Oceanic and Atmospheric Administration
NPOESS	National Polar-Orbiting Operational Environmental Satellite System
NSOF	NOAA Satellite Operations Facility
NUP	NOAA Unique Product
NVAP	National Aeronautics and Space Administration Water Vapor Project
NWP	Numerical Weather Prediction
ODT	Objective Dvorak Technique
OISST	Optimum Interpolation Sea Surface Temperature
OSGS	Office of Satellite Ground Services
OSPO	Office of Satellite and Product Operations
PCF	Process Control File
PCT (TPW-PCT)	Percentage of Total Precipitable Water
PDA	Product Distribution and Access
PDS	Product Distribution Subsystem
PGM	Product Generation Manager
PMW	Passive Microwave

PSF	Process Status File
PSLF	Process Log/Status File
RAD	Requirements Allocation Document
RadC	Radiance CONUS (satellite channel info)
RadF	Radiance FD (satellite channel info)
RAM	Random Access Memory
RAP	Rapid Refresh Model
RR	Rainfall Rate (instantaneous)
SAN	Storage Area Network
SCF	System Control Files
SCR	Software Code Review
SDR	Sensor Data Record
SDT	Subjective Dvorak Enhanced Infrared 'EIR' Technique
SPSRB	Satellite Products and Services Review Board
SSMI (or SSM/I)	Special Sensor Microwave Imager
STAR	Center for Satellite Applications and Research
TC	Tropical Cyclone
TPW	Total Precipitable Water
VIIRS	Visible Infrared Imager Radiometer Suite
XML	eXtensible Markup Language

1. PRODUCTS

This is an external user's manual document describing the Multiplatform Tropical Cyclone Surface Wind Analysis (MTCSWA) products and output files. The MTCSWA product system was developed at the Center for Satellite Applications and Research (STAR) and will be implemented into operations at the NOAA NPOESS Data Exploitation (NDE).

The intended users of the External Users Manual (EUM) are end users of the output products and files, and the product verification and validation (V&V) teams. The purpose of the EUM is to provide product users and product testers with information that will enable them to acquire the product, understand its features, and use the data. External users are defined as those users who do not have direct access to the processing system.

1.1. Product Overview

The main purpose of this project is to create an algorithm package to operationally generate an estimation of the 700mB wind field around active tropical cyclones. The resulting mid-level winds are then adjusted to the surface applying a very simple single column approach. The MTCSWA products will use the imagery and sounder instruments onboard geostationary and polar weather satellites. The output will consist of both NetCDF4 and XFER/FIX (ASCII) files.

1.1.1. Product Requirements

All MTCSWA basic and derived requirements are available in the MTCSWA Requirements Allocation Document (RAD). These requirements identify the users and their needs with respect to file content, format, latency, and quality. This document is available upon request from the STAR Project Lead and Product Team.

A summary of MTCSWA product requirements is shown in Table 1-1.

Table 1-1 - MTCSWA Product Requirements

Attribute	Requirement
Geographic Coverage	Global
Refresh Rate	3 hours
Timeliness	3 hours
Horizontal Cell Size	10km
Measurement Precision	1 m/s
Measurement Accuracy	5 m/s
Latency	3 hr

1.1.2. Product Team

The MTCSWA product team consists of individuals from STAR, CSU, and OSPO, and are listed in Table 1-2.

Table 1-2 - MTCSWA Product Team Information

Team Member	Organization	Role	Contact Information
Walter Wolf	STAR	STAR Project Lead	5830 University Research Court College Park, MD. 20740 Phone: 301-683-1314 Email: Walter.Wolf@noaa.gov
Liquin Ma	OSPO	PAL	5830 University Research Court College Park, MD. 20740
Thomas King	STAR	Development Lead	5830 University Research Court College Park, MD. 20740 Phone: 301-683-3547 Email: Thomas.S.King@noaa.gov
Peter Keehn	STAR	Software Developer	5830 University Research Court College Park, MD. 20740 Phone: 301-683-3548 Email: Peter.Keehn@noaa.gov
John Knaff	STAR	Algorithm Devevloper	CIRA/Colorado State University Campus Delivery 1375 Fort Collins, CO 80523-1375 John.Knaff@noaa.gov 970 491-8881
Jack Dostalek	CSU	Algorithm Developer	CIRA/Colorado State University Campus Delivery 1375 Fort Collins, CO 80523-1375 Jack.Dostalek@colostate.edu
Kelly Neely	STAR	STAR NESDIS Team	5825 University Research Court, Suite 1500,

			Riverdale, MD. 20740
Priyanka Roy	STAR	STAR NESDIS Team	5825 University Research Court, Suite 1500, Riverdale, MD. 20740
Shanna Sampson	STAR	STAR NESDIS Team	5825 University Research Court, Suite 1500, Riverdale, MD. 20740
John Lindeman	STAR	STAR NESDIS Team	5825 University Research Court, Suite 1500, Riverdale, MD. 20740
Yufeng Zhu	OSPO	Product Operation Support Team	5830 University Research Court College Park, MD. 20740

1.1.3. Product Description

The MTCSWA (Multiplatform Tropical Cyclone Surface Wind Analysis) algorithm combines information from several satellites' data sources to create a mid-level (near 700 hPa) wind analysis for active tropical cyclones. The output products are intended for operational and scientific users.

1.2. Product History

The MTCSWA product system was created by Dr. John Knaff at the NESDIS Center for Satellite Applications and Research (STAR) Regional and Mesoscale Meteorology Branch (RAMMB) located in Fort Collins, Colorado. MTCSWA was originally put into operations at OSPO in November 2011.

Updates to the analysis code and inputs are the basis for this work. MTCSWA will be upgraded from version 1.0 to 2.0, and will include scientific improvements and new input data from satellites such as GOES-16/17 while retiring legacy inputs such as QuickScat and AMSU non-linear balance winds from NCEP. MTCSWA products on heritage systems will be retired.

1.3. Product Access

MTCSWA will be running on NDE operational servers and will be monitored 24 X 7. Its output will be put on the MTCSWA webpage, ESPC ftp site and ESPC PDA (Production Distribution and Access)

Any user who needs to obtain MTCSWA files from PDA need contact ESPC PDA administrator (PDA_DHS@noaa.gov). PDA administrator will provide an 'ESPC Data Access Request Form' and detail information about how to access MTCSWA files on ESPC PDA.

MTCSWA products are mainly distributed as NetCDF and ASCII format files, and will be archived at NCEI (National Centers for Environmental Information).

The NESDIS' Policy on Access and Distribution of Environmental Data and Products is provided at: http://www.ospo.noaa.gov/Organization/About/access.html.

Table 1-3 lists the MTCSWA product output files and their formats. Five output files in NetCDF, XFER FIX (ASCII), PNG, and TEXT format will be produced for each storm of interest found during the processing run.

Table 1-3 - MTCSWA Output Files

File	Description	Format	Size/file
MTCSWA-BBCCYYYY_v1r1_blend_sYYYYMMDDhhmmsss_eYYYYMMDDhhmmsss_cYYYYMMDDhhmmsss.nc	MTCSWA results for the ATCF storm identifier in the form BBCCYYYY	NetCDF	~32 MB
MTCSWA-BBCCYYYY_v1r1_blend_sYYYYMMDDhhmmsss_eYYYYMMDDhhmmsss_cYYYYMMDDhhmmsss_FIX	MTCSWA results for the ATCF storm identifier in the form BBCCYYYY	ATCF FIX Format (ASCII)	~900 bytes
MTCSWA-BBCCYYYY_v1r1_blend_sYYYYMMDDhhmmsss_eYYYYMMDDhhmmsss_cYYYYMMDDhhmmsss.png	MTCSWA output image in PNG format, used for monitoring	PNG	300KB
MTCSWA-BBCCYYYY_v1r1_blend_sYYYYMMDDhhmmsss_eYYYYMMDDhhmmsss_cYYYYMMDDhhmmsss_hr.png	MTCSWA output hr image in PNG format, used for monitoring	PNG	350-750KB
MTCSWA-BBCCYYYY_v1r1_blend_sYYYYMMDDhhmmsss_eYYY	MTCSWA log file	Text (ASCII)	40-100KB

YMMDDhhmmsss_cYYYYMMDDhhmmsss.log			

Where:

MTCSWA – Multiplatform Tropical Cyclone Surface Wind Analysis
BB – Ocean Basin
CC – Cyclone Number
v1r1 – version 1, revision 1
blend – Blended enterprise processing (implies more than one satellite is used in product generation)
s – image start time
e – image end time
c – image creation time
YYYY – 4-digit year
MM – 2-digit Month
DD – 2-digit Day of Month
hh – 2-digit Hour
mm – 2-digit Minute
sss – 3-digit Second
hr – high resolution image

Table 1-4 list the MTCSWA NetCDF file contents. The NetCDF file contains groups of data: analysis, track, fix, and data. Accessing these files will require software that can work with the NetCDF format. Note that in the 'Dim' column, 'N' refers to the number of observations.

Table 1-4 - MTCSWA NetCDF File Contents

Variable	Type	Description	Dim	Units	Range
analysis/latitude	float	latitude	151x151	degrees north	
analysis/longitude	float	longitude	151x151	degrees east	
analysis/U	float	u component of the wind field	151x151	kt	
analysis/V	float	v component of the wind field	151x151	kt	
analysis/Spd	float	magnitude of the horizontal velocity vector	151x151	kt	

analysis/U_sfc	float	u component of the surface wind field	151x151	kt	
analysis/V_sfc	float	v component of the surface wind field	151x151	kt	
analysis/Spd_sfc	float	magnitude of the horizontal velocity vector at the surface	151x151	kt	
fix/center_lat	float	tropical cyclone center fix latitude		degrees north	
fix/center_lon	float	tropical cyclone center fix longitude		degrees east	
fix/mslp	float	tropical cyclone central pressure		hPa	
fix/max_wind	short	maximum 1-minute sustained wind speed		kt	
fix/radius_max_wind	short	radius_max_wind		nm	
fix/bearing	short	bearing		degree	
fix/quadrant_code	byte	wind radius code	4		
fix/r34	short	radius of 34 kt wind intensity by quadrant	4	nm	
fix/r50	short	radius of 50 kt wind intensity by quadrant	4	nm	
fix/r64	short	radius of 64 kt wind intensity by quadrant	4	nm	
fix/atcf_storm	char	ATCF storm identifier in the form BBCCYYYY, where BB is the ocean basin, CC is the cyclone number, and YYYY is the four-digit year	8		
fix/fix_time	char	ATCF FIX time as YYYYMMDDHHMM	12		
fix/storm_name	char	storm name if available	15		
track/date	int	year,month,day as YYYYMMDD of storm track	3		
track/time	int	hour of storm track	3		
track/intensity	int	maximum sustained wind speed	3	kt	

track/latitude	float	latitude of storm track	3	degrees north	
track/longitude	float	longitude of storm track	3	degrees east	
obs/date	int	year,month,day as YYYYMMDD of observation	N (no. of observations)		
obs/time	int	hour,minute,second as hhmmss of observation	N		
obs/latitude	float	latitude of observation	N	degrees north	
obs/longitude	float	longitude of observation	N	degrees east	
obs/U	float	u component of the wind field	N	kt	
obs/V	float	v component of the wind field	N	kt	
obs/pressure	int	pressure of observation	N	hPa	
obs/type	char	observation type	4xN		

The Fix file (ASCII CVS file) is formatted for use with the Automated Tropical Cyclone Forecast (ATCF) workstation used at NHC (National Hurricane Center), JTWC (Joint Typhoon Warning Center), and CPHC (Central Pacific Hurricane Center). Figure 1-1 shows an example ATCF Fix format file (*_FIX), which is a form of ASCII and so can be examined with most text editing applications.

```
AL, 10, 201909231500,  70, ANAL,      PR,  , 2812N,  6800W,   10 , 2,   , 2,  985, 2, MEAS,  34,  NEQ,  105,
95,   45,   20,  ,  ,  ,  , 2,  21,   , L,  NSOF, XXX, XXX, 201909230300, 201909231827,   ,   , AMSU CD WV IR
ASCT    , NOAA/OSPO Combined Multi-Platform Satellite Analysis
AL, 10, 201909231500,  70, ANAL,      PR,  , 2812N,  6800W,   10 , 2,   , 2,  985, 2, MEAS,  50,  NEQ,   80,
0,   0,   30,  ,  ,  ,  , 2,  21,   , L,  NSOF, XXX, XXX, 201909230300, 201909231827,   ,   , AMSU CD WV IR
ASCT    , NOAA/OSPO Combined Multi-Platform Satellite Analysis
AL, 10, 201909231500,  70, ANAL,      PR,  , 2812N,  6800W,   10 , 2,   , 2,  985, 2, MEAS,  64,  NEQ,   20,
0,   0,   20,  ,  ,  ,  , 2,  21,   , L,  NSOF, XXX, XXX, 201909230300, 201909231827,   ,   , AMSU CD WV IR
ASCT    , NOAA/OSPO Combined Multi-Platform Satellite Analysis
```

Figure 1-1 – MTCSWA ATCF Fix File Example

The NDE-required metadata is shown in Table 1-5 to Table 1-8 for the NetCDF output file (the Fix file does not contain metadata). There are four main types of metadata: collection level, granule level, gridded level, and project development team and publisher information. Some of the metadata is static, such as much of Table 1-8, while other metadata (Table 1-6) is dynamic. Product monitoring is not required so product monitoring metadata will not be included.

Table 1-5 - Collection Level Metadata

Attribute Name	Data Type	Value/Description
Conventions	string	CF-1.7
standard_name_vocabulary	string	CF Standard Name Table (version 65)
project	string	NPP Data Exploitation
institution	string	DOC/NOAA/NESDIS/OSPO > Office of Satellite and Product Operations, NESDIS, NOAA, U.S. Department of Commerce
naming_authority	string	gov.noaa.nesdis.ncei
platform	string	multiple
instrument	string	multiple
title	string	MTCSWA
summary	string	Multiplatform Tropical Cyclone Surface Winds Analysis
history	string	MTCSWA v1r1
processing_level	string	NOAA Level 3
production_site	string	NOAA/NESDIS/STAR
production_environment	string	rhw1158 mm
references	string	*Optional Attribute*

Table 1-6 - Granule Level Metadata - Dynamic

Attribute Name	Data Type	Sample Input for GAR
source	string	
production_site	String	NOAA/NESDIS/STAR
production_environment	String	rhw1158 mm
id	string	MTCSWA-EP132019_v1r1_blend_s201909231542000_e201909231542000_c201909231542000.nc
time_coverage_start	string	2019-09-23T15:42:00Z
time_coverage_end	string	2019-09-23T15:42:00Z
date_created	string	2019-09-23T15:42:00Z

Table 1-7 - Gridded Level Metadata

Attribute Name	Data Type	Sample Input for GAR
analysis_time	string	2019092315
cdm_data_type	string	grid
geospatial_lat_min	float	8.1
geospatial_lat_max	float	23.1
geospatial_lon_min	float	216.6
geospatial_lon_max	float	231.6
geospatial_lat_units	string	degrees_north
geospatial_lon_units	string	degrees_east

Table 1-8 - Project Development Team and Publisher Information

Attribute Name	Data Type	Sample Inputs for GAR
creator	string	NOAA/NESDIS/STAR
creator_name	string	DOC/NOAA/NESDIS/STAR > MTCSWA TEAM, Center for Satellite Applications and Research, NESDIS, NOAA, U.S. Department of Commerce
creator_email	string	
creator_url	string	
publisher_name	string	DOC/NOAA/NESDIS/NDE NPP Data Exploitation, NESDIS, NOAA, U.S. Department of Commerce
publisher_email	string	espcoperations@noaa.gov

publisher_url	string	http://www.ospo.noaa.gov

2. ALGORITHM

2.1. Algorithm Overview

The MTCSWA algorithm combines information from five satellite data sources to create a mid-level (near 700 hPa) wind analysis using a variational approach described in Knaff and DeMaria (2006). The resulting mid-level winds are then adjusted to the surface applying a very simple single column approach. Over the ocean an adjustment factor is applied, which is a function of radius from the center ranging from 0.9 to 0.7, and the winds are turned 20 degrees toward low pressure. Over land, the oceanic winds are reduced by an additional 20% and turned an additional 20 degrees toward low pressure.

The details of the MTCSWA algorithm are described in the MTCSWA Algorithm Theoretical Basis Document (ATBD). This document can be made available by either the MTCSWA Product Area Lead (PAL) or STAR Algorithm Lead

2.2. Input Satellite Data

2.2.1. Satellite Instrument Overview

Multiple instruments onboard the geostationary and polar weather satellites provide the data for the MTCSWA products. This is necessary for the global geographic coverage requirements of MTCSWA. Data from imagery and sounder instruments include MIRS ATMS and AMSU sounder data, GOES 15 and GOES 16 storm-centered infrared IR imagery, Himawari-8 storm-centered IR imagery, and MeteoSat storm-centered infrared imagery. Additionally, cloud/feature track winds products from GOES 15, GOES 16, MeteoSat, and Himawari-8 are used as input.

2.2.2. Satellite Data Preprocessing Overview

Storm Advisor Decs (a-deck) data files trigger the MTCSWA product system. The a-deck files are obtained from the National Hurricane Center, Joint Typhoon Database, and Pacific Hurricane Center. The system checks for new A-deck files every 3 hours, and the MTCSWA product has a latency of 1 hour allocated for ESPC processing.

2.2.3. Input Satellite Data Description

Table 2-1 lists the input data (dynamic), including satellite imagery and sounder data, satellite wind products, and a-deck files.

Table 2-1 - MTCSWA Dynamic Input Data Files

File type	Optional/Required	Filename	File format	Source	Time relative to MTCSWA job coverage
a-deck files	At least 1 required	aBaSnYYYY.dat Ba – basin Sn - storm number YYYY – Year	ASCII	PDA	All files with time stamps within [(coverage start - hours) to coverage end]
GOES 16/17	At least 1 file (or set of files) required	OR_ABI-L1b-RadF-M6C13_G??_s20191081440224_e20191081449544_c20191081450001.nc Where ?? = 16/17	NetCDF4	PDA	Latest file(s) from each satellite within [coverage start to coverage end]
H-8		HS_H08_20190416_1100_B13_FLDK_R20_S??10.DAT.bz2 (10 total segments) Where ?? = 01 - 10	HSD in bz2	PDA	
Meteosat 8/11		H-000-MSG?__-MSG?_____-IR_108___-000001___-201904181900-C_ (9 total segments) Where ? = 4/1	MGDR lite	PDA	
ASCAT OSW	Optional	ascat_20190418_163900_metop?_34153_srv_o_125_ovw.l2_winds-lite Where ? = a/b	MGDR lite	PDA	All files with coverage within [(coverage start - 8 hours) to coverage end]

TC XYA	Optional	TC-sh982019-XYA_v1r2_metopa_s20190413220000_e20190414100000_c20190414013010.nc	Netcdf4	PDA	All files with coverage overlapping or within [(coverage start - 8 hours) to coverage end]
GOES DMW FD	Optional	OR_ABI-L2-DMWF-M6C02_G16_s20190930910228_e20190930919536_c20190930935586.nc	Netcdf4	PDA	All files with coverage overlapping or within [(coverage start + 2 hours) to coverage end]
NRL Winds	Optional	IR_winds_601mb_800mb_20190402 IR_winds_801mb_1000mb_20190402 VIS_winds_601mb_800mb_20190402 VIS_winds_801mb_1000mb_20190402 WV_winds_601mb_800mb_20190402 WV_winds_801mb_1000mb_20190402	ASCII	PDA	All files with dates within [(coverage start date – 2 days) to coverage end date]

2.3. Input Ancillary Data

Static ancillary datasets required by MTCSWA are provided along with the algorithm software and scripts. Table 2-2 lists each data set, file size, and a short description is provided.

Table 2-2 - Input Static Ancillary Data Files

File	Format	Source	Description	Purpose

aland.dat	Ascii	DAP	Western hemisphere land file	Determine distance to land vs. ocean.
wland.dat	ASCII	DAP	Eastern hemisphere land file	Determine distance to land vs. ocean.
sland.dat	ASCII	DAP	Southern Hemisphere land file	Determine distance to land vs. ocean.
Eval.OUT	ASCII	DAP	Eigenvalues for the IRWD code	Normalizing PCs
Means.OUT	ASCII	DAP	Means for IRWD code	Standardizing IR data
EVEC_cov_ra.OUT	Binary	DAP	Eigenvectors for the IRWD code	Calculating PCs
6pred_means_stdev.out	ASCII	DAP	IRWD means and standard deviations for the first five predictors (cos(lat), storm speed, vmax,vmax^2, vmax^3)	IRWD regressions
A0.out	ASCII	DAP	Amplitude wave#0 regression coefficients IRWD	Provide wave #0 wind information
A1.out	ASCII	DAP	Amplitude wave#1 regression coefficients IRWD	Provide wave #1 wind information
A2.out	ASCII	DAP	Amplitude wave#2 regression coefficients IRWD	Provide wave #2 wind information
P1.out	ASCII	DAP	Phase wave#1 regression	Provide wave #1 wind information

			coefficients IRWD	
P2.out	ASCII	DAP	Phase wave#2 regression coefficients IRWD	Provide wave #2 wind information

3. PERFORMANCE

As specified by the Requirements Allocation Document, the operational MTCSWA products will check for a-deck files (indicating tropical storms) every 3 hours. The products will have a latency of 1 hour for ESPC processing, and will have a timeliness of 6 hours, at 0.5 hours after synoptic time.

3.1. Product Testing

Since observation of the complete wind field of tropical cyclones is rarely observed, a match-up strategy is impractical. Capabilities are based on past research suggesting requirements are satisfied. Validation is based on analysis results matching parallel product generation at CIRA (Cooperative Institute for Research in the Atmosphere). Since inputs from ASSISTT and CIRA often differ, data from the ASSISTT runs are extracted and re-run using the CIRA algorithm. When this is done results match identically.

3.1.1. Test Data Description

Test cases are provided with each DAP to NDE and OSPO for product verification before transition to operations. The test cases provide input and static and dynamic ancillary data, and the resulting product datasets for verification. Requirements as specified in the RAD document must be met in testing, and only after NDE and OSPO are satisfied that requirements are met will the MTCSWA products will be transitioned into operations.

Test data, including input data, reference results, PCF files, and scripts are provided by STAR to OSPO for testing before operational use of MTCSWA. The test data is in the form of a “tar” file and in uncompressed form requires about 8.8GB of storage space.

3.1.2. Unit Test Plans

Testing of MTCSWA products (and all products) are tested regularly with each update. The science teams, which develop these products, test them for accuracy and validation. The STAR group tests the algorithms and scripts to ensure that RAD requirements are met, and then operations must test these products to make sure that they run successfully on their systems. If there are problems in any one of these testing procedures, then the relevant groups must work together to iron-out any issues.

3.2. Product Accuracy

The RAD specifies that the MTCSWA products will have a horizontal cell size of 10 km, a measurement precision of 1 m/s, and a measurement accuracy of 5 m/s. See Table 1-1 for an overview of accuracy and other product requirements.

3.2.1. Test Results

Algorithm validation test results by the science team can be found in the Algorithm Basis Theoretical Document (ATBD) and Algorithm Readiness Review (ARR) presentation.

3.2.2. Product Accuracy

MTCSWA products have been validated against observations. The accuracy and precision of the EPS Fog products fall well within the accuracy and precision specifications. The detailed validations are available at Algorithm Readiness Review by contacting the MTCSWA Product Area Lead (PAL) at STAR.

3.3. Product Quality Output

N/A

3.4. External Product Tools

STAR and OSPO will work together an implementation of appropriate monitoring tools. It should be noted that software such as python, NCL, and Fortran are able to access MTCSWA NetCDF files, and the text files can be accessed by a wide variety of software applications.

4. PRODUCT STATUS

The MTCSWA system shall have QC (Quality Control) monitoring capability, and the product files will include overall quality control flags and quality summary level metadata. The metadata is generated for distribution, quality control, and post-processing. The algorithm products shall be validated and verified operationally by OSPO.

4.1. Operations Documentation

NESDIS/STAR (2020), Multi-satellite-platform Tropical Cyclone Surface Wind Analysis (MTCSWA) System Maintenance Manual (SMM)

NOAA/NESDIS (2010): Multiplatform Tropical Cyclone Surface Wind Analysis External Users Manual (EUM)

NOAA/NESDIS (2010): Multiplatform Tropical Cyclone Surface Wind Analysis Algorithm Theoretical Basis Document (ATBD)

NESDIS/STAR (2020) Multi-satellite-platform Tropical Cyclone Surface Wind Analysis (MTCSWA) Algorithm Readiness Review (ARR) presentation

NESDIS/STAR (2020), MTCSWA DAP Documents including the Readme file, Delivery Memo, PCF_PSF file, and Production Rules

NESDIS/STAR (2019), Upgrade to the Multi-Platform Satellite Tropical Cyclone Surface Wind Analysis (MTCSWA) Requirements Allocation Document (RAD)

Knaff and DeMaria (2006): A Multi-Platform Satellite Tropical Cyclone Wind Analysis System, 14th Conference on Satellite Meteorology and Oceanography, Poster Session 4 (Extended Abstract)

4.2. Maintenance History

Excerpts and/or references to maintenance documentation deemed of value to product users (e.g., relevant sections of maintenance reports). *(Document Object 58)*
Writers: PAL

TBD

END OF DOCUMENT