1. Ocean Dynamics Algorithm

Title: Ocean Currents

Authors and Affiliations

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Topics: (Other)

Program: (AWG)

2. Introduction

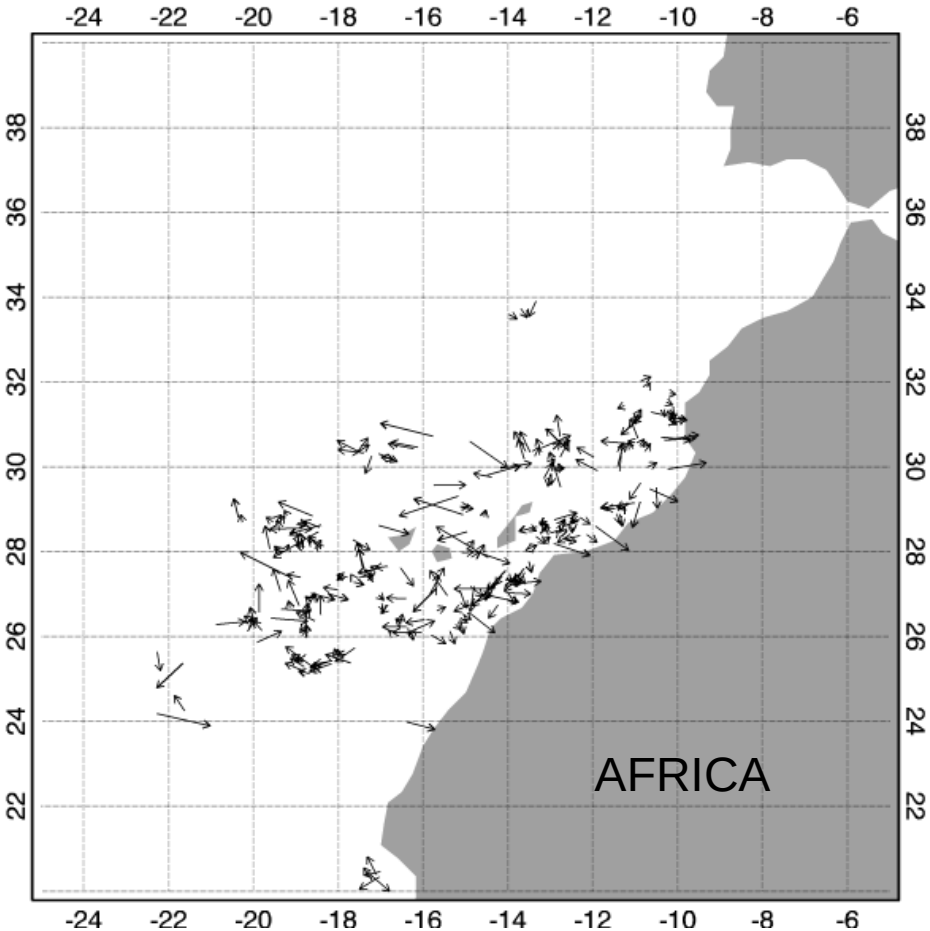
- NOAA does not generate real-time ocean currents
- Ocean Currents are considered a necessary product to be generated by GOES-R but only for Day 2
- An Ocean Surface Vector approach is performed in an attempt to derive ocean currents
  - Atmospheric Motion Vector (AMV) “feature tracking” was used
  - This methodology did not generate true ocean currents
- A GOES-R3 project was initiated to investigate alternative methods that could generate true ocean currents
  - Working with Ted Strub & Alex Kurapov at Oregon State University (OSU)
  - University of Maryland/CICS postgraduate student

3. Methodology/Expected Outcomes

The GOES-R ocean surface vector approach consists of the following general steps:

- Locate and select a suitable target in second image (middle image; time=t_0) of image triplet
- The sum of the square differences (a pattern matching algorithm to locate the target in an earlier and later image) is applied
  - Track target backward in time (to first image; time=t-Δt) and forward in time (to third image; time=t+Δt) and compute corresponding displacement vectors.
  - Compute mean vector displacement valid at time = t_0
- Perform quality assurance on ocean surface vectors. Flag suspect vectors. Compute and append quality indicators to each vector
- Apply mask to get Offshore Currents

4. Results (1)



Example of Ocean Current Vectors Derived from MSG SEVIRI

Vector length indicates derived current (1 degree=1m/sec)

Shows Upwelling off N. Africa combined with the complex upwelling pattern in the vicinity of the canary islands

4. Results (2)

- VALIDATION OF OCEAN VECTORS
  - MSG/SEVIRI* data centered at 12 UTC were selected for 8 days in each season (total 32 days)
  - A variety of target sizes were evaluated.
  - Compare with currents from the global version of the Navy Coastal Ocean Model (NCOM)

MSG/SEVIRI- Meteosat Second Generation/Spinning Enhanced Visible Infrared Imager*

4. Results (3a)

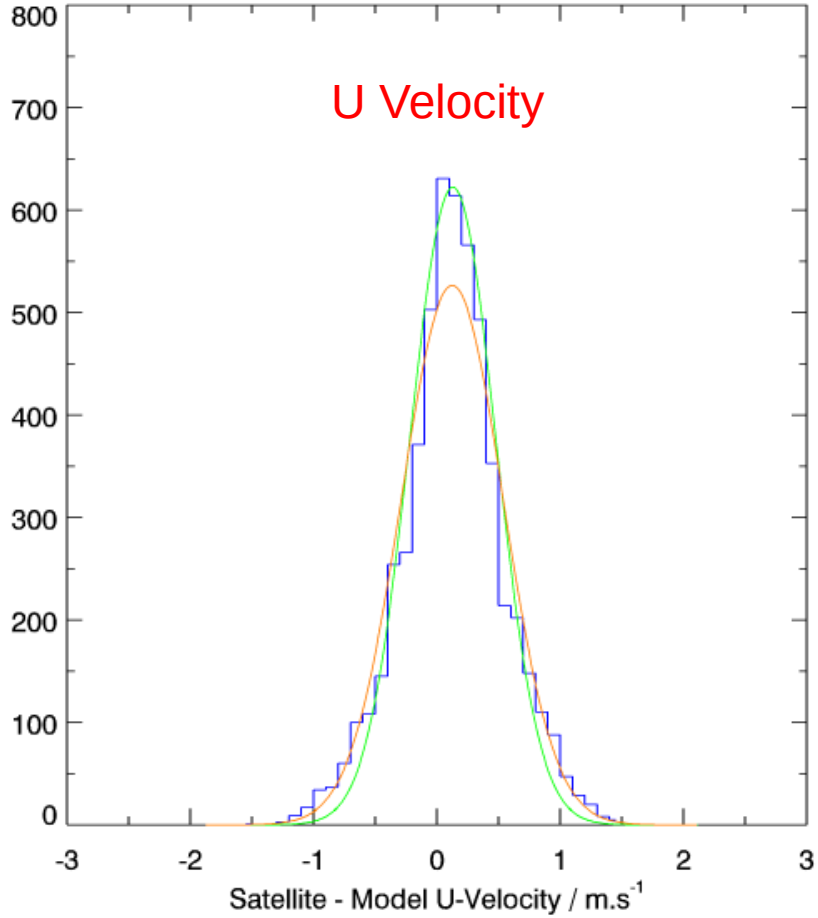
Orange = Gaussian curve represented by S.D

Green = Gaussian represented by R.S.D.

Blue = histogram of errors (MSG – NCOM)

5×5 Target

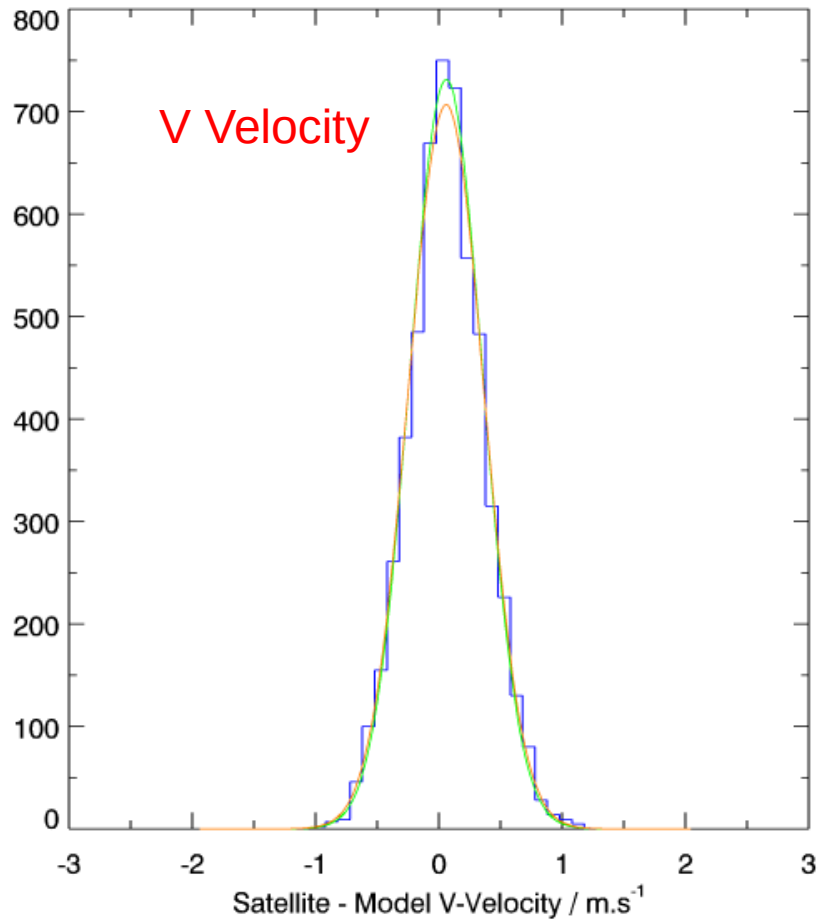
Median = 0.13 R.S.D. = 0.348



NOTE: Green Curve Matches Peak and Central Distribution

4. Results (3b)

Median = 0.06 R.S.D. = 0.297



Orange = Gaussian curve represented by S.D

Green = Gaussian represented by R.S.D.

Blue = histogram of errors (MSG – NCOM)

5×5 Target

NOTE: Green Curve Matches Peak and Central Distribution

5. Possible Path to Operations

- Results shown for AMV approach just satisfy specified requirements
- However, currents generated are unrealistic
  - Implies requirements were insufficiently stringent
  - New approaches needed
- Results from GOES-R3 Ocean Currents project (w/OSU) are encouraging
- Two alternative methods have been investigated
  - Feature tracking/optical flow
  - Direct assimilation into high-resolution ocean model
- Requires further investigation/refinement before adoption for “Day 2” GOES-R products

6. Future Plans

- N.B. GOES-R AWG project has ended and algorithm has been delivered
- Use UMD-CICS portion of GOES-R funding to support postgraduate student
  - Familiarize with OSU work
- Also have CREST postdoctoral fellow starting at STAR
  - Assimilation into land-ocean model
  - Work with UMD student to evaluate practicality of assimilation methodology for generating high-resolution ocean currents in operational setting

7. Publication List

- References
  - GOES-R AWG ATBD Ocean Dynamics (September 2011)