

An Automated Mesoscale Forecast Verification System

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Motivation

- A tool for the investigation of meteorological datasets
- Focus on model verifications, with credit for bold but perhaps inaccurate forecasts
- Easy to use

APL/UW aMVT

- Web-hosted manipulation of UWME data
- Submit-process-notify-review cycle
- In addition to grid-wide verification, decompose forecast errors into amplitude and displacement components

Dimensionality

- UWME SREF system
- Up to 5 years, up to 2 runs per day
- 12km/36km domains
- 8+ models, 20+ fields, 16+ taus
- APL/UW has ~2TB of MM5 output data

aMVT: Input

Date Range

From: Dec 01 2004
To: Mar 01 2005
Initialization Hour: 00Z 12Z

Analysis

Model: cent
Hour: 0
Domain: 12KM 36KM

Forecast Model

Model: cent
eta
gfs
ngps
Forecast Hour: 00
12
24
36
48
Temporal Shift: +/- 3 hr +/- 6 hr

Data Parameters

Data Parameters: SST
SLP
Surface Pressure
2m Temperature
Pressure Dependent Data Parameters: Geopotential Height
Mixing Ratio
Temperature
U Wind Component
Pressure Level: 850 mb
700 mb
500 mb
300 mb

Search Parameters

Matching Operator: MSE MQE
Search Type: Full LSA LSA with IBM
Search Cell: Width: Height:
Search Area: Width: Height:
Arrows to Display:

Display Options

Show Images
 Show Searches
 Show Errors

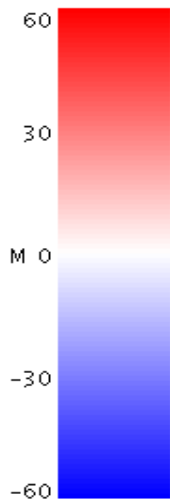
Fields marked in red are required.

aMVT: Verification Summary

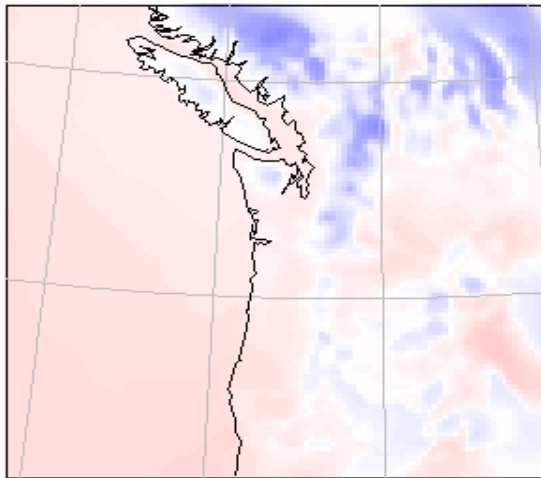
12km grid H85000

For forecasts initialised 12 hours before reference

Tau: 12h

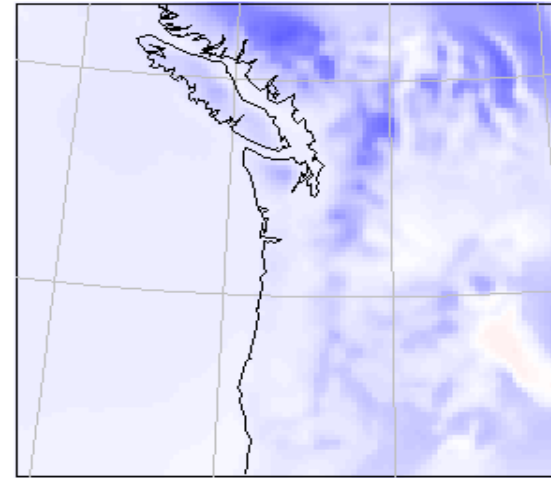


eta (82)



Mean Global Error 1.98
Mean Global Abs Error 5.47

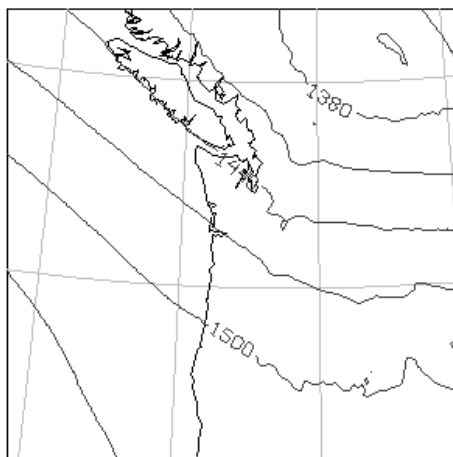
gfs (81)



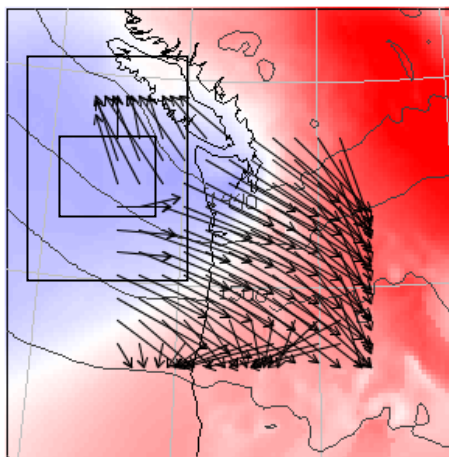
Mean Global Error -7.29
Mean Global Abs Error 7.33

aMVT: 'Feature' matching

cent : valid at 2005020500

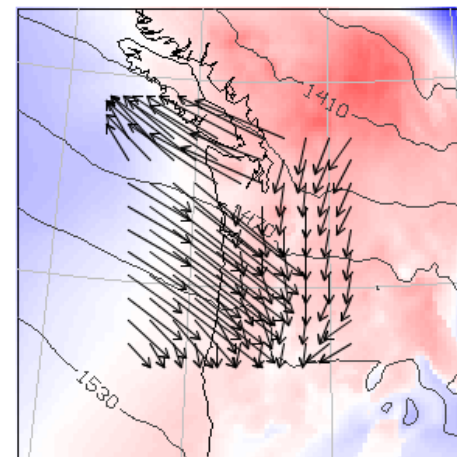


eta : init at 2005020300 valid at 2005020500



Mean Error 13.3
Mean Absolute Error 21.2
Mean Search Error 406 ([Search Details](#))
Mean Amplitude Error 100 (24.7%)
Mean Spatial Error 306 (75.3%)

gfs : init at 2005020300 valid at 2005020500



Mean Error 4.56
Mean Absolute Error 9.76
Mean Search Error 118 ([Search Details](#))
Mean Amplitude Error 28.1 (23.7%)
Mean Spatial Error 90.2 (76.3%)

aMVT: Retrievable Results

Index of processed requests

- [20041102_20050302_0_d2_H85000_cent_0_eta+gfs+ngps_24](#) (stuart20050303145157)
- [20040302_20050302_0_d2_H85000_cent_0_eta+gfs+ngps+ukmo_12+24+36+48](#) (stuart20050303115109)
- [20050301_20050301_0_d2_T50000_cent_0_eta_24_full_mean.sqrdiff_20x20_40x40](#) (ptewson20050302111636)
- [20050224_20050224_0_d2_H50000_cent_0_eta+ngps_24_full_mean.sqrdiff_20x20_30x30](#) (ptewson20050225122309)
- [20050224_20050224_0_d2_H50000_cent_0_eta+ngps_24_full_mean.sqrdiff_20x20_30x30](#) (ptewson20050225121510)
- [20050224_20050224_0_d2_H50000_cent_0_eta+ngps_24_full_mean.sqrdiff_20x20_30x30](#) (ptewson20050225120602)
- [20050122_20050222_0_d2_H85000_cent_0_eta+gfs_12_full_mean.sqrdiff_20x20_30x30](#) (stuart20050223130158)
- [20050122_20050222_0_d2_H85000_cent_0_eta+gfs_24_full_mean.sqrdiff_20x20_30x30](#) (stuart20050223092728)
- [20050221_20050221_0_d2_T2_cent_12_jma+ngps_36](#) (ptewson20050222162048)
- [20050215_20050220_0_d1_H85000_cent_0_gfs+ngps_36_ibm_mean.quarticdiff_20x20_25x25](#) (sandgathe20050222152354)
- [20050215_20050220_0_d1_H85000_cent_0_gfs+ngps_36_ibm_mean.quarticdiff_20x20_25x25](#) (sandgathe20050222152343)

Further processing?

- aMVT maintains experimental results, but...
- Images are WYSIAYG...
- So aspects of the results (e.g. search 6-tuples) available for digital output into Matlab, R, etc

Under Development

- Feature Identification
- Rotation, Divergence
- Data formats: NetCDF

Wider Applicability

- aMVT is essentially non-programmatic manipulation of gridded/matrix data sets
- Transferable to other feature-based comparisons (satellite imagery?)

Conclusions

- Automated mesoscale verification is a useful 'first step' tool in the analysis and comparison of forecast outputs
- Spatial and/or temporal adjustments to forecast features allow credit to forecasts whose global performance score poorly

Links

- <http://mvt.apl.washington.edu>
- <http://isis.apl.washington.edu/extractor/MM5DataExtractor.jsp>
- <mailto:stuart@apl.washington.edu>

aMVT: Error Decomposition

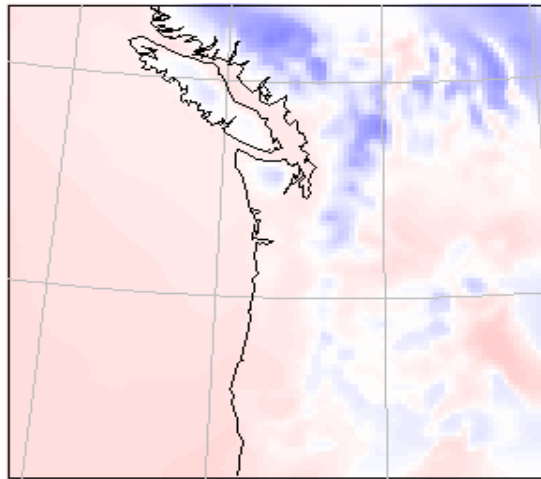
12km grid H85000

For forecasts initialised 12 hours before reference

Tau: 12h

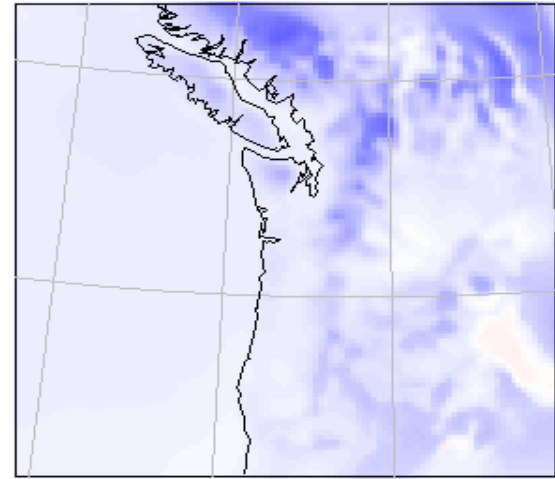


eta (82)



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gfs (81)

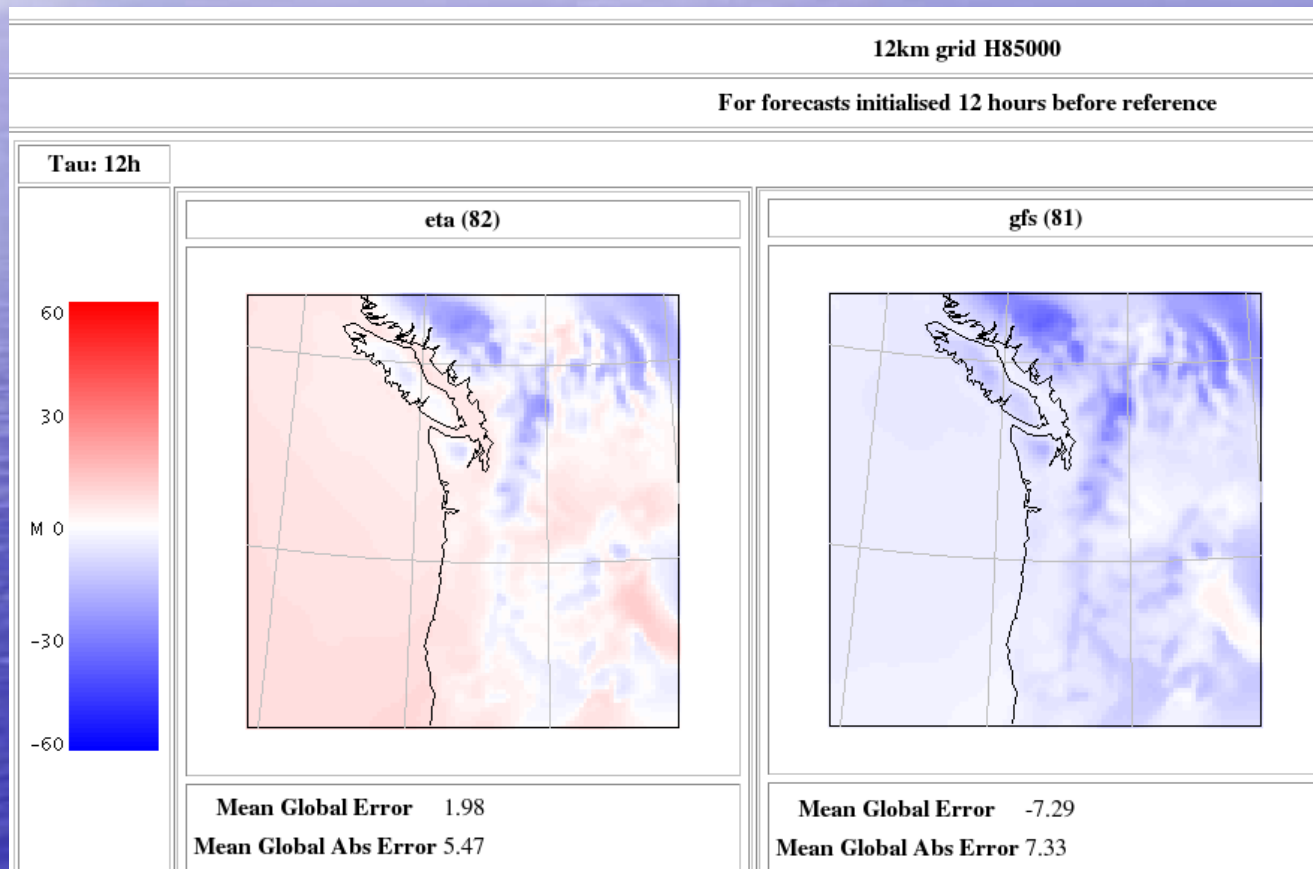


Mean Global Error -7.29
Mean Global Abs Error 7.33

Technologies

- Java
- VisAD
- WebApp/HTTP

Graphical View of Search Performance ??



Feature Verification 1

- Small box boundary
- Feature snaps wrong...

Individual Result

- Pic of 1 per run result, global

Recent Improvements

- Absolute scaling of field differences
- Digital output for statistical processing
- Results Index
- Geo-registering of model output

Typical (?) Questions

- Over the past 3 months, did ETA perform better than GFS regarding 850mb geopotential height with Cent as a reference?
- Is the

Features

- Full grid comparisons
- Sub-grid comparisons, with both spatial and temporal searches
- Composite and individual results
- Graphical, textual outputs
- Retrievable results
- Submit-process-notify-view cycle

Coverage

- UW Atmos Sciences ensemble data
- APL uses subset of generated output
- MM5 output format, need others