



# Cloud Verification in MET Our first steps

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# MET Cloud verification capability

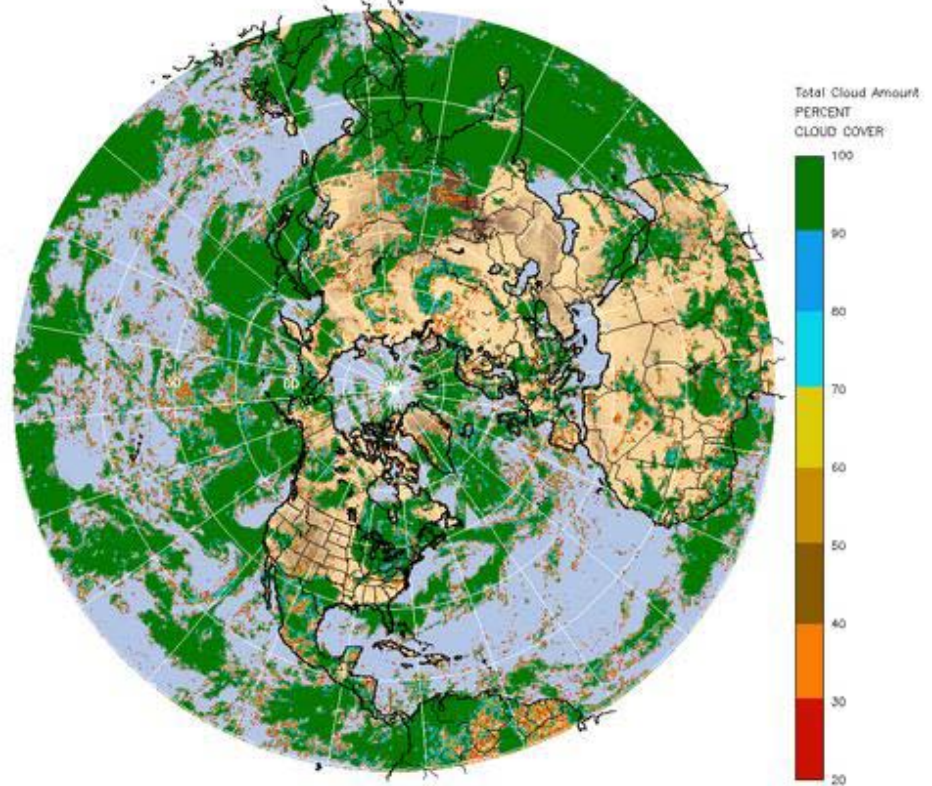
- WWMCA (World Wide Meteorological Cloud Analysis) tool
  - Reads, regrids, reformats WWMCA data
  - Separate plotting tool.
  - Bonus enhancement to MET polar stereographic grids.
- Multi-category contingency table analysis.



# Ground Truth: WWMCA

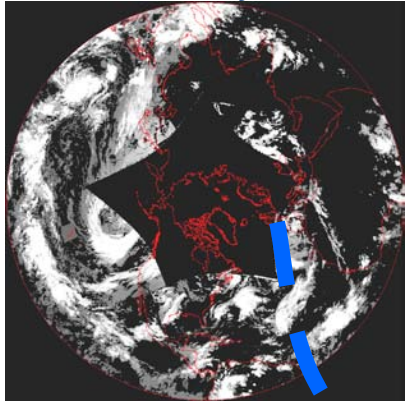
- WWMCA = World Wide Merged Cloud Analysis
- Run hourly
- Northern and Southern Hemisphere
- Total cloud (resolution to nearest 1%), cloud base and top heights
- 16<sup>th</sup> mesh grid (~788,000 usable points)

TOTAL CLOUD AMOUNT WITH COLOR  
COLORS REPRESENT TOTAL CLOUD PERCENT  
CDFSI ANALYSIS VALID 1800Z 30 06 2009 Mesh: 16 zoom ratio = 1-0.80

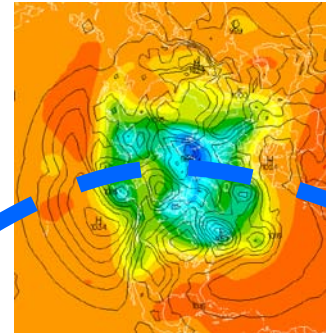
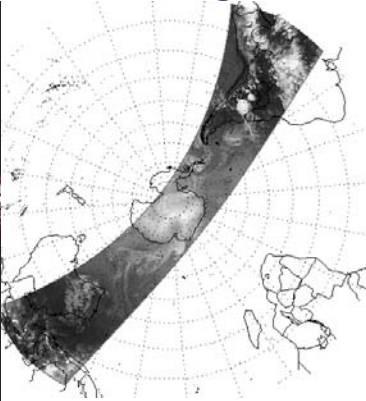


# Ground Truth: WWMCA

Geostationary Data

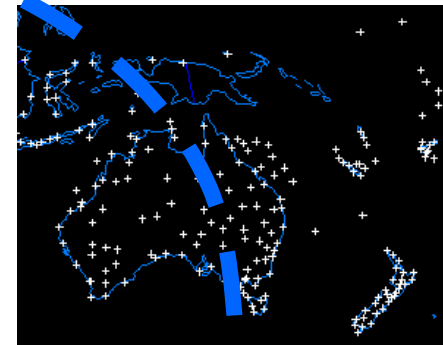


Polar Orbiting Data

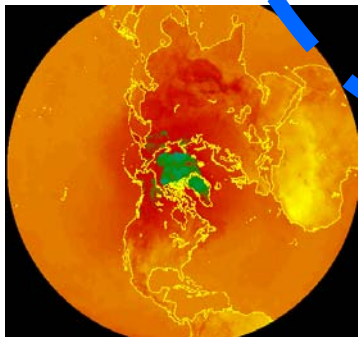
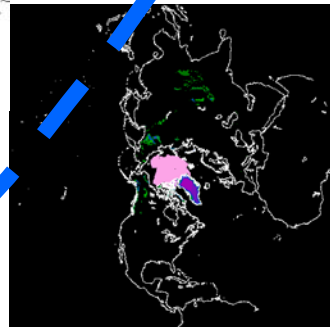


NOGAPS  
Upper Atmos. Temp

Surface Observations



Snow Analysis  
Resolution: 25 nm  
Obs: Surface, SSM/I  
Freq: Daily, 12Z

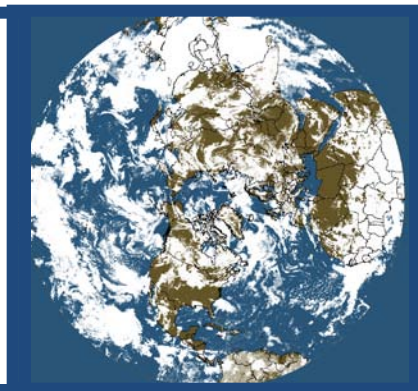


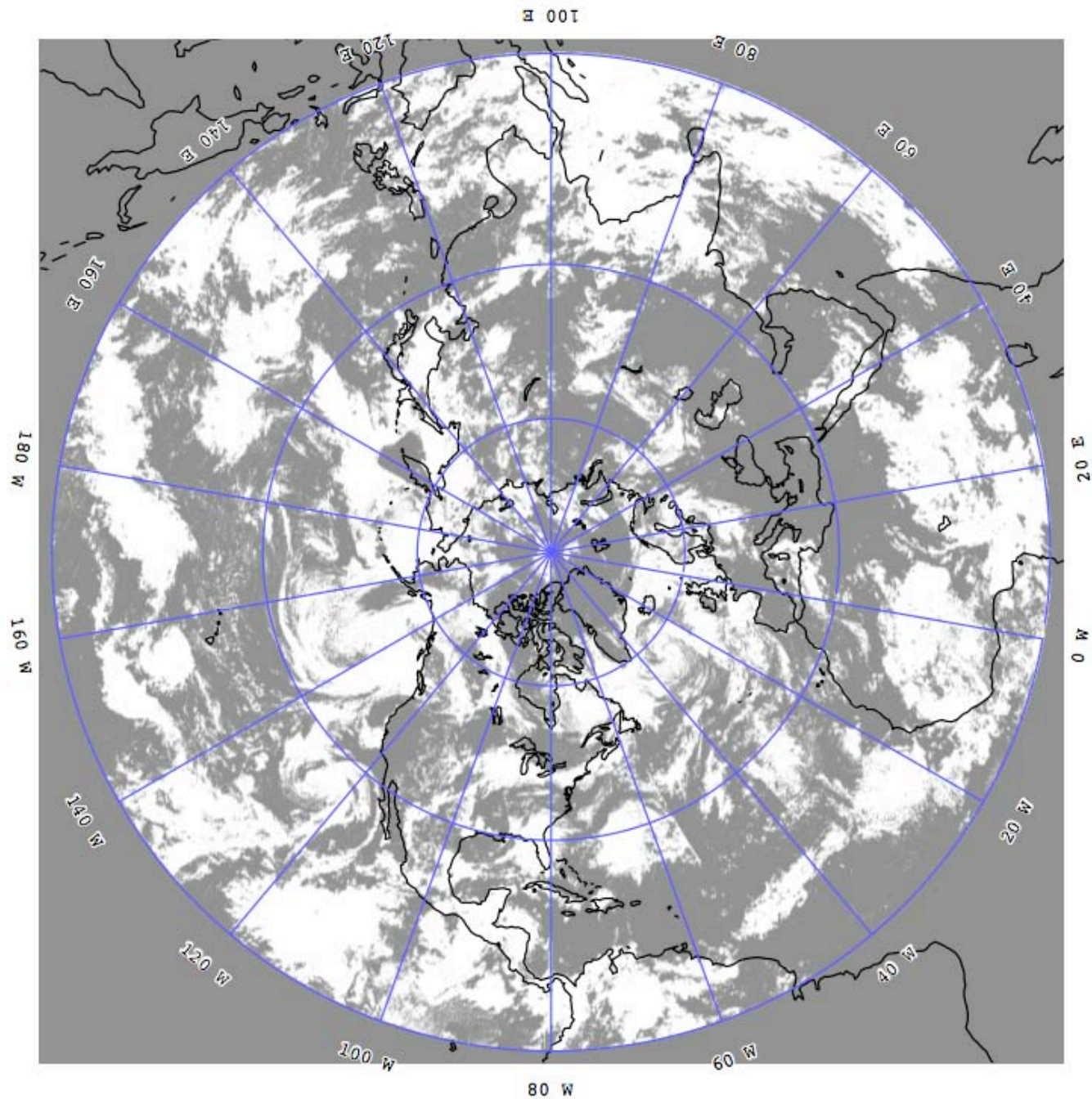
Surface Temp Analysis  
Resolution: 25 nm  
Obs: IR imagery,  
SSM/I Temp  
Freq: 3 Hourly

## World-Wide Merged Cloud Analysis (WWMCA)

Hourly, global, real-time, cloud analysis @12.5nm

*Total Cloud and Layer Cloud* data supports  
National Intelligence Community, cloud  
forecast models, and global soil temperature  
and moisture analysis.





WWMCA\_TOTAL\_CLOUD\_PCT\_NH\_2009082700



# Multi-Category Contingency Tables

- Used to verify cloud forecasts
  - Total cloud percentage
  - 3 thresholds define a 4x4 contingency table

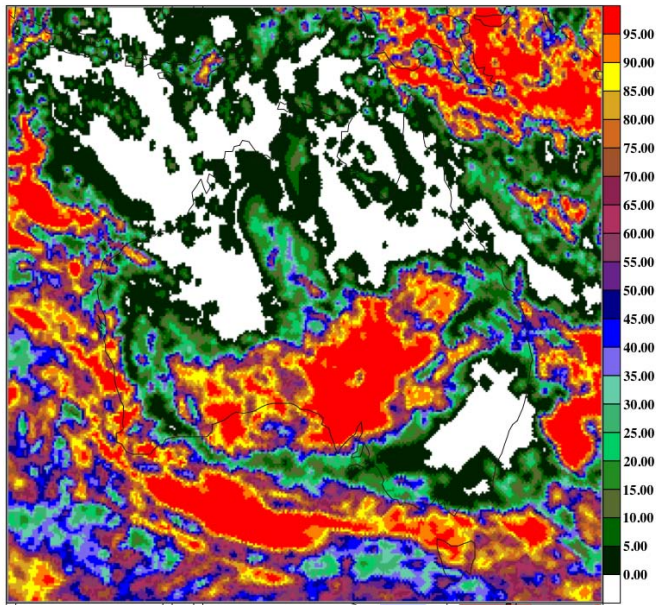
	OBS $\leq$ 25	25 < OBS $\leq$ 50	50 < OBS $\leq$ 75	75 < OBS
FCST $\leq$ 25				
25 < FCST $\leq$ 50				
50 < FCST $\leq$ 75				
75 < FCST				

- Derived Statistics
  - ▣ Accuracy (% correct on diagonal)
  - ▣ Hanssen and Kuipers Discriminant
  - ▣ Heidke Skill Score
  - ▣ Gerrity Score

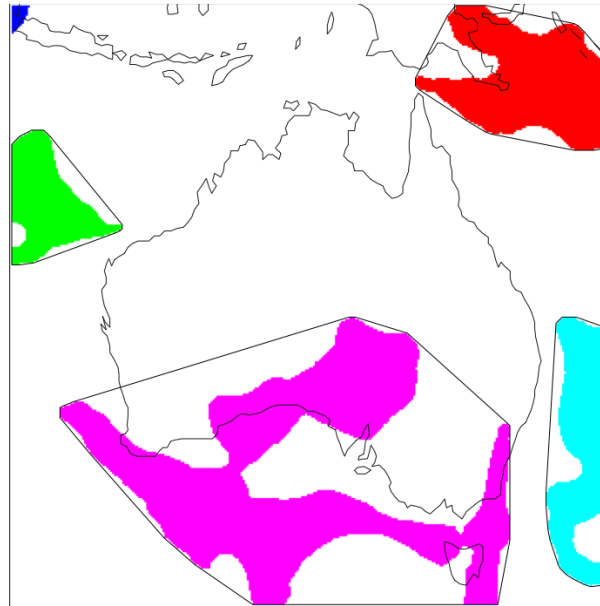
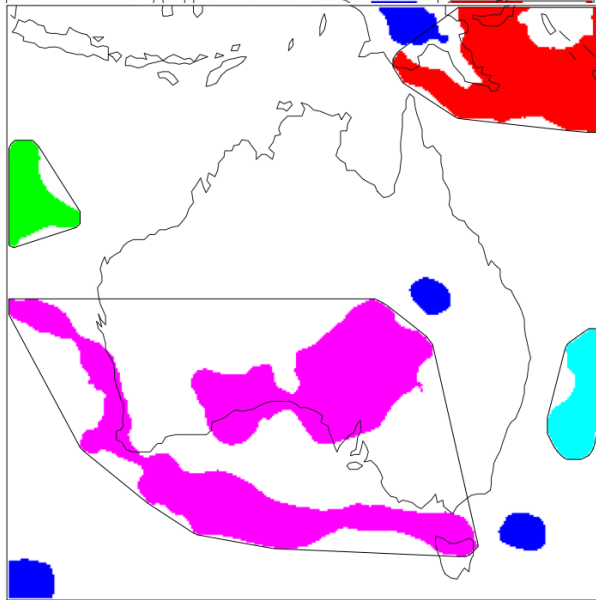
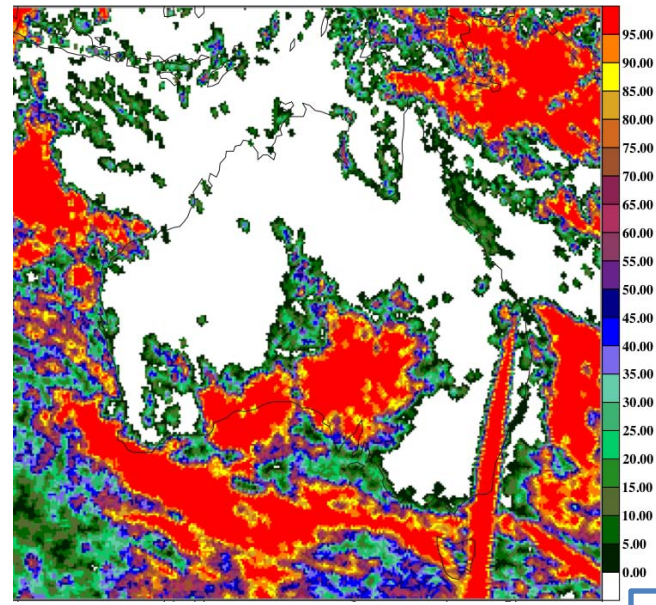
	MF	MO	ME	RMSE	ACC	HK	HSS	GER
ADVCLD NH	39.7	44.5	-4.8	38.5	50%	.25	.36	.48
ADVCLD SH	38.2	48.2	-9.9	43.6	50%	.28	.29	.37
DCF C (45km)	48.1	45.3	2.7	45.6	51%	.26	.27	.37
DCF U (15km)	35.0	43.1	-8.1	39.6	57%	.30	.32	.42
DCF U neighborhood	35.0	43.1	-8.2	38.4	57%	.31	.32	.42
SCFM G	43.5	44.8	-1.15	40.6	46%	.23	.23	.32
SCFM NH	44.0	44.5	-0.5	38.3	51%	.29	.28	.39
SCFM SH	40.2	47.1	-6.9	41.3	46%	.23	.22	.31

**WARNING: Only a few days of example data included. Results meaningless and for example only.**

Forecast



Observation



Area Ratio: 0.88

Centroid  
Distance: 22.5  
grid squares



# Conclusions

- Include more satellite formats for evaluation of cloud forecasts.
- Add appropriate satellite data preprocessing.
- Enhanced database and display capability.
- Determine utility of spatial methods (wavelet, neighborhood, MODE) for verifying cloud forecasts.
- Implement VAG recommendations based on workshop outcomes.