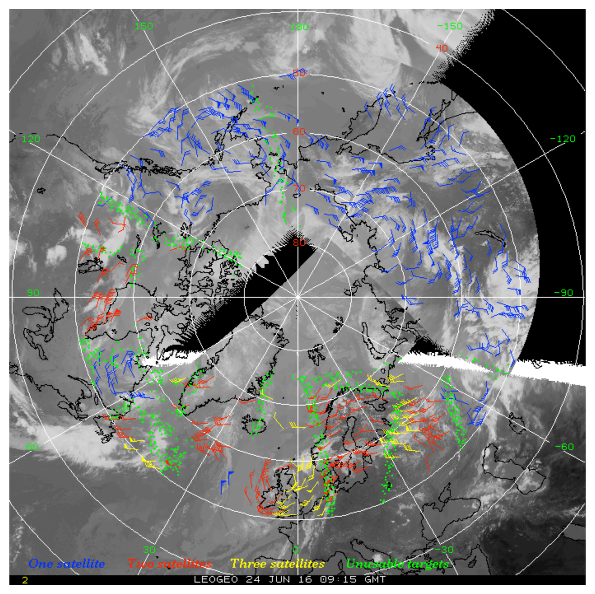
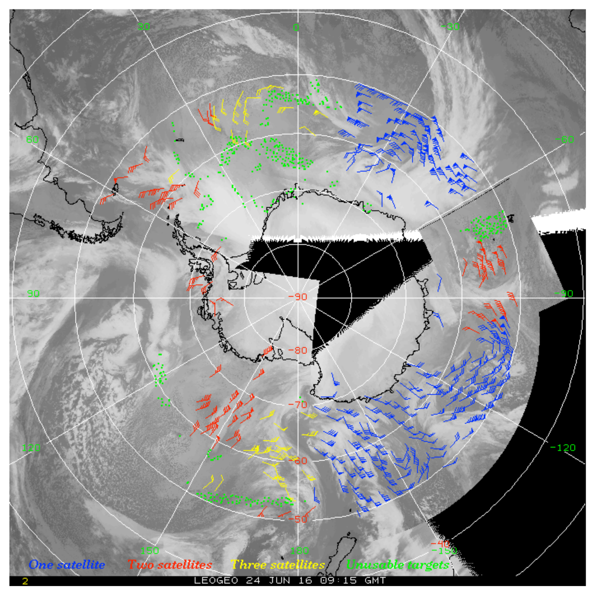
P8



Assimilation and Forecast Impact of the Leo/Geo AMVs in the GDAS/GFS

David Santek[1], Brett Hoover[1], Maria Madsen[2]

[1]Space Science and Engineering Center, Madison, Wisconsin
[2]Department of Atmospheric and Oceanic Sciences, University of Wisconsin-Madison



Introduction

Deriving Atmospheric Motion Vectors (AMV) from satellite images has been done successfully for many years from both geostationary and polar orbiting platforms. The spatial coverage of satellite-derived AMVs is generally equatorward of 60° latitude for geostationary satellites and poleward of 70° latitude for the polar satellites. This coverage results in a 10° gap, which has been noted as a potential problem by numerical weather prediction (NWP) centers. Specifically, the dynamically active polar jet stream can be located in this latitudinal zone and improper model initialization may lead to errors in the forecasts.

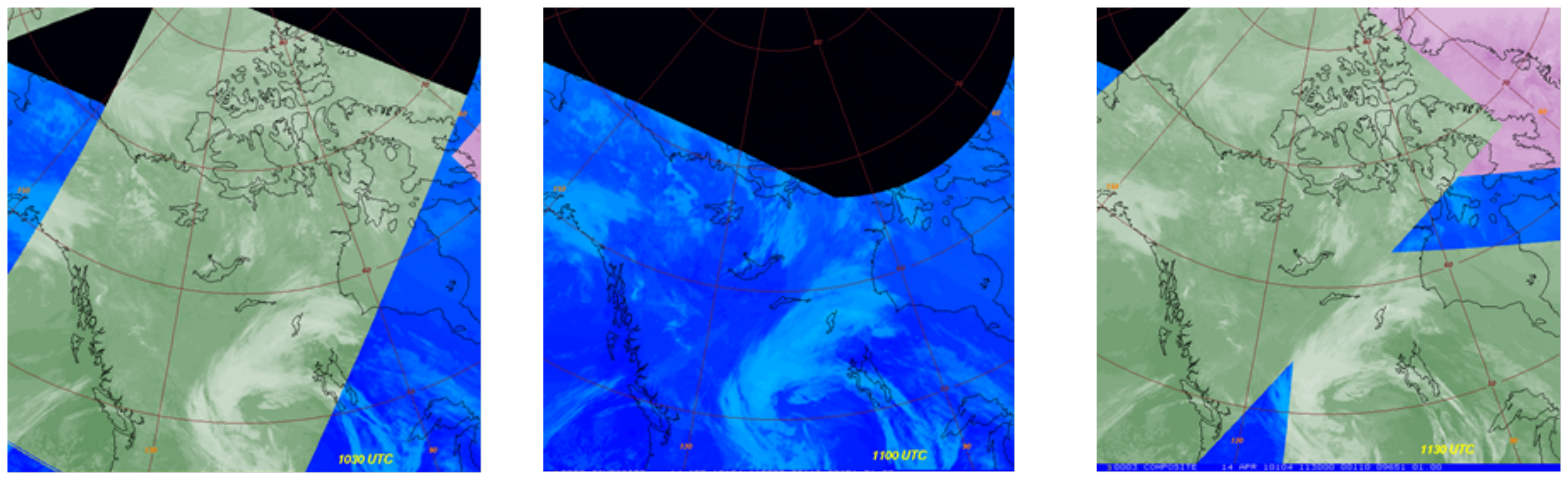
A novel technique was developed to fill this AMV-void gap using an advanced image compositing technique designed to blend the data from the many polar (e.g., NOAA AVHRR, Metop AVHRR, Terra/Aqua MODIS) and geostationary (e.g., GOES, Meteosat, Himawari 8) weather satellites. We are currently producing in real-time these composite images and deriving AMVs (known as Leo/Geo winds). Several NWP centers are incorporating these winds into their operational global models.

Image Compositing Technique

Blend data from the many polar and geostationary weather satellites, preserving the following pixel level quantities:

1. Brightness temperature
2. Scan time
3. Pixel distance from satellite subpoint
4. Pixel area
5. Satellite ID
6. Sensor wavelength
7. Parallax distance
8. Parallax direction

These quantities are used to determine the how the composite is generated, depending on the application. In this case, satellite-derived winds at high latitudes require the highest resolution data, while carrying ancillary information of time and viewing geometry (to account for parallax) at each pixel.



A time sequence of three infrared composites from 1030, 1100, 1130 UTC on 14 April 2010. The color represents pixel resolution corresponding to a satellite image type: geostationary (blue), AVHRR GAC (magenta), and Metop AVHRR or Terra and Aqua MODIS (green).

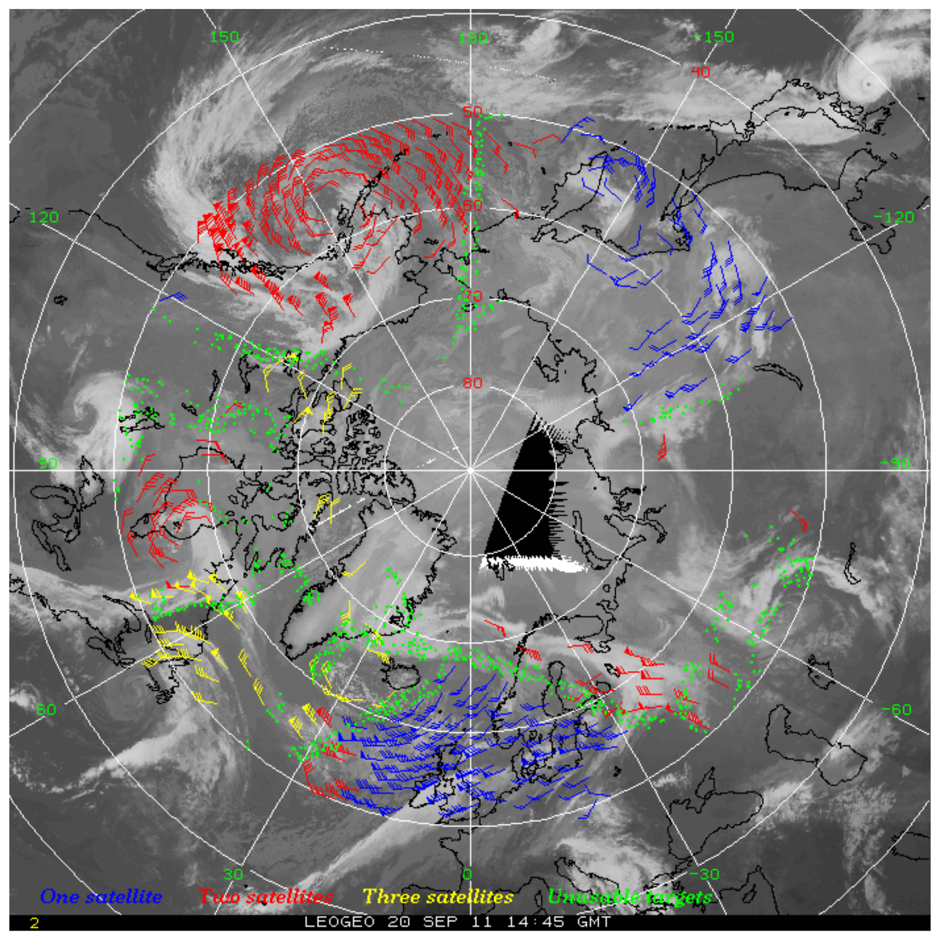
Winds Algorithm

Vectors are generated from either **single** satellite or by mixing **two** or **three** satellites.

Tracking can use data from different satellites in the 3 images (accounts for time and parallax at each pixel)

Target/search box in each individual image must be from a single satellite

Potential targets that cannot be tracked: mixed satellites within target or search box



Acknowledgements

Funding for this research was provided by NOAA grant NA15NES4320001.

Validation with RAOBs

Northern Hemisphere				
POES	# OBS =	3817	V_{rmse} =	5.54
GOES	# OBS =	200953	V_{rmse} =	6.08
MIX	# OBS =	55943	V_{rmse} =	6.77

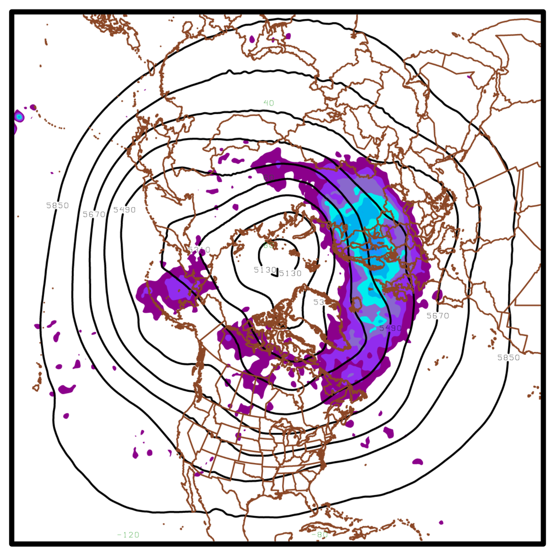
Southern Hemisphere				
GOES	# OBS =	1738	V_{rmse} =	7.75
MIX	# OBS =	188	V_{rmse} =	7.66

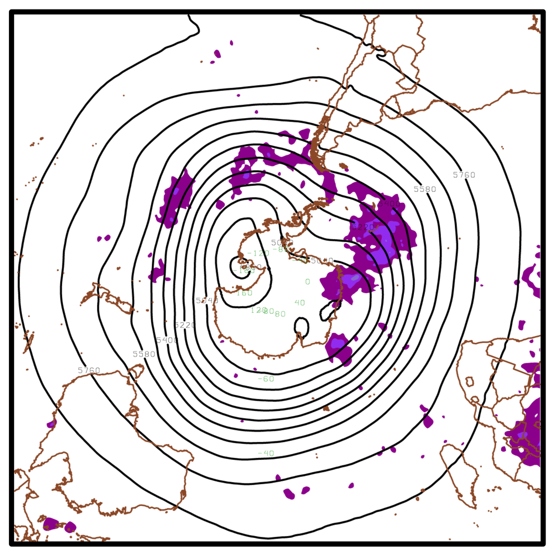
In both hemispheres, the Leo/Geo AMVs express RMSE values on-par with other satellite winds.

GDAS/GFS Experiments: 01 April – 23 May 2014

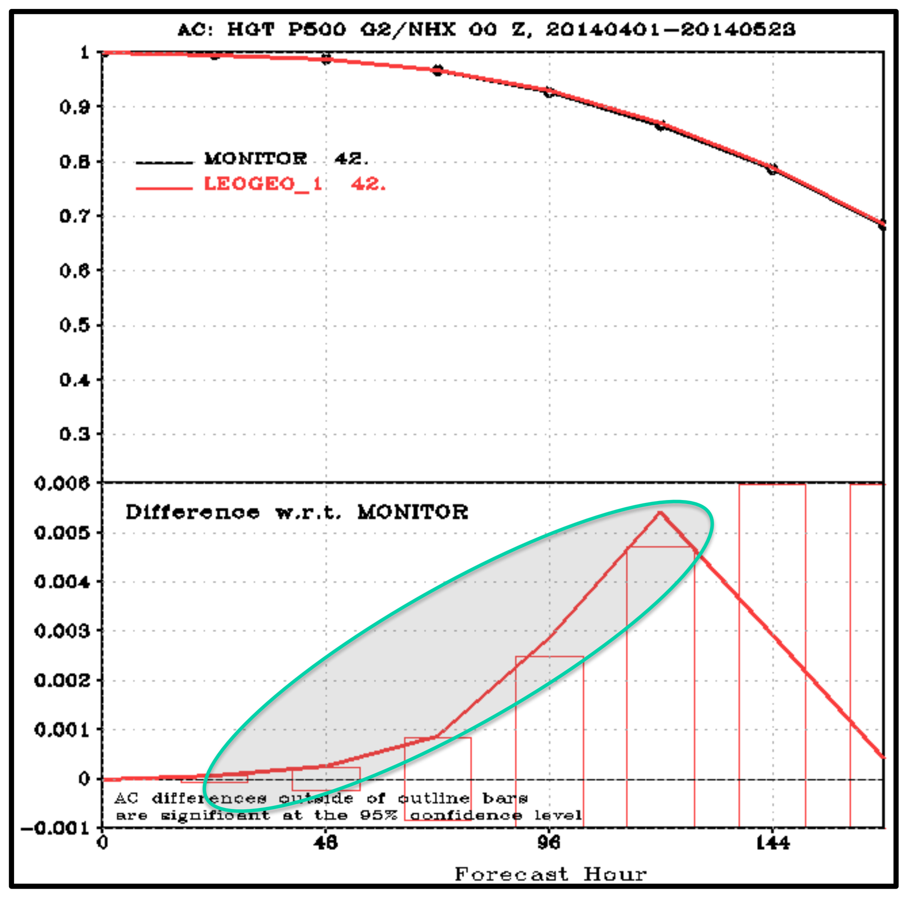
- T670 GDAS/GSI on S4 at SSEC
- Analyses produced every 6 hours
- 168-hour forecasts every 0000 UTC
- Ingest Leo/Geo winds through GSI

Impact of AMVs on 500 hPa analysis heights exhibits geographic preference. Greatest impact in region covered by Meteosat (highest temporal availability)

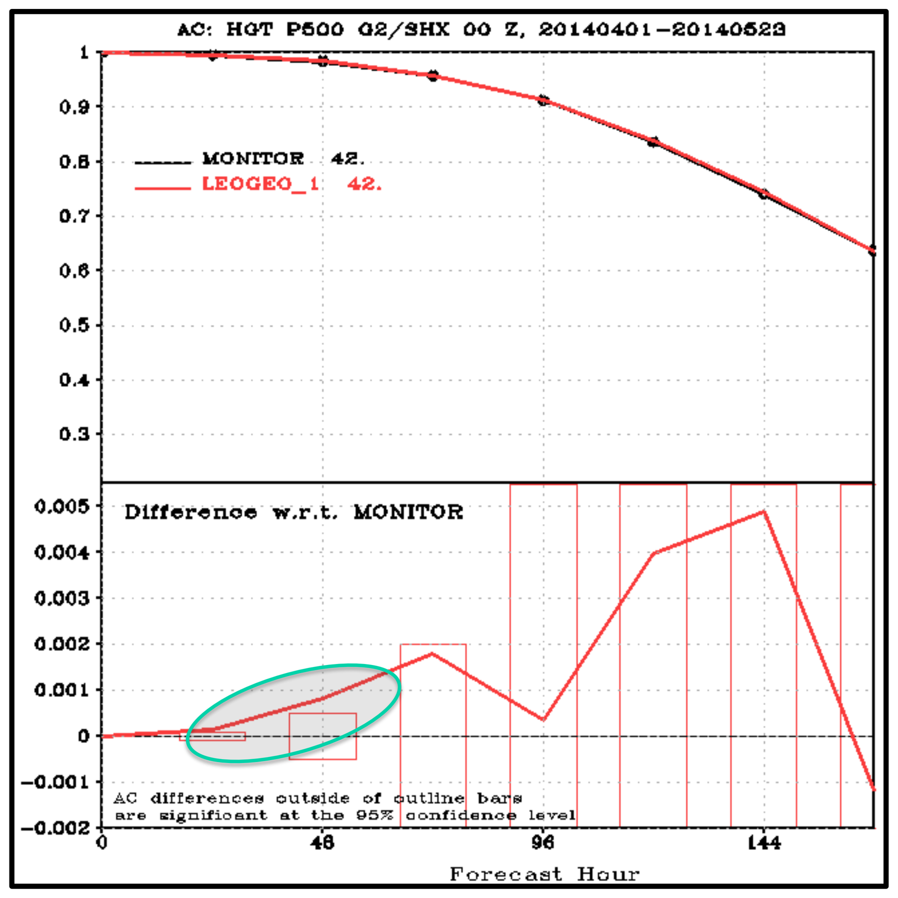




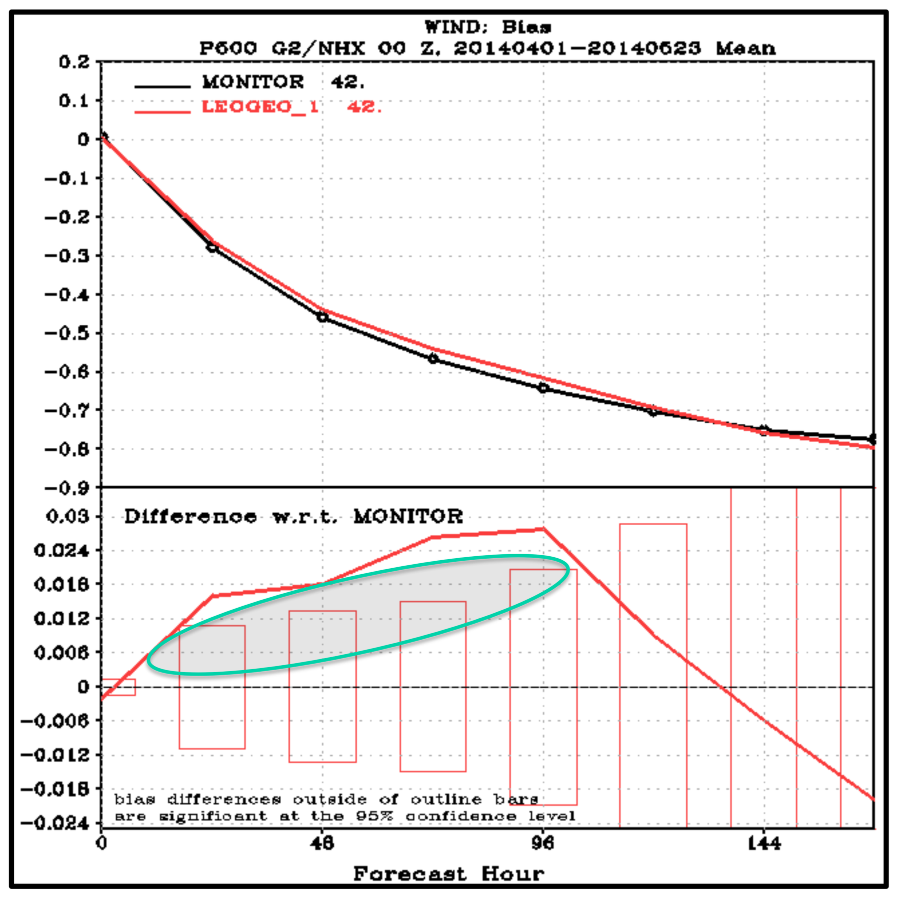
GFS Forecast Impact: Anomaly Correlation



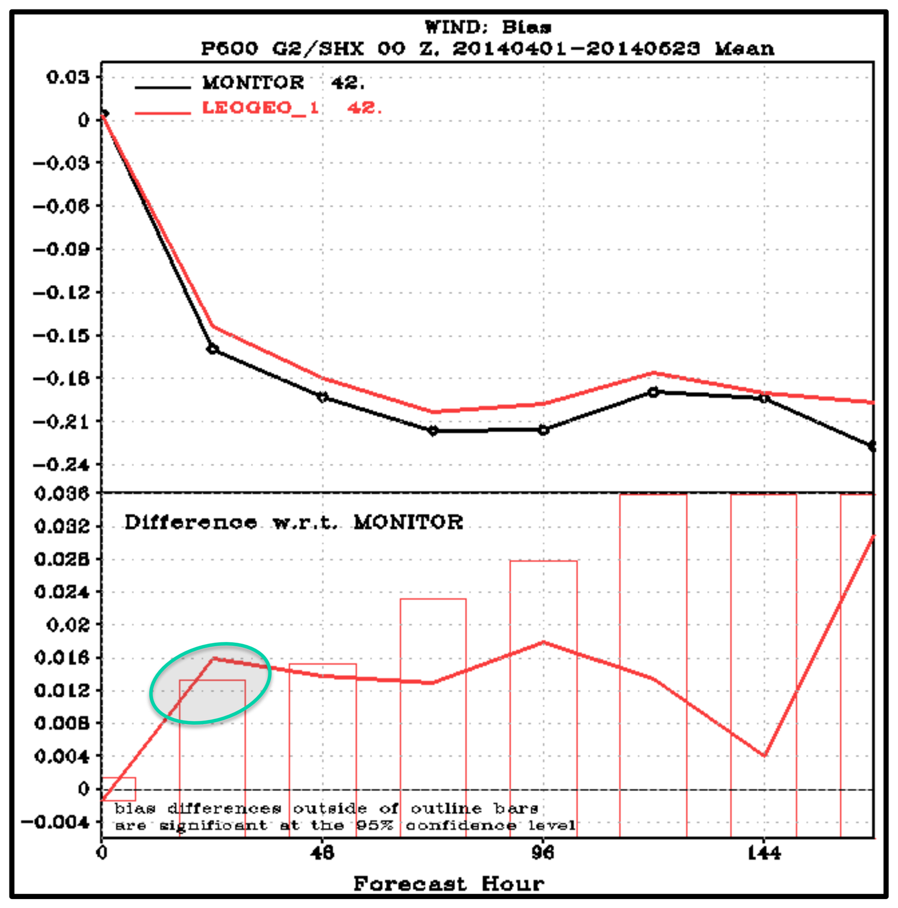
Northern Hemisphere: **500 hPa height** improvement statistically significant for **24-120 hour forecasts**



Southern Hemisphere: **500 hPa height** improvement is statistically significant for **24-48 hour forecasts**



Northern Hemisphere: **500 hPa wind speed bias** improvement statistically significant for **24-96 hour forecasts**



Southern Hemisphere: **500 hPa wind speed bias** improvement is statistically significant for the **24 hour forecast**