Comparison of MISR and Meteosat-9 Cloud Motion Winds

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MARIE CURIE ACTIONS

1 Introduction

We compared cloud motion winds (CMWs) from the Multi-angle Imaging SpectroRadiometer (MISR) with visible and infrared CMWs obtained by the Spinning Enhanced Visible and Infrared Imager (SEVIRI) on Meteosat-9 (MSG-2).

Our study employed 1-year worth of data, thus, offers a more robust and detailed evaluation of MISR CMWs than previous comparisons relying on sparse radiosonde or wind profiler observations.

For the year 2008, we found 225,155 collocated wind pairs including only good quality retrievals from both data sets.

2 Methodology

MISR CMWs
- TC_STEREO product version F08-0017
- Paths 150 – 230
- Wind quality "good" or "very good"

Meteosat-9 CMWs
- Visible and infrared winds
- Quality Indicator without first guess >80%
- Cloud top pressure converted to geometric cloud top height using ERA-Interim reanalysis

Finding collocations with:
- $\triangle$lat and $\triangle$lon $\leq 0.5^{\circ}$
- $\triangle$time $\leq$ 15 min
- Meteosat-9 CMW closest to MISR CTH
- Filtering of MISR"clear sky winds"

3 Annual Mean Results

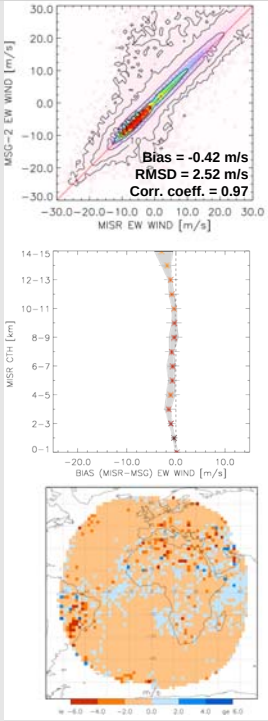
Scatterplots of MISR and Meteosat-9 CMWs & CTHs

Vertical profiles of MISR and Meteosat-9 CMW & CTH bias

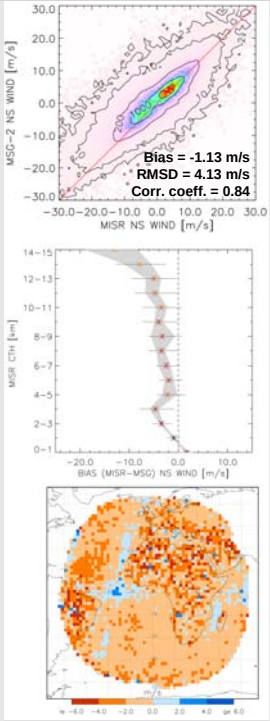
Spatial variation of MISR and Meteosat-9 CMW & CTH bias

$$bias = \frac{1}{N}\sum_{i=1}^{N}(MISR_i - MSG2_i)$$

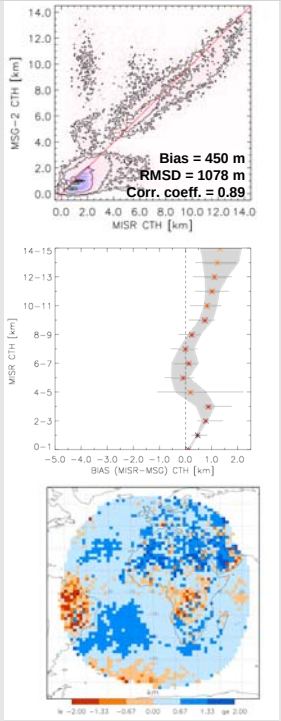
EW Wind



NS Wind



Cloud Top Height



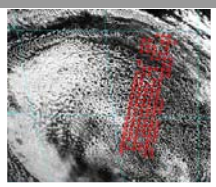
Summary

Biases in EW wind are typically small and negative over both land and ocean. Variation with height is also weak.

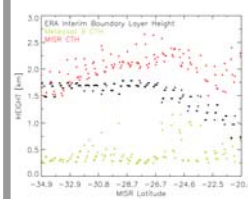
Biases in NS wind are also mostly negative but larger than those in EW wind, especially over land.
They show strong variation with height.

Biases in CTH are mostly positive, except for some regions in Brazil and Central Africa. There is clear dependency on cloud altitude.

4 Case Study

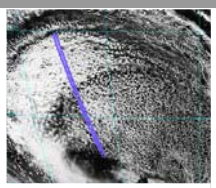


10:42-UTC SEVIRI image with MISR wind locations from orbit 46033 overlaid.

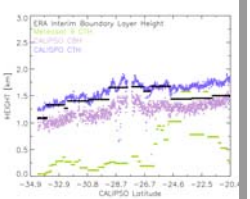


Corresponding MISR and Meteosat-9 CTHs, and ERA-Interim BLHs.

In this extensive and persistent marine Sc-field MISR and Meteosat-9 CMWs were in excellent agreement (both speed and direction). However, MISR CTHs compared better with CALIPSO CTHs and ERA-Interim boundary layer heights (BLHs) than Meteosat-9 CTHs. Meteosat-9 CTHs significantly underestimated even CALIPSO cloud base heights (CBHs).



14:42-UTC SEVIRI image with CALIPSO retrieval locations overlaid.



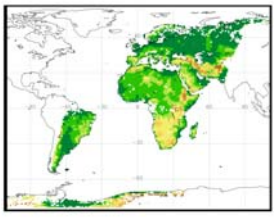
Corresponding CALIPSO CBHs and CTHs, Meteosat-9 CTHs, and ERA-Interim BLHs.

5 MISR "Clear Sky Winds"

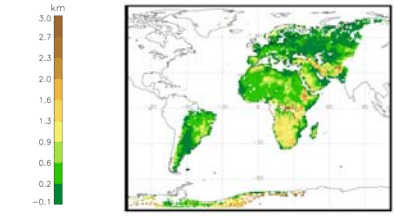
MISR does not employ target selection, thus, makes retrievals over cloud-free land domains too. These "clear sky winds" put lower bounds on MISR CMW and CTH errors.

If camera co-registration is accurate, clear sky wind speeds are near zero and heights are close to the scene elevation.

Mean "wind" heights, calculated from a total of 147,602 clear sky retrievals, were in excellent agreement with mean scene elevations, indicating accurate MISR navigation.



Average scene elevation for cloud-free land domains from DEM.



Average MISR "wind" height for cloud-free land domains.

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