

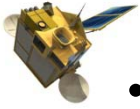
# The impact of window size on AMV



E.H. Sohn and R. Borde



# Objectives



- The operational AMV determination at Korea Meteorological Administration (KMA) uses cross-correlation method with target box size of 32x32 pixels (larger than 160km X 160 km) which can include broad cloud with multi-layer atmospheric motion system.
- The purpose of this preliminary study is to check the impact of target box size on the AMV extraction.
- AMV information (speed, direction and height) derived from several target box size is compared with those of current target size (32X32 pixels).



# Contents



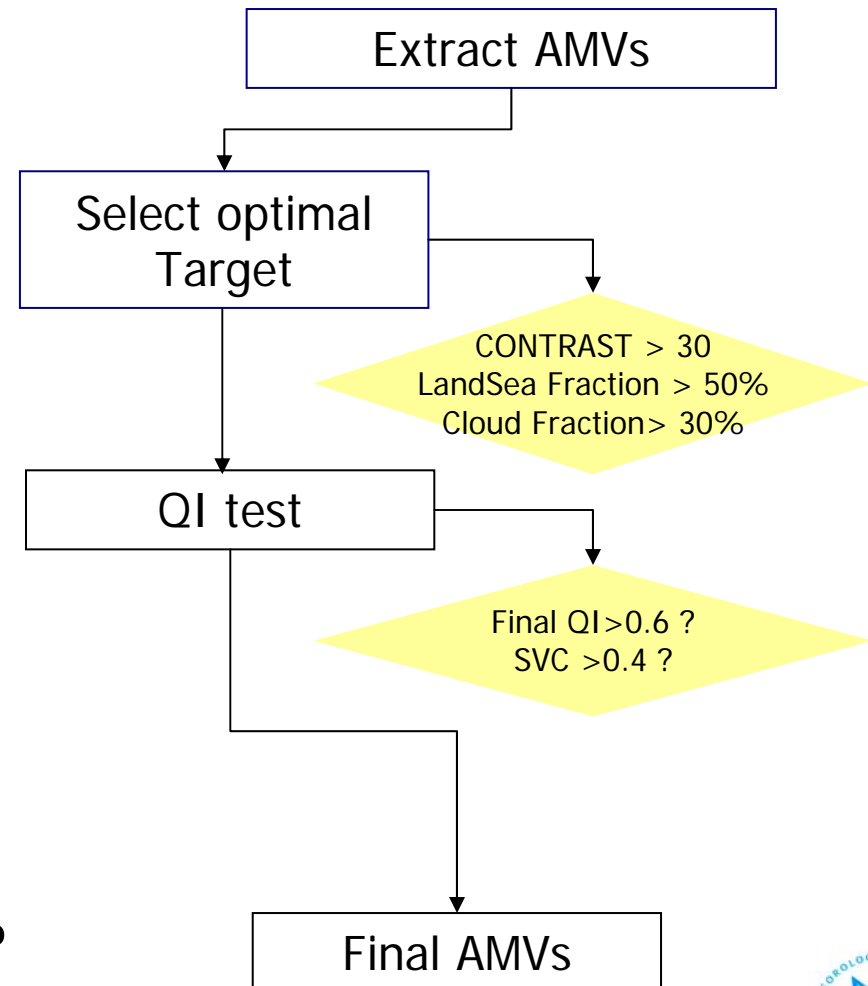
- AMV scheme
- 1<sup>st</sup> study: Various target box size AMVs intercomparison
- 2<sup>nd</sup> study: Mean flow 32x32 against average local flows 8x8 and/or max. QI local AMV 8x8
- 3<sup>rd</sup> study: Comparison against Rawin-sonde observation
- Future works



# AMV estimation

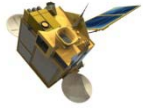


- Use regular grid to extract AMV
- Vector tracking : Cross Correlation Method
- Select optimal targets of all of AMVs using CONTRAST etc.
- Height Assignment : EBBT Method using 15% the coldest pixels within target box.
- Hunt final AMVs out with QI scheme developed by EUMETSAT (W/O NWP comparison)

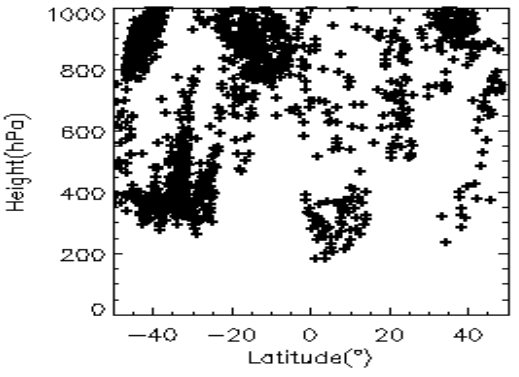
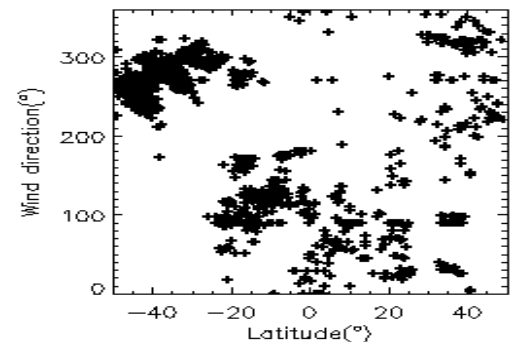
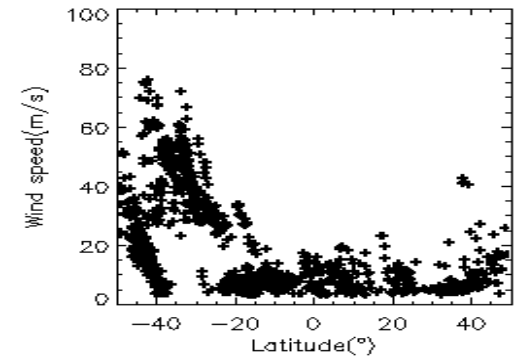
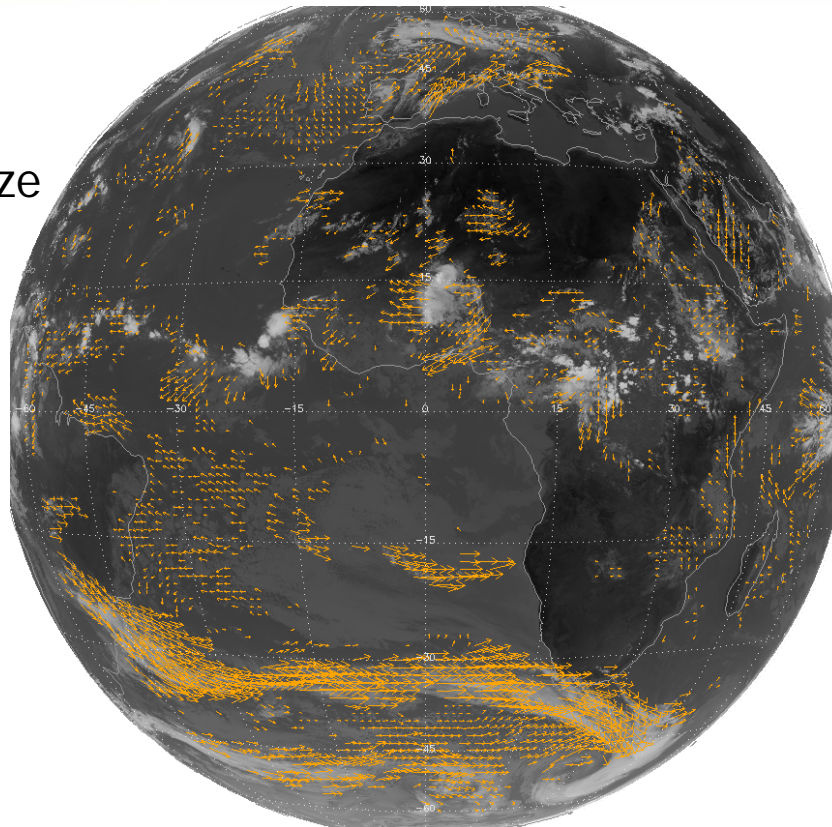


# Data set

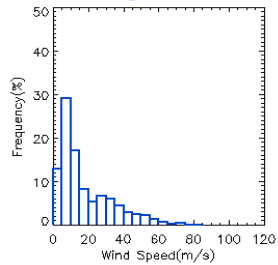
MSG SEVIRI IR channel  
(12:12, 12:27, and 12:42UTC, 18, Aug., 2006)



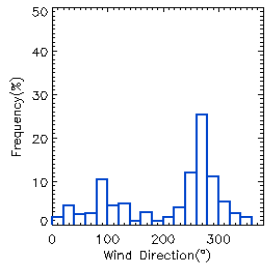
AMV  
from Target box size  
32x32



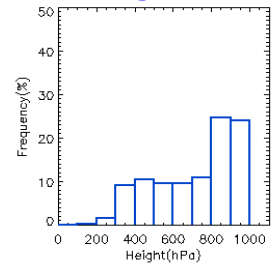
Wind Speed(m/s)



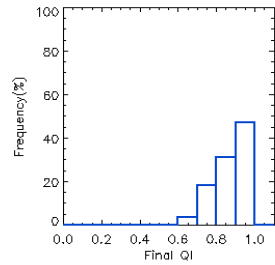
Wind direction(°)



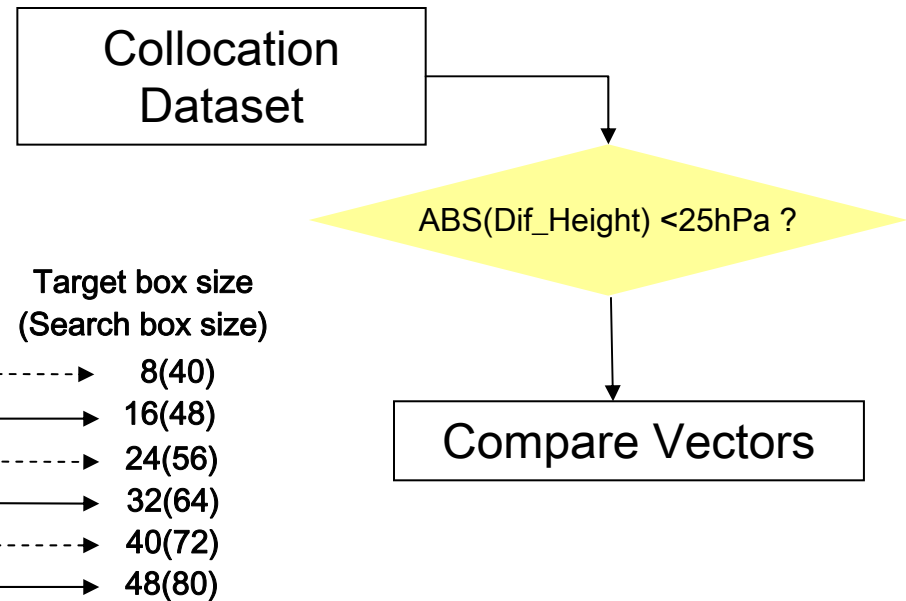
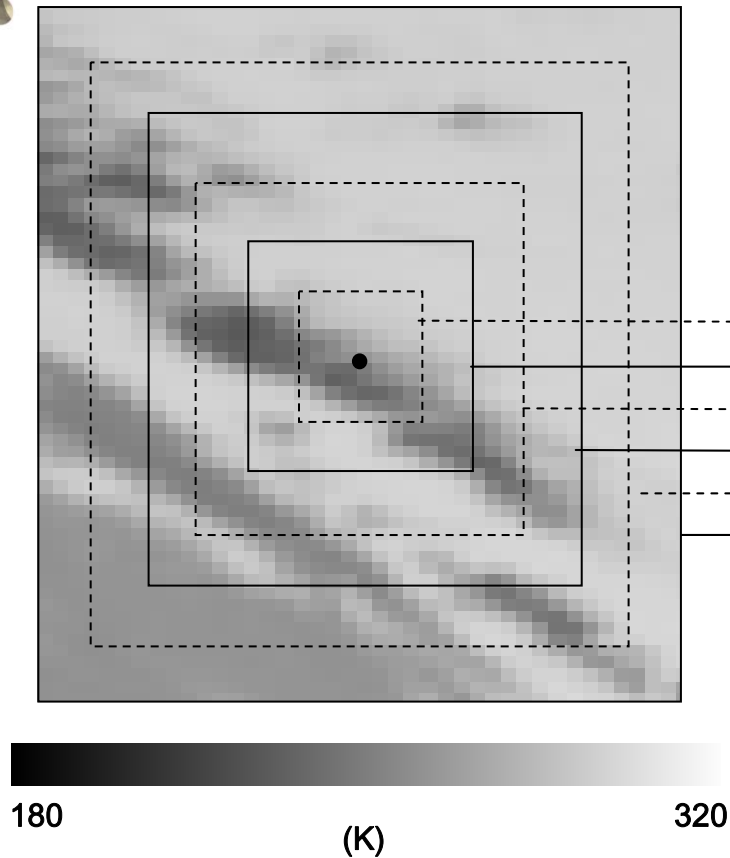
Height(hPa)



Final QI



# 1<sup>st</sup> study: AMVs extracted at same location



- extract AMV from 6 target box sizes at the same location.
- set search box size to get the maximum wind speed, about 88m/s.
- Select AMV within 50 hPa by comparing with height of AMV from target box size 32x32.
- Compare AMV from various target box size



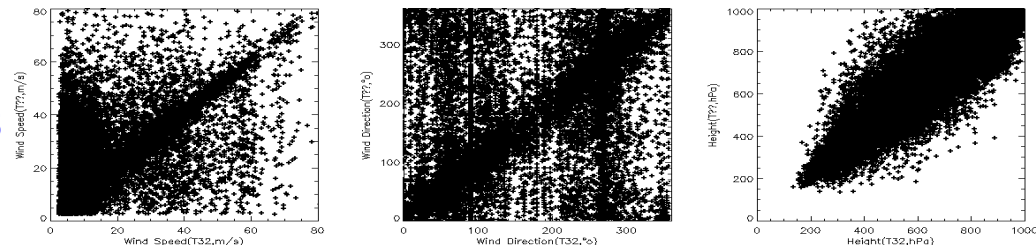
Wind speed(m/s)

wind direction(°)

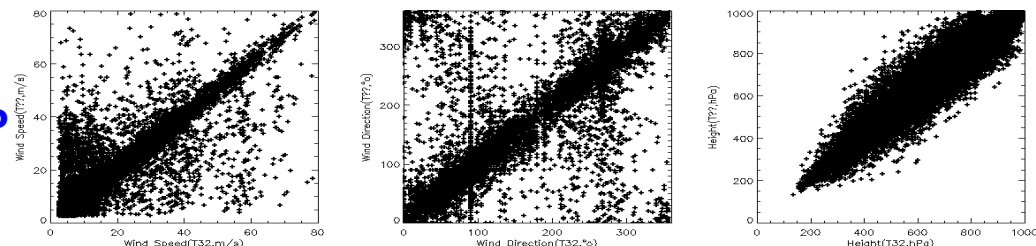
height(hPa)



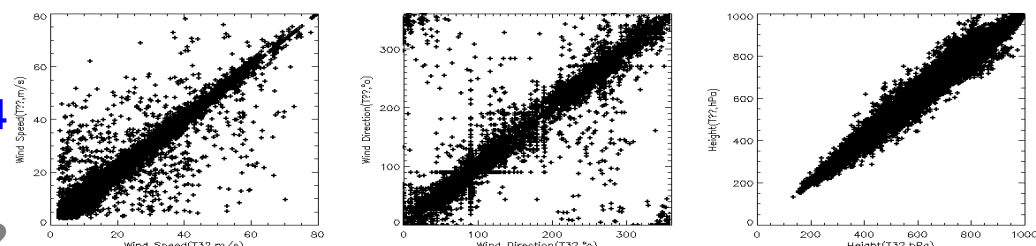
8x8



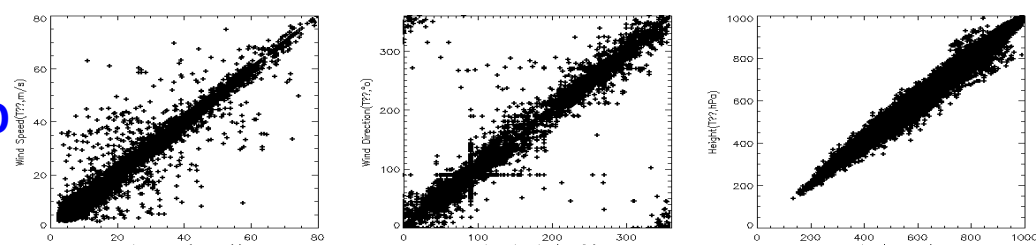
16x16



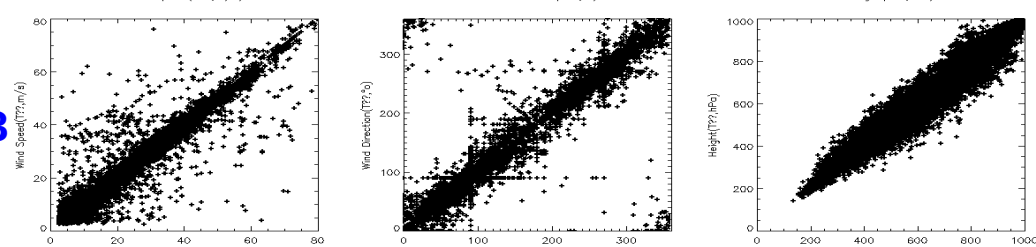
24x24



32x32



40x40



48x48

32x32

No filtering

- Smallest target size results are very noisy for AMV speeds and directions

- Height less spread out

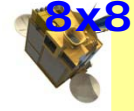
- better agreement with close target sizes (24x24 and 40x40)



Wind speed(m/s)

wind direction(°)

height(hPa)



8x8

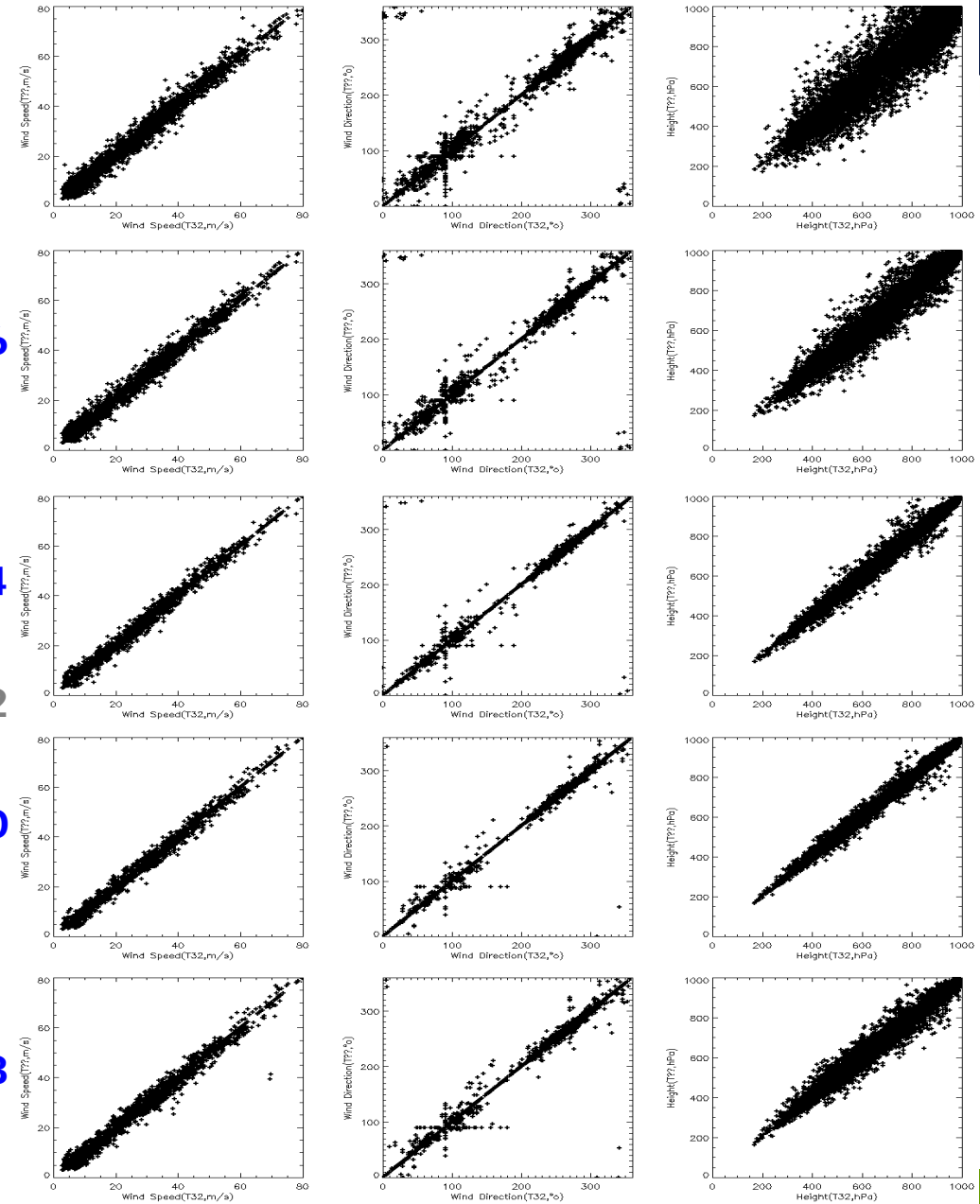
16x16

24x24

32x32

40x40

48x48



32x32

## QI filter

(AMV from every target box size is removed when final qi is less than 0.6)

- Due to strong impact of QI filter, few AMVs remained.
- Similar impact of QI filter for all target sizes (speed and direction)
- moderate impact on height





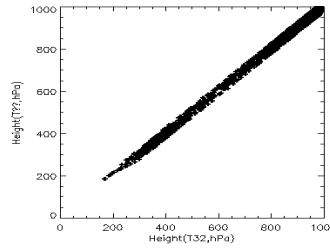
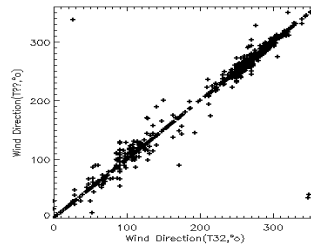
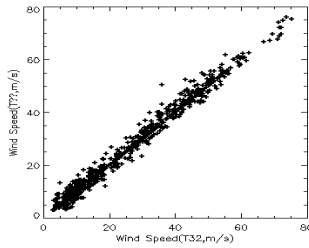
Wind speed(m/s)

wind direction(°)

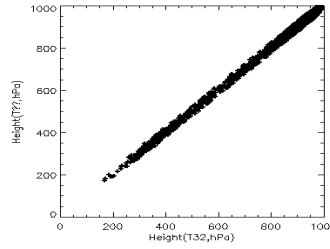
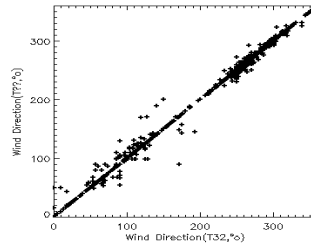
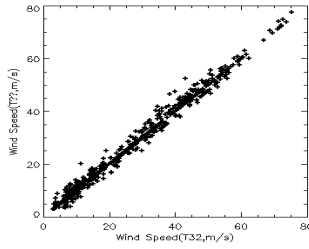
height(hPa)



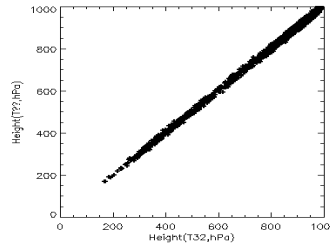
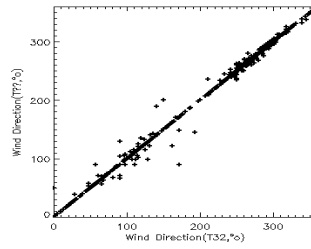
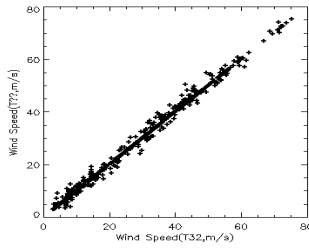
8x8



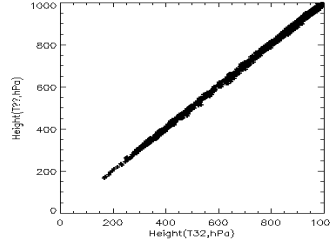
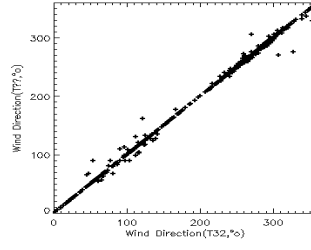
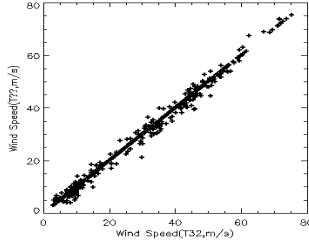
16x16



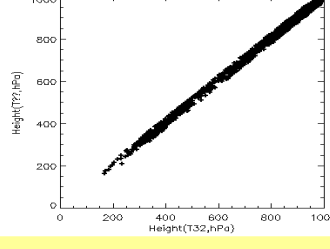
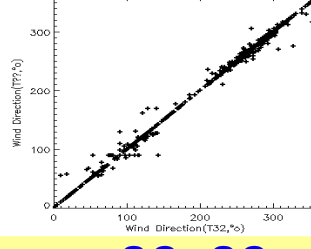
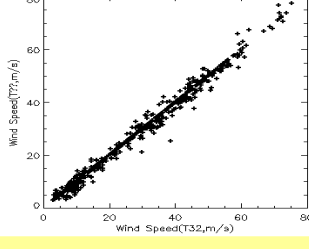
24x24



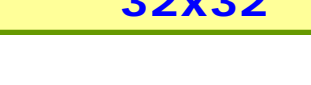
32x32



40x40



48x48



32x32

Q1 filter

+

50hPa filter

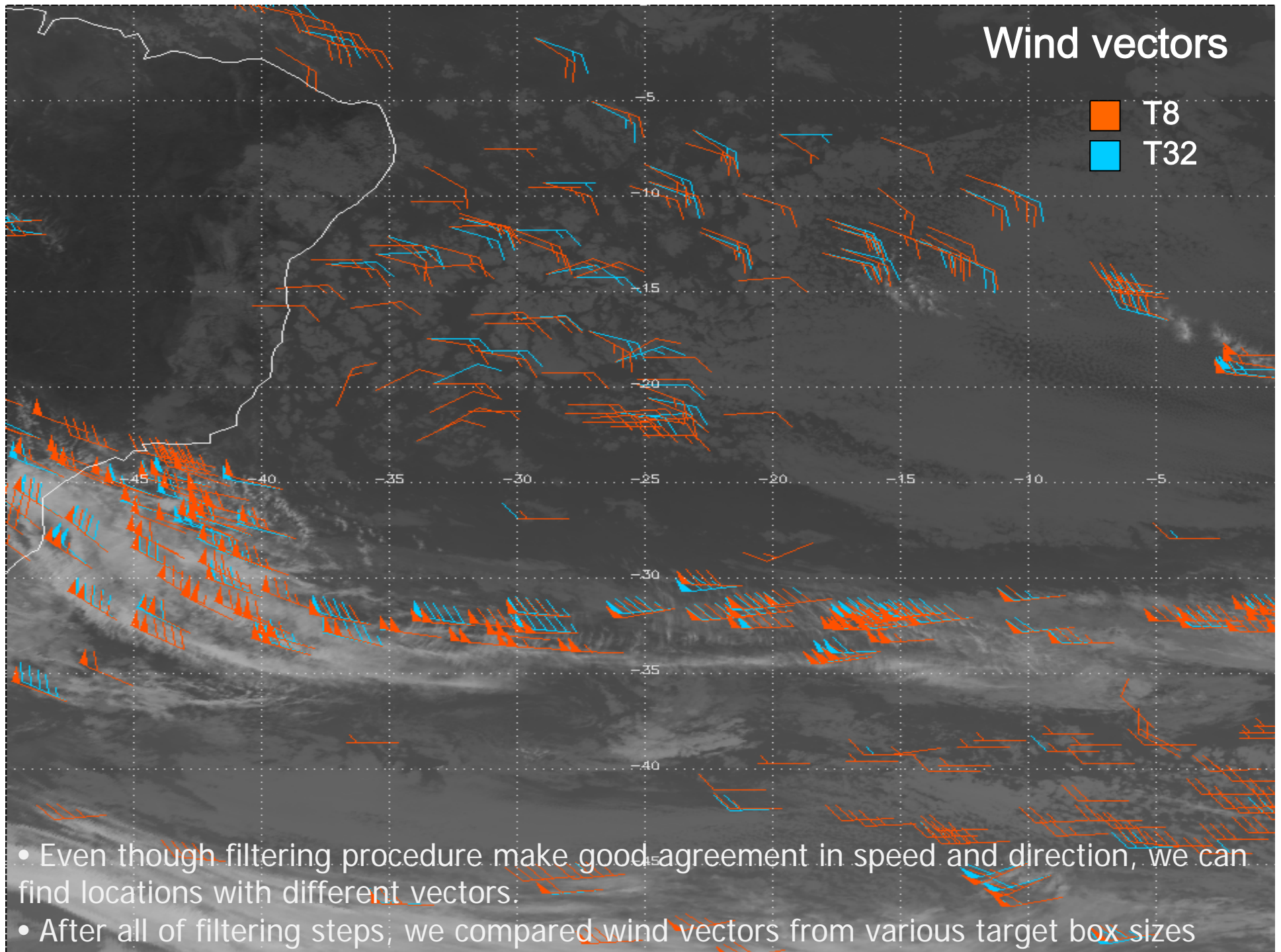
(Another filtering is added to compare AMV results from targets with same cloud feature.

when difference of height between AMVs is greater than 50 hPa, not compared. )

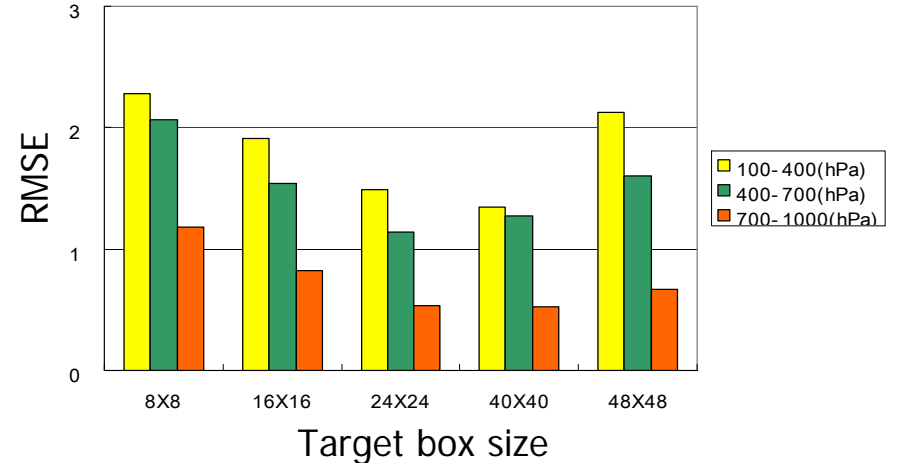
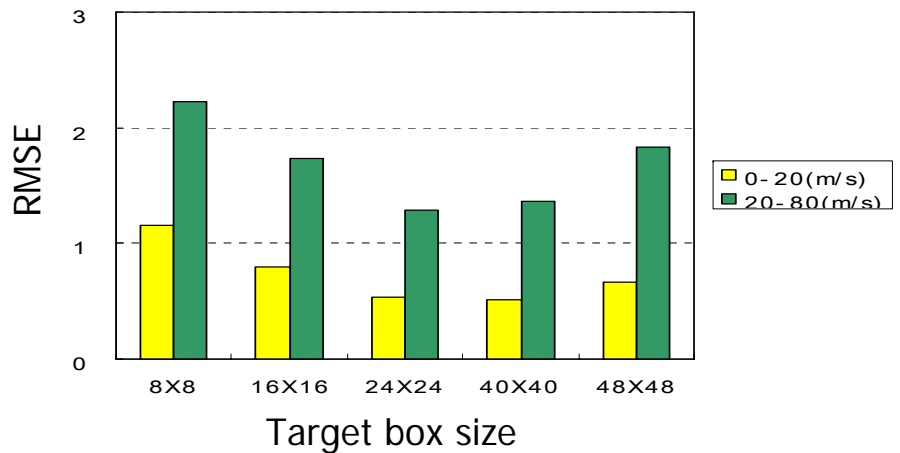
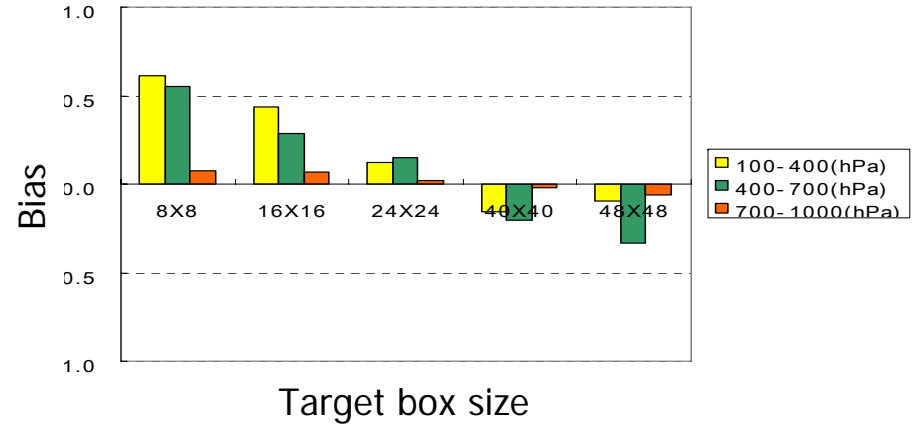
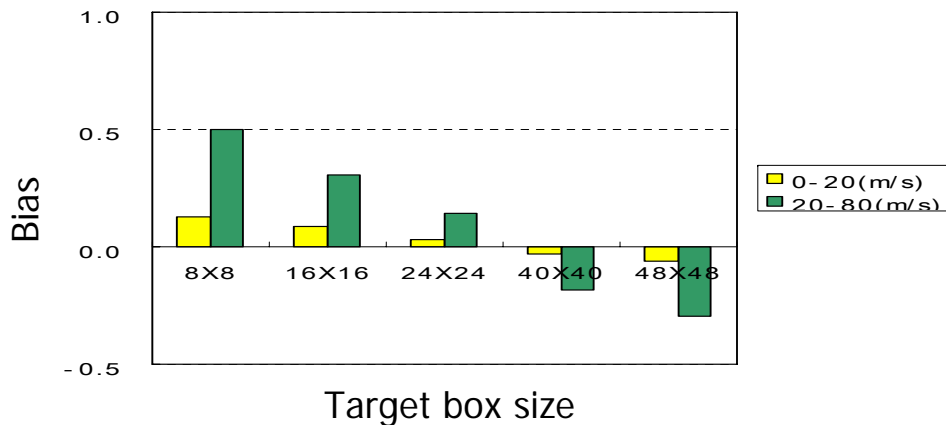
- few AMVs remained.

- No clear positive impact on the speed and/or direction dispersions using 50hPa filter





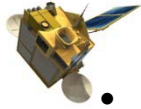
# Bias & RMSE of Wind speed (m/s) for wind speed (left) and height (right) of target box size 32X32



- The smaller target box size than current target box size 32x32 is, the relatively larger bias is, even though it is very small.
- Smaller target box size has positive bias. It means that 8x8 has slightly stronger wind speed than 32x32.
- Larger target box size than current target box size is opposite.
- RMSE is similar to bias.



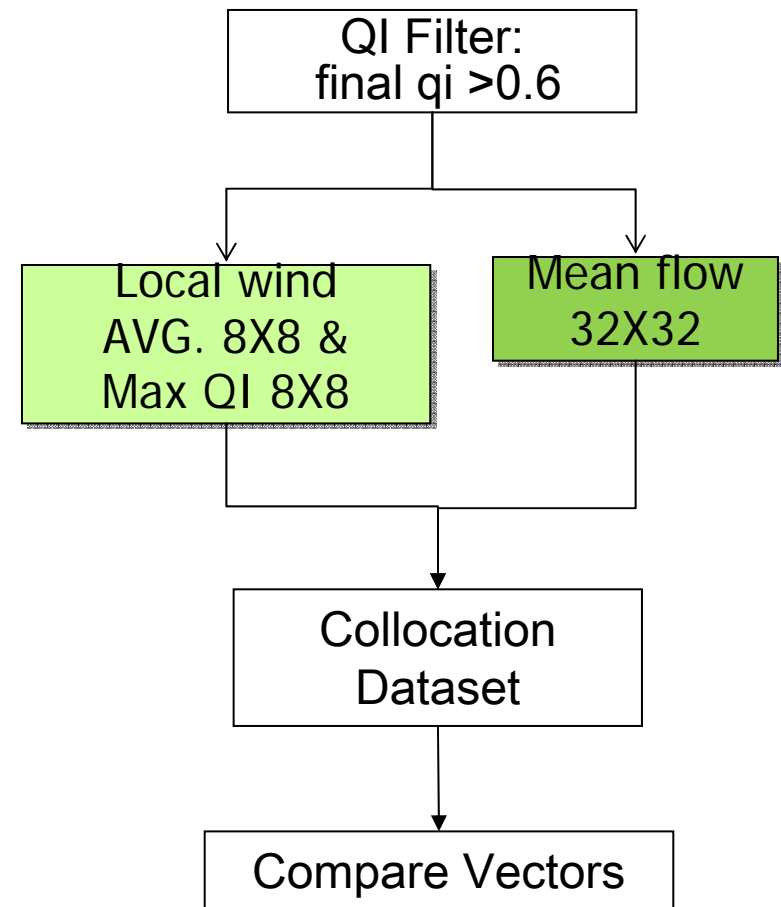
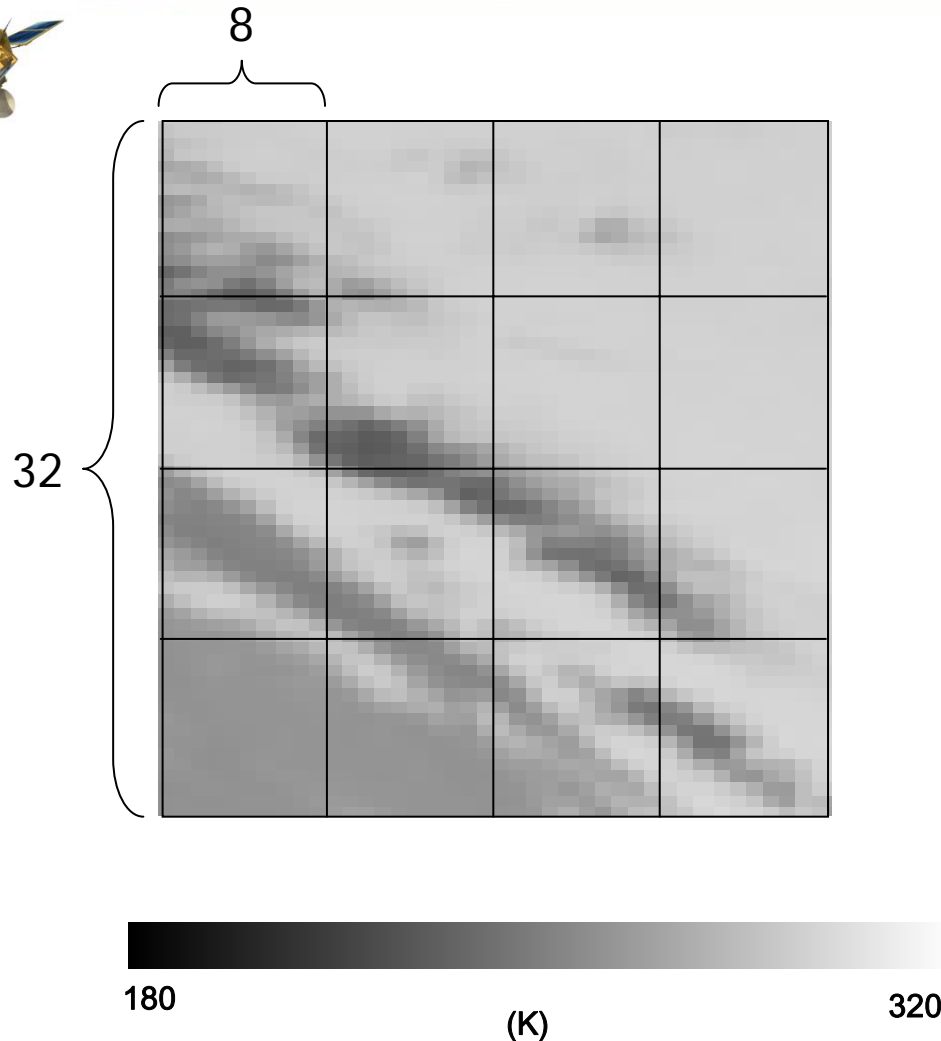
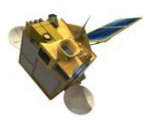
# 1<sup>st</sup> study: preliminary conclusions



- Raw AMV information is very noisy for smallest target box sizes
- Strong impact of QI filter on speed and direction, but lots of AMVs detected at small scales are lost. Similar impact for all of target box sizes.
- The 50 hPa filter does not improve the general agreement in speed and direction. It just reduced the number of AMVs.
- Although using the limited AMV for comparison due to strict filtering, Smaller target box size extracted slightly stronger wind speed than larger target box size.



# 2<sup>nd</sup> study: Mean flow against local AMVs average



- 2<sup>ND</sup> Study is to compare mean flow from target box size 32x32 with local wind from target box size 8x8.
- Local winds are averaged when the number of good winds within 32x32 is greater than 5 and then compared with mean flow.
- As well as, mean flows are compared with local wind with max qi within target box 32x32

Avg.8x8 vs. 32x32

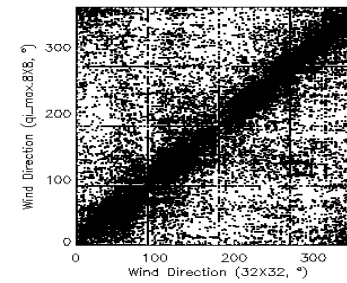
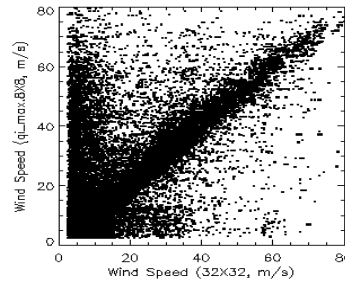
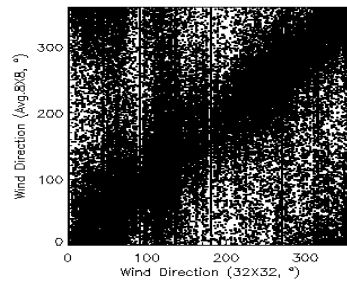
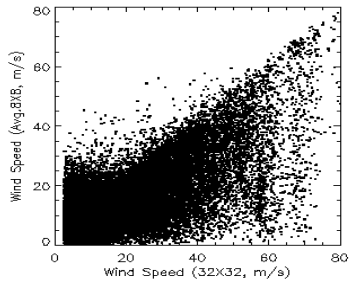
Max QI.8x8 vs. 32x32

Wind speed

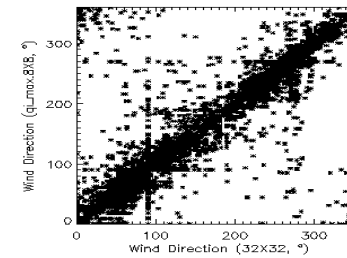
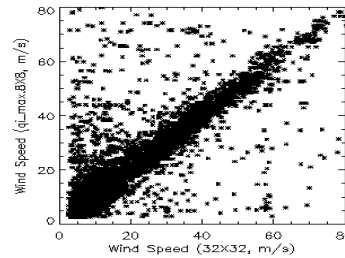
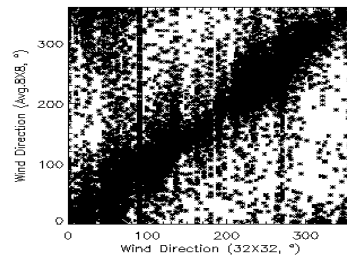
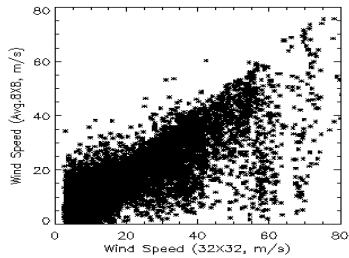
Wind direction

Wind speed

Wind direction



RAW AMV

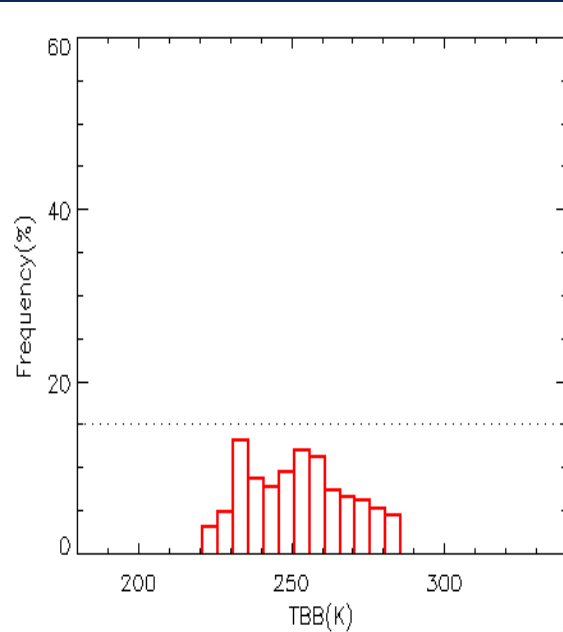
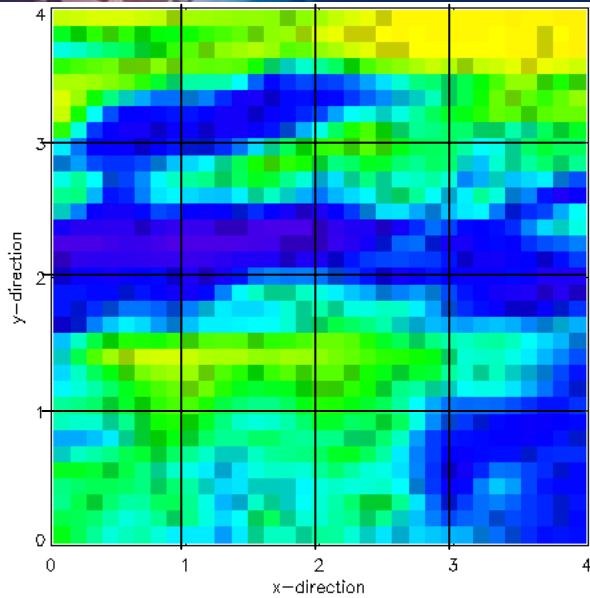


CONTRAST test

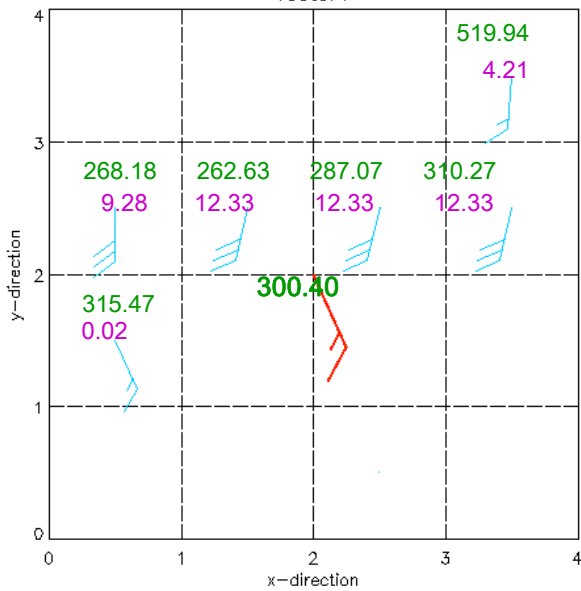
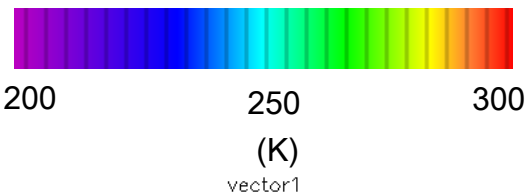
Final qi > 0.6

- Scatter plots of speed and direction between mean flow and averaged local winds (left) / Max qi local winds(right)
- Similar to 1<sup>st</sup> study, filtering process make good agreement between local wind and mean flow.
- Current threshold of qi for 8x8 is very strict and local winds close to mean flow remain.



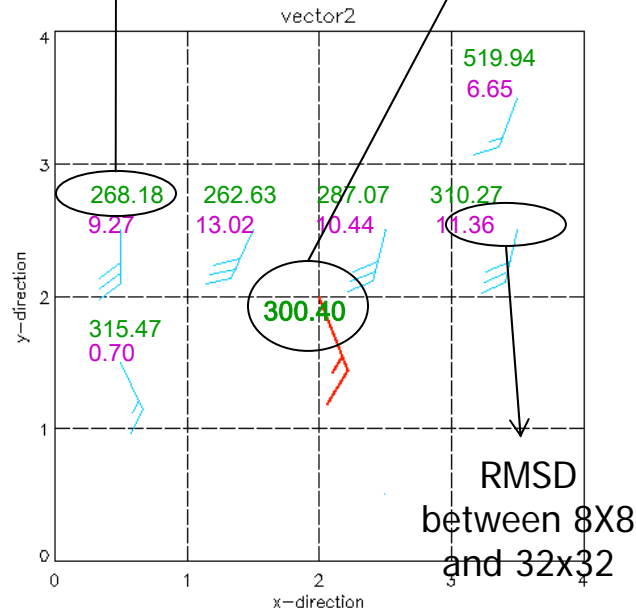


- Local winds at different level exist within target box size, 32x32.
- Most local winds are different to mean flow in speed and direction.
- For this example, Mean of RMSVD between local wind and mean flow is 9.07m/s.

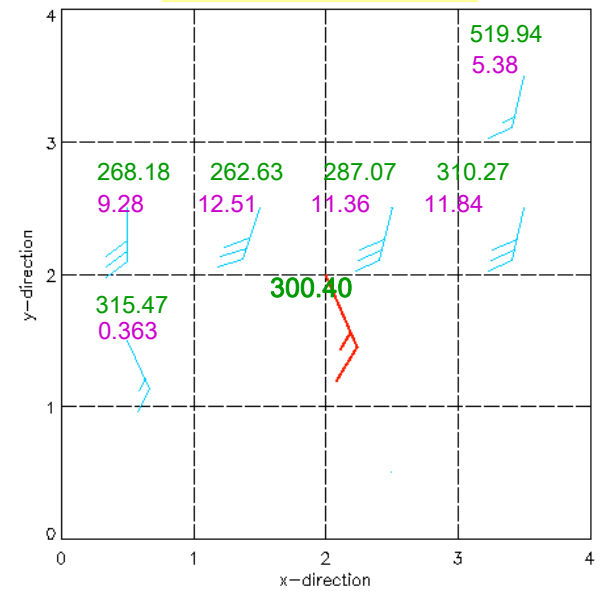


AMV height from 8x8

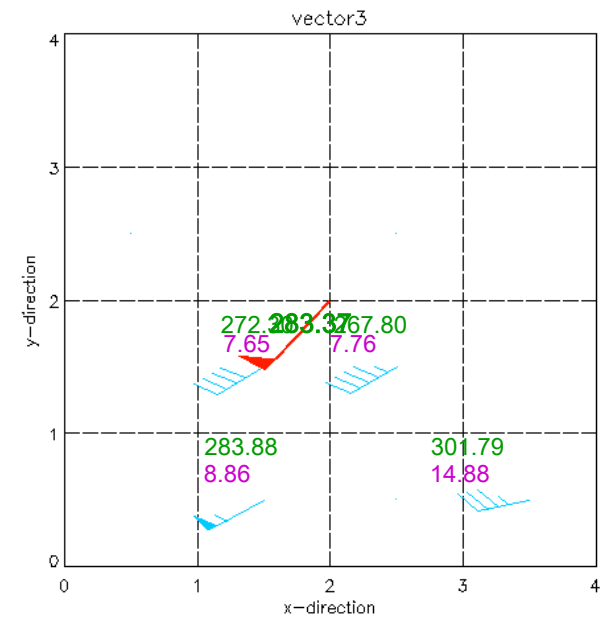
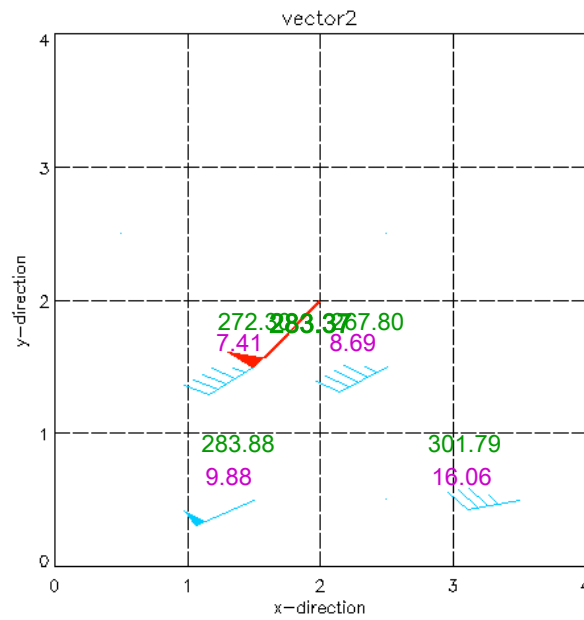
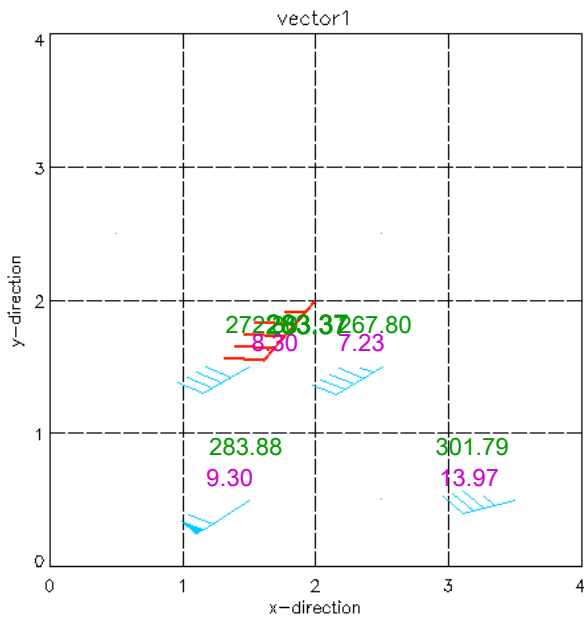
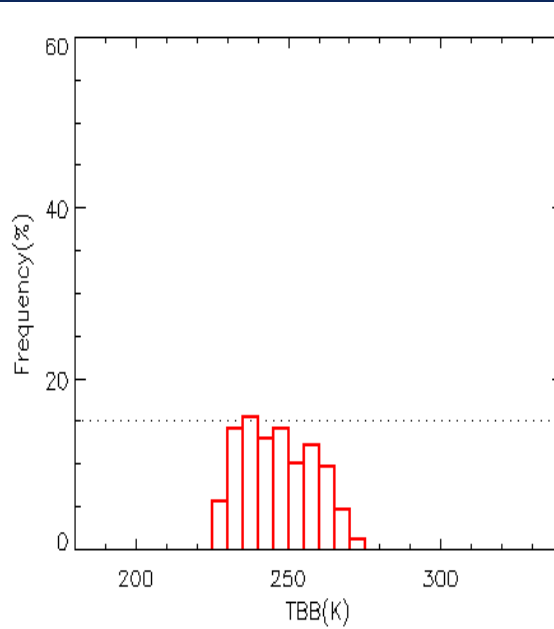
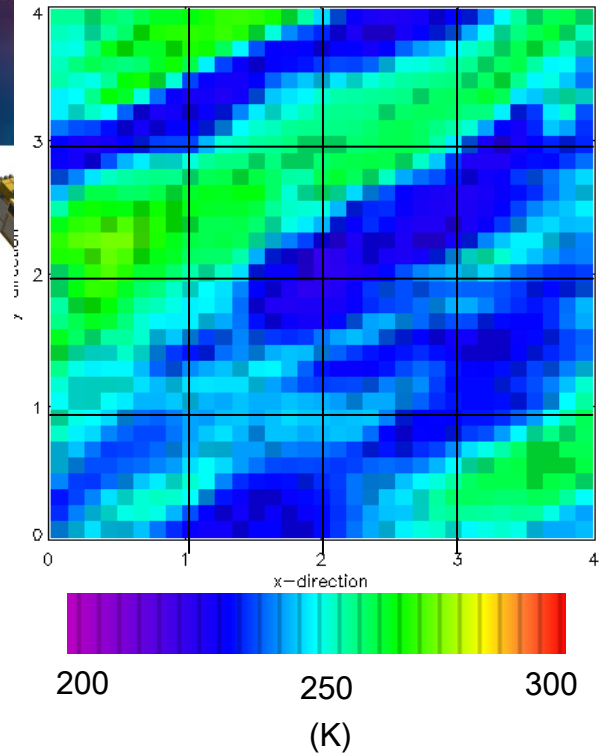
AMV height from 32x32



Final Vector



Mean of RMSVD: 9.80 m/s  
 Max. of RMSVD : 14.89 m/s  
 Min. of RMSVD : 7.65 m/s

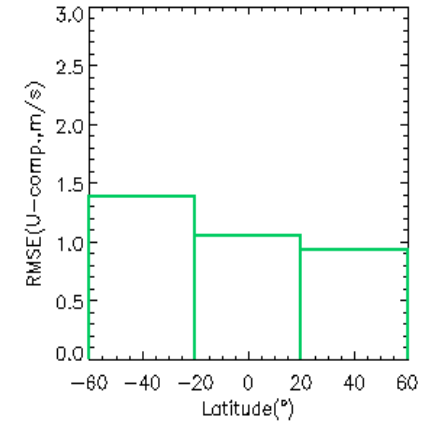
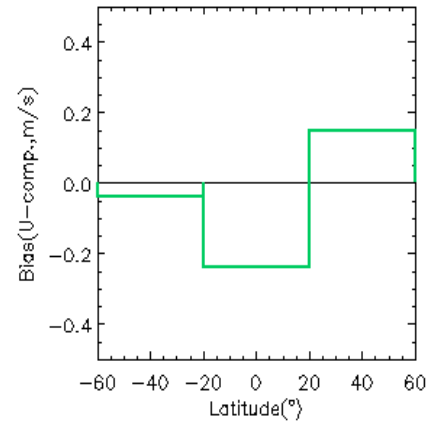
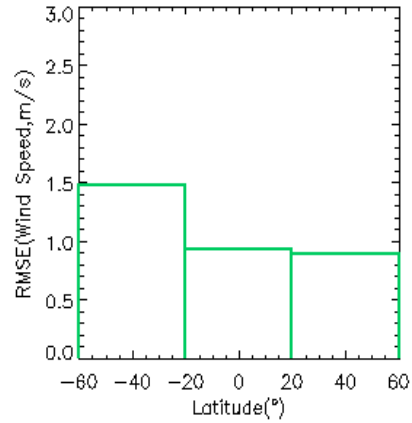
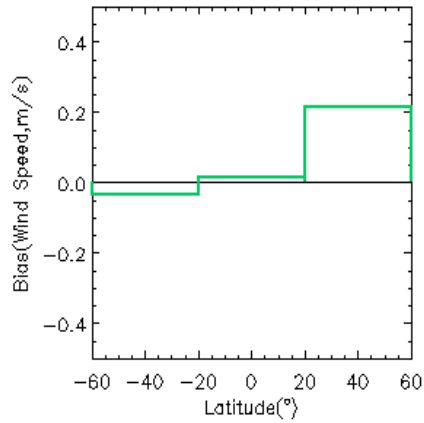






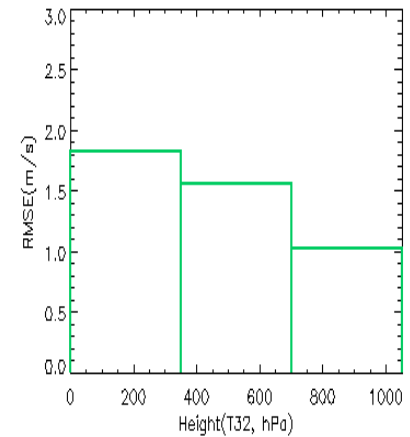
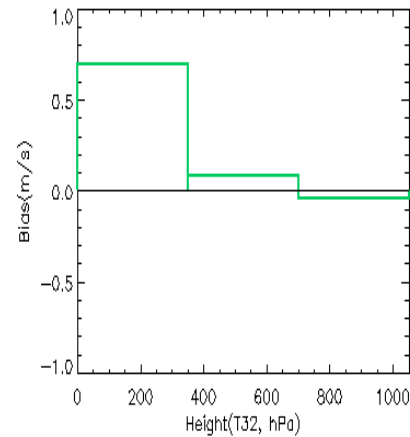
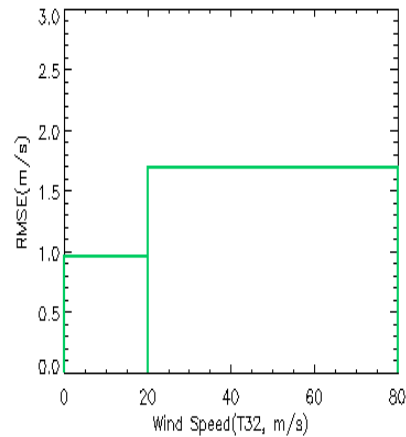
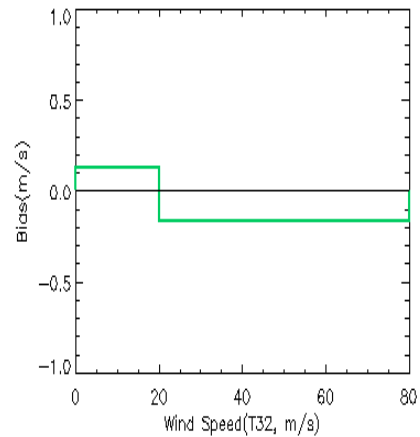
Bias & RMSD of Wind speed (m/s) for latitudinal band

Bias & RMSD of U-comp. (m/s) for latitudinal band

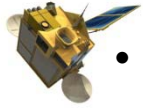


Bias & RMSD of Wind speed (m/s) for Wind speed of Target 32X32

Bias & RMSD of Wind speed (m/s) for Height of Target 32X32



## 2<sup>nd</sup> study: preliminary conclusions

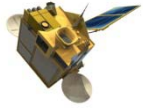


- Without any filtering 8x8 speeds and directions are very different to 32x32 ones, both for average and 8x8 QI max results.
- After QI filter, good agreement for speeds and directions between large flow at 32x32 and average and Max QI at 8x8 appears.
- However, Several 8x8 AMV (average and /or Max QI) passed the QI tests and are different to corresponding 32x32 AMV
- Similar to the result of 1<sup>st</sup> study, very strict filtering for 8x8 may make the dispersion between local and mean flow decreased.



3<sup>rd</sup> study:

Comparison against Rawin-Sonde observaiton



## Data Set 2

- 8X8, 16x16 and 32X32 AMVs from MTSAT-1R ,IR channel with 30 min. interval
- 15 Jun – 31 July,2007
- RSOB of 00 & 12 UTC within 65° satellite zenith angle
- 6 hours interval ECMWF reanalysis data for first guess of air temperature and humidity profile



# Comparison AMVs / RSOB



**AMV output**  
( Quality Index > **0.6** )

**RSOB**

**All AMVs which are assigned within**

Time : **1 hour**

Distance : **150 km**

Height : **25 hPa**

Wind Speed : **30 ms<sup>-1</sup>**

Wind Direction : **90 °**

**from RSOB will be collocated**

**Compare AMVs with Rawin-Sonde Observations**  
without Spatial or Temporal Interpolation

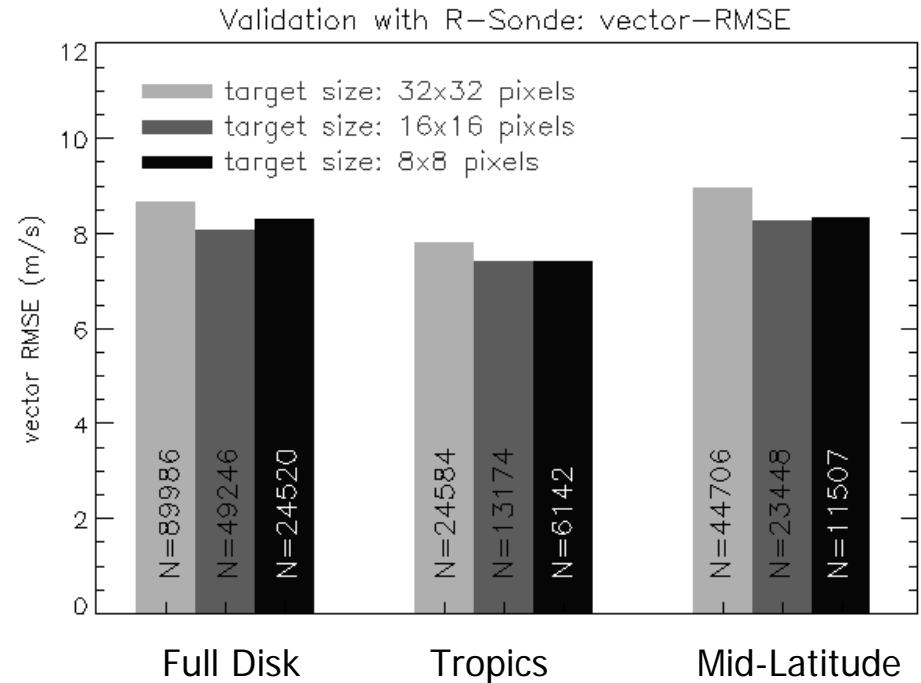
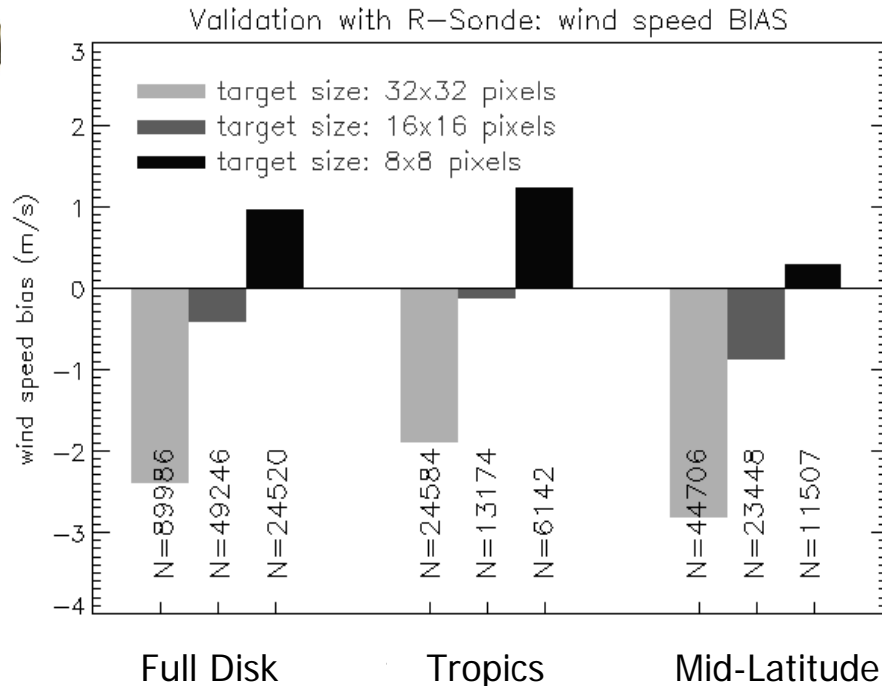
$$\text{RMSE}_{\text{vector}} = \frac{\sum \sqrt{(U_{\text{AMV}} - U_{\text{sonde}})^2 + (V_{\text{AMV}} - V_{\text{sonde}})^2}}{N}$$

$$\text{BIAS}_{\text{speed}} = \frac{\sum (WS_{\text{AMV}} - WS_{\text{sonde}})}{N}$$



## Wind speed bias

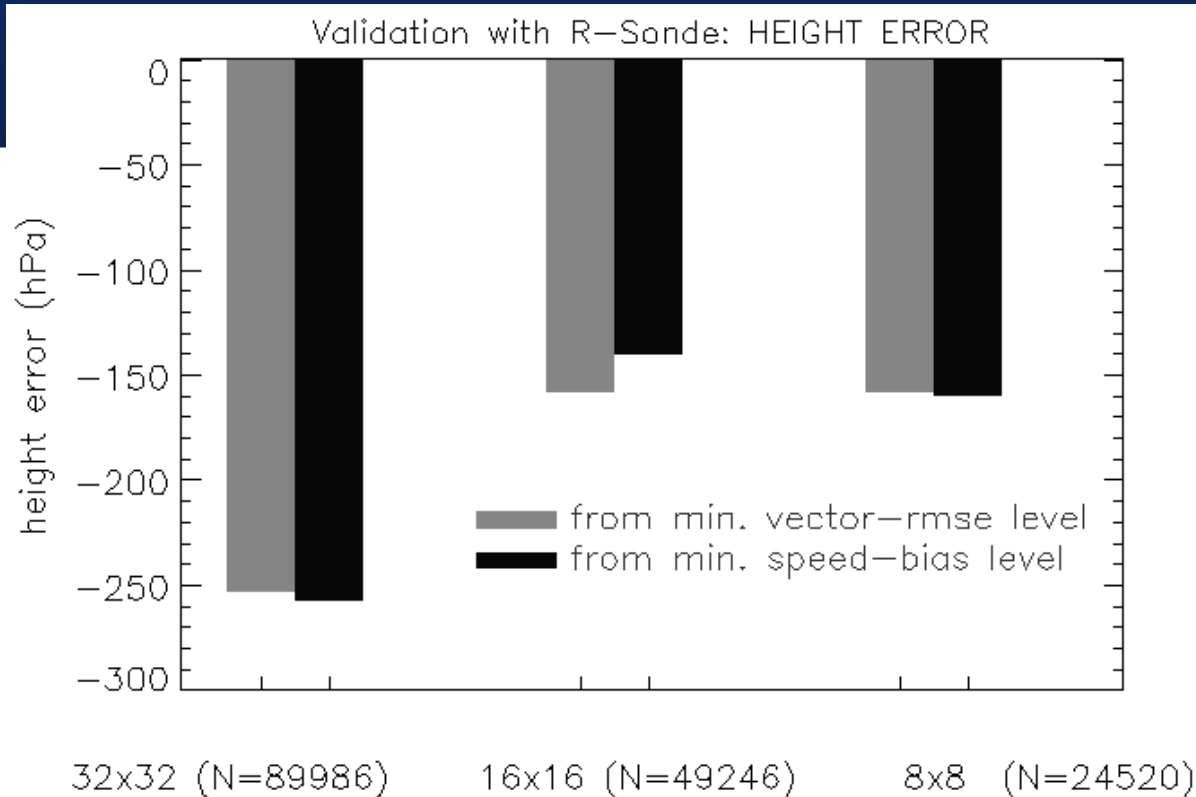
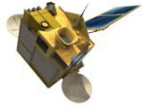
## RMSVD



Bias=AMV-RSOB

- Smaller target box size than current target box size has smaller bias.
- Bias is from - 2.3 m/s to 0.2m/s by change of target box size.
- 8x8 target box has positive bias while other target boxes, 16x16 and 32x32 has negative bias.
- Validation results show that 16x16 target box has better agreement with RSOB in both of bias and RMSD.





- Height assignment of KMA uses 15% coldest pixels within target box.
- In this study, the same HA is applied for every target box size, regardless of target box size.
- This figure shows that AMV height assignment errors (height difference from 'level of minimum RMSE or BIAS') by assuming that vector tracking is perfect.
- 16x16 target box has the smallest height error.

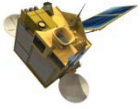


## 3<sup>rd</sup> study: preliminary conclusions

- AMVs with smaller target increase vector speeds, comparing current target size 32x32.
- Overall, 16x16 target size has better agreement with RSOB than other target sizes in terms of wind speed, as well as in height assignment.
- Slow bias of current target 32x32 which can contain multi-layer cloud feature or reflect movement of the weather system may be reduced by resizing of target size.



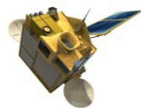
# Future works



- To inspect the relationship between local wind and mean wind (2<sup>nd</sup> Study), analyzing the impact of smaller target on AMV, .
- To find method to filter out bad local winds from target box size 8x8, since current QI filter removes considerably many good local winds (Adjust QI threshold).







**Thank you**

