



# ADM-Aeolus VAMP WP 4a: Mie Core QC

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PM4 : 27-Apr-2009



## Content:

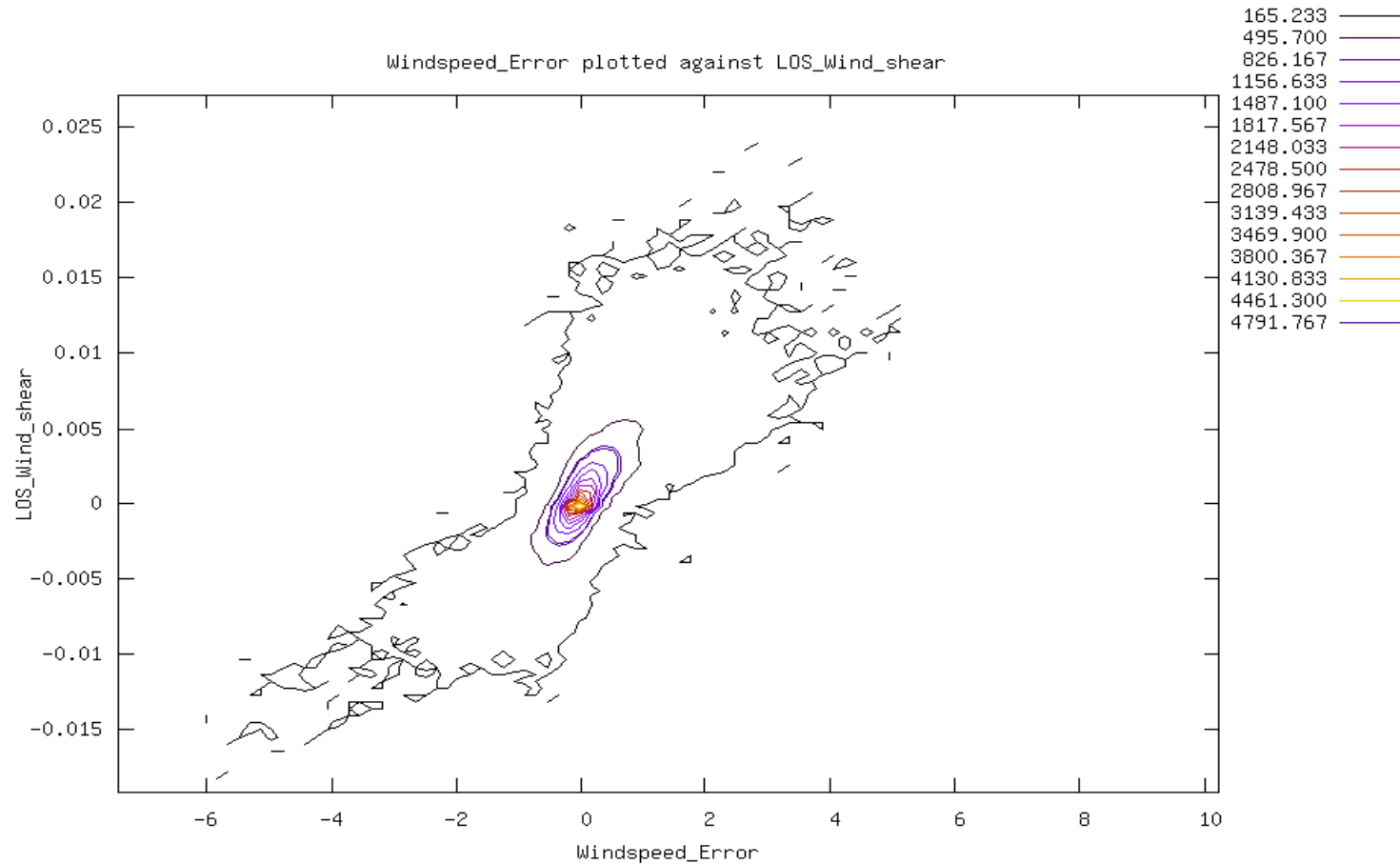
- task
- tool improvements
- results
  - simple atmosphere
  - CALIPSO
- conclusions
- todos



## Task WP 4a

- Investigate the utilization of MieCore algorithm outputs as quality indicators:
  - Mie line width (FWHM) against wind shear, turbulence and horizontal gradients
  - other MieCore outputs?
- Investigate usefulness of Rayleigh line-width
  - to be retrieved from known amplitude and A,B signal
  - assumption optical properties above well known
- look at differences with LIPAS implementation

# ••• Windshear effect

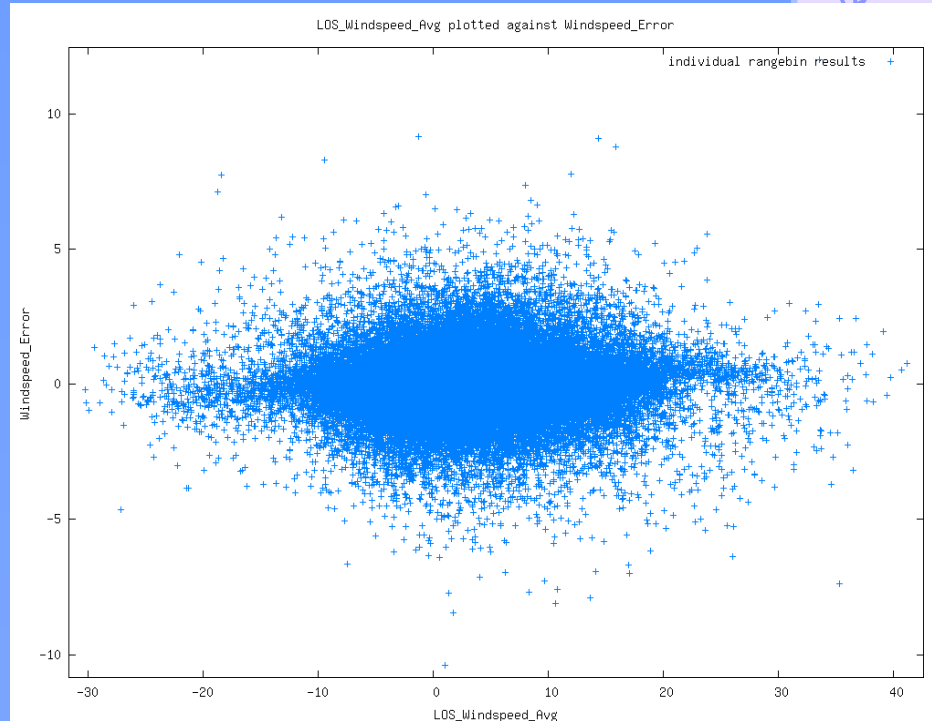
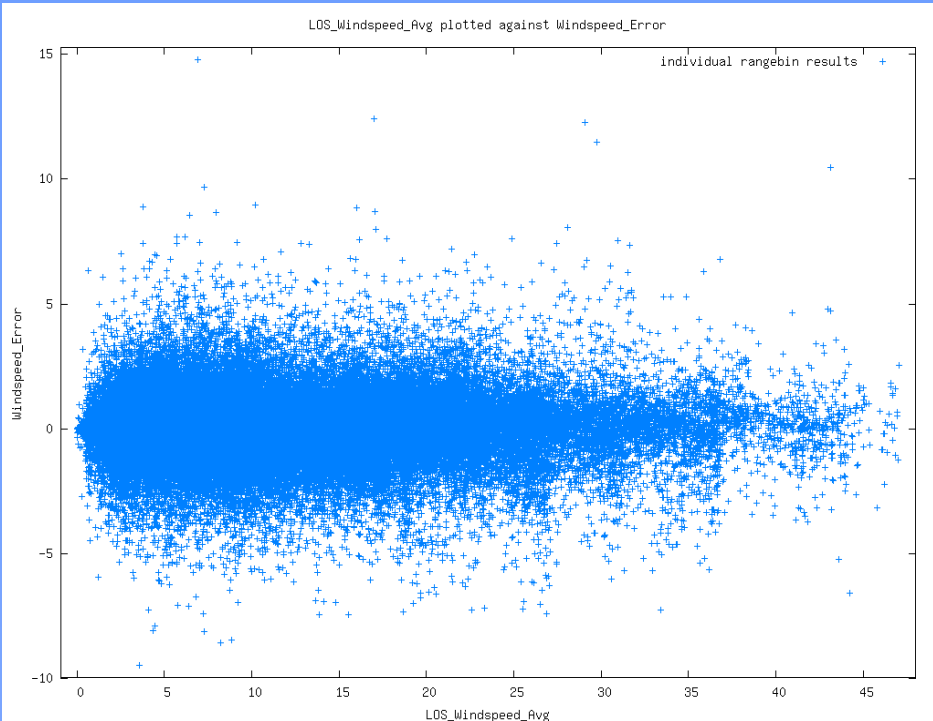


## Tool improvements

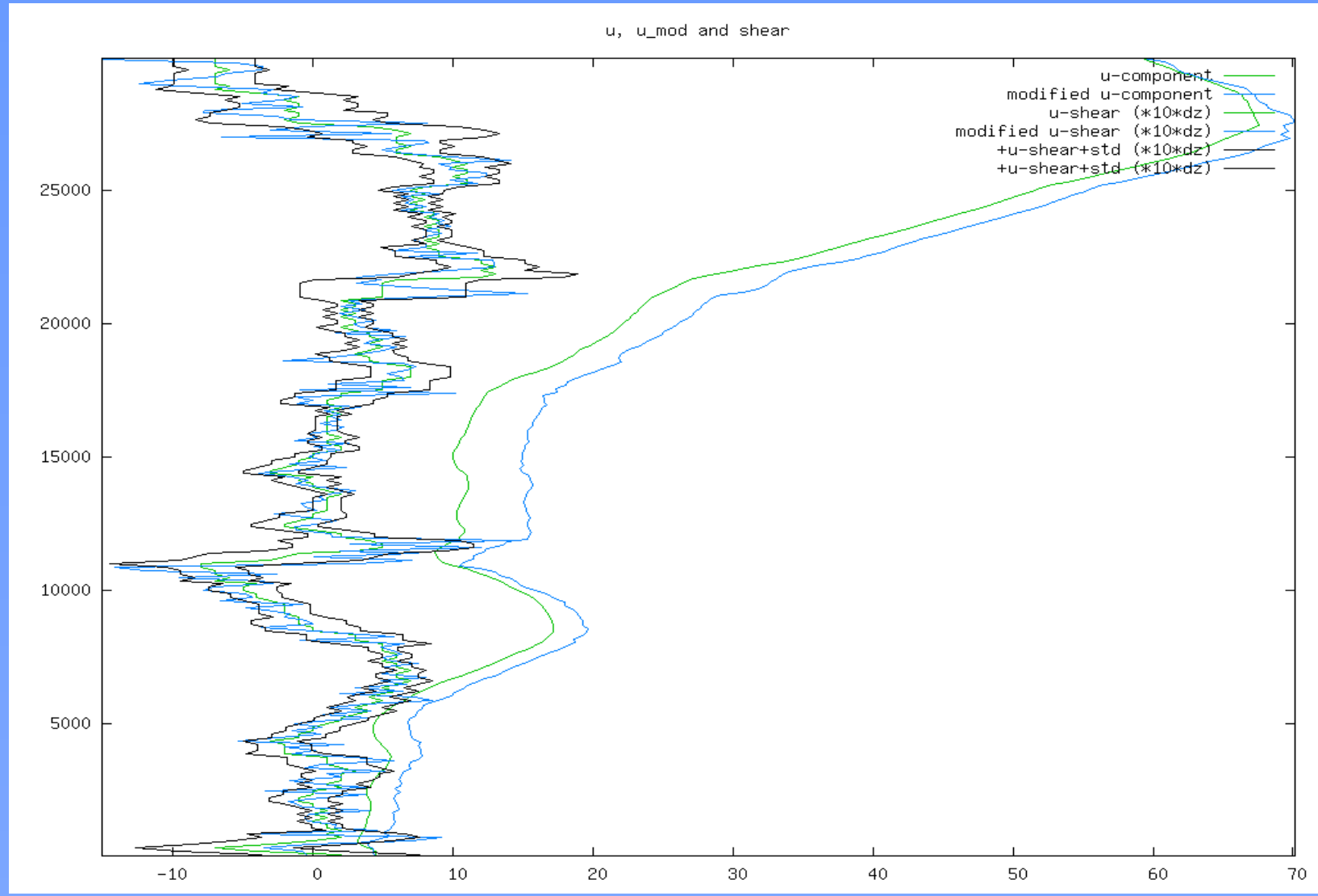
- Simulation tool:
  - correction of u,v,w wind component to los conversion
  - addition of error multiplier method (multiplier=2)
- Plotting tool:
  - calculation of statistics: mean and std for selected layers of data in the scatterplots

# Simulations

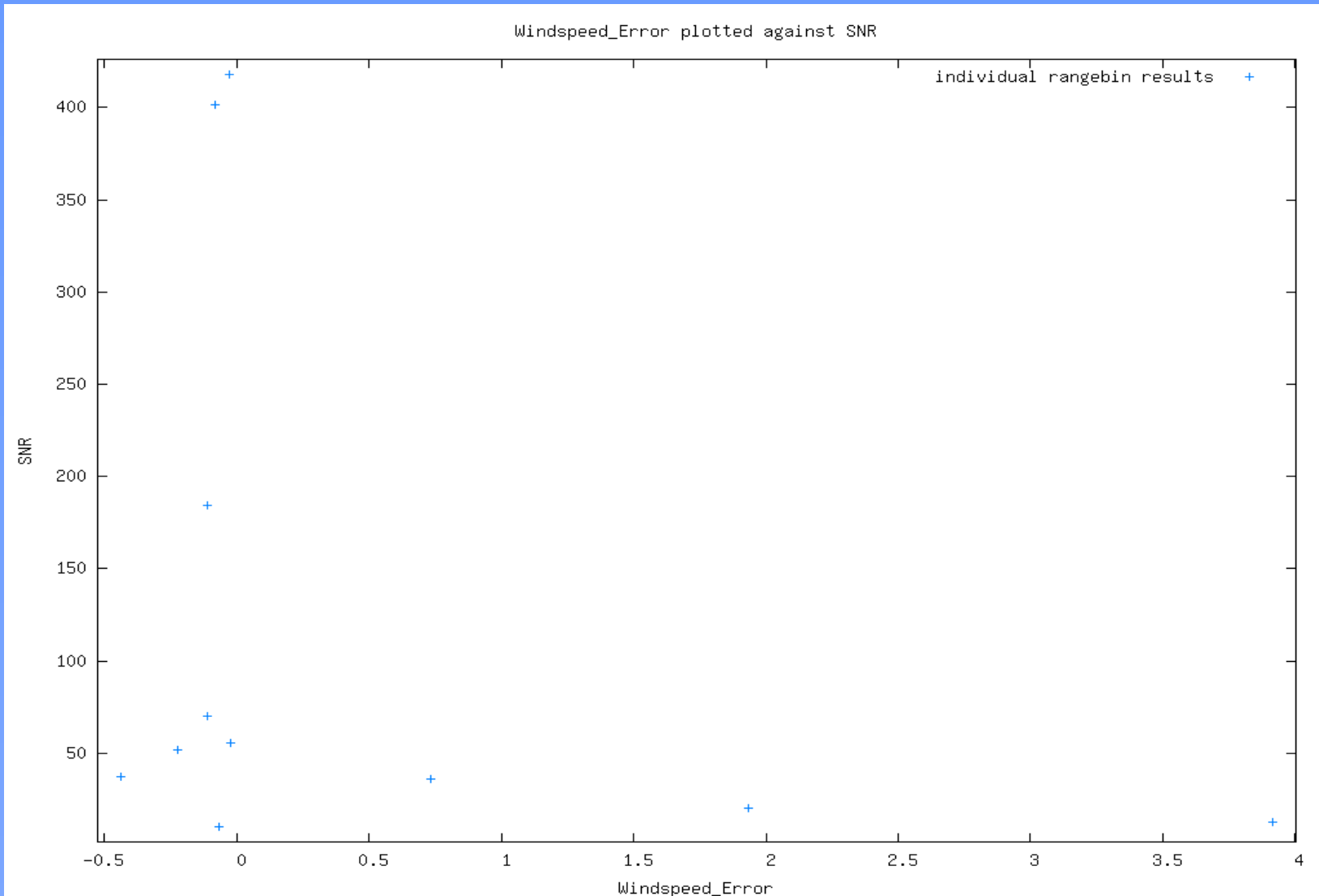
- Wrong results due to typo in LOS conversion (left plot):



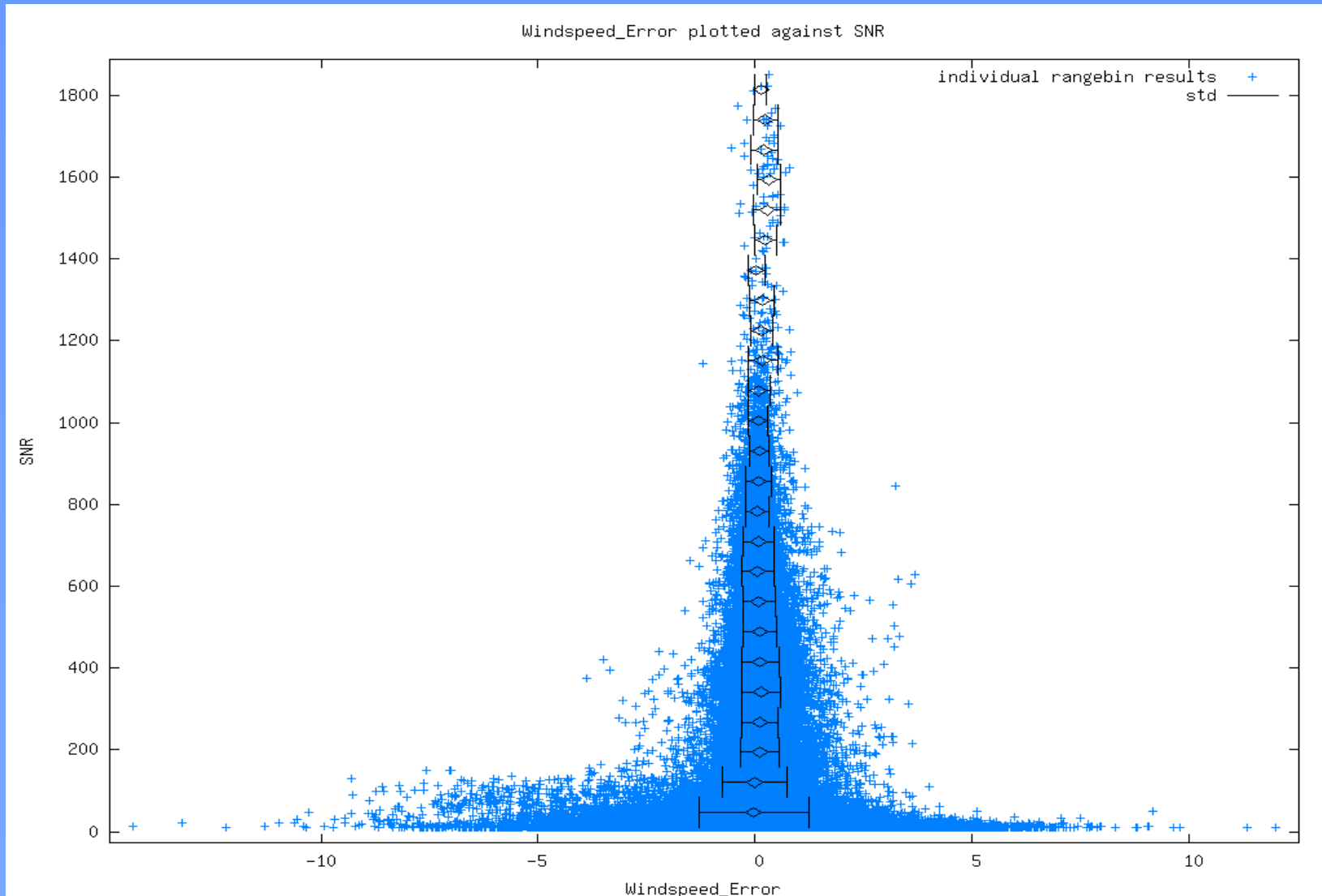
# ••• Error multiplier method



# ••• Simple atmosphere (11 valid points)



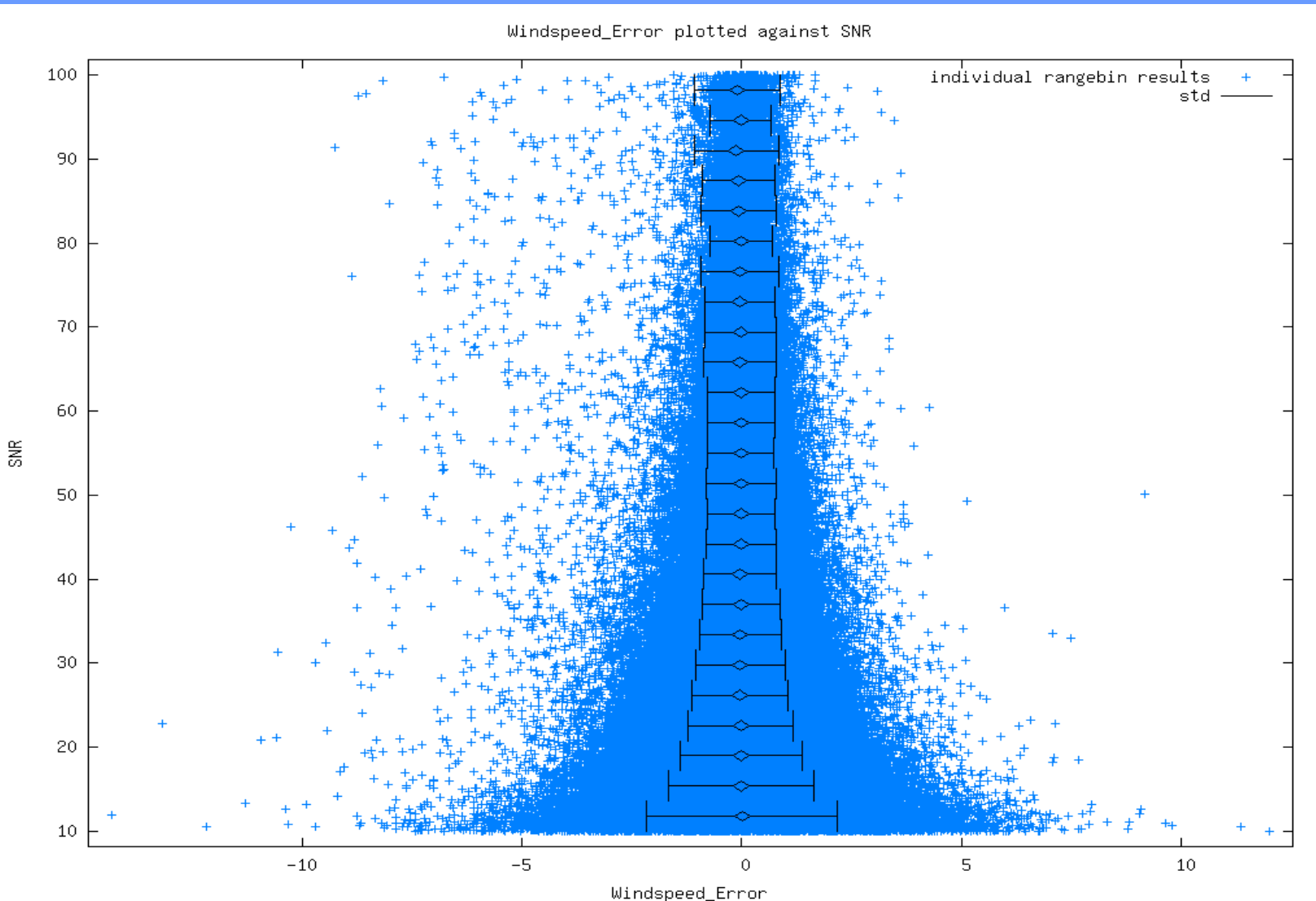
# Statistics: mean and std: SNR



## Statistics: mean and std: SNR

- For most SNR values std in windspeed\_error is far below 1 m/s.
- This is caused by the fact that extremely high SNR values seem to dominate in this plot, even though this forms just a small part of all data
- Only for SNR between 10 and 83 the std is 1.27 m/s
- So zoom in on the bulk of all data (SNR below 100)

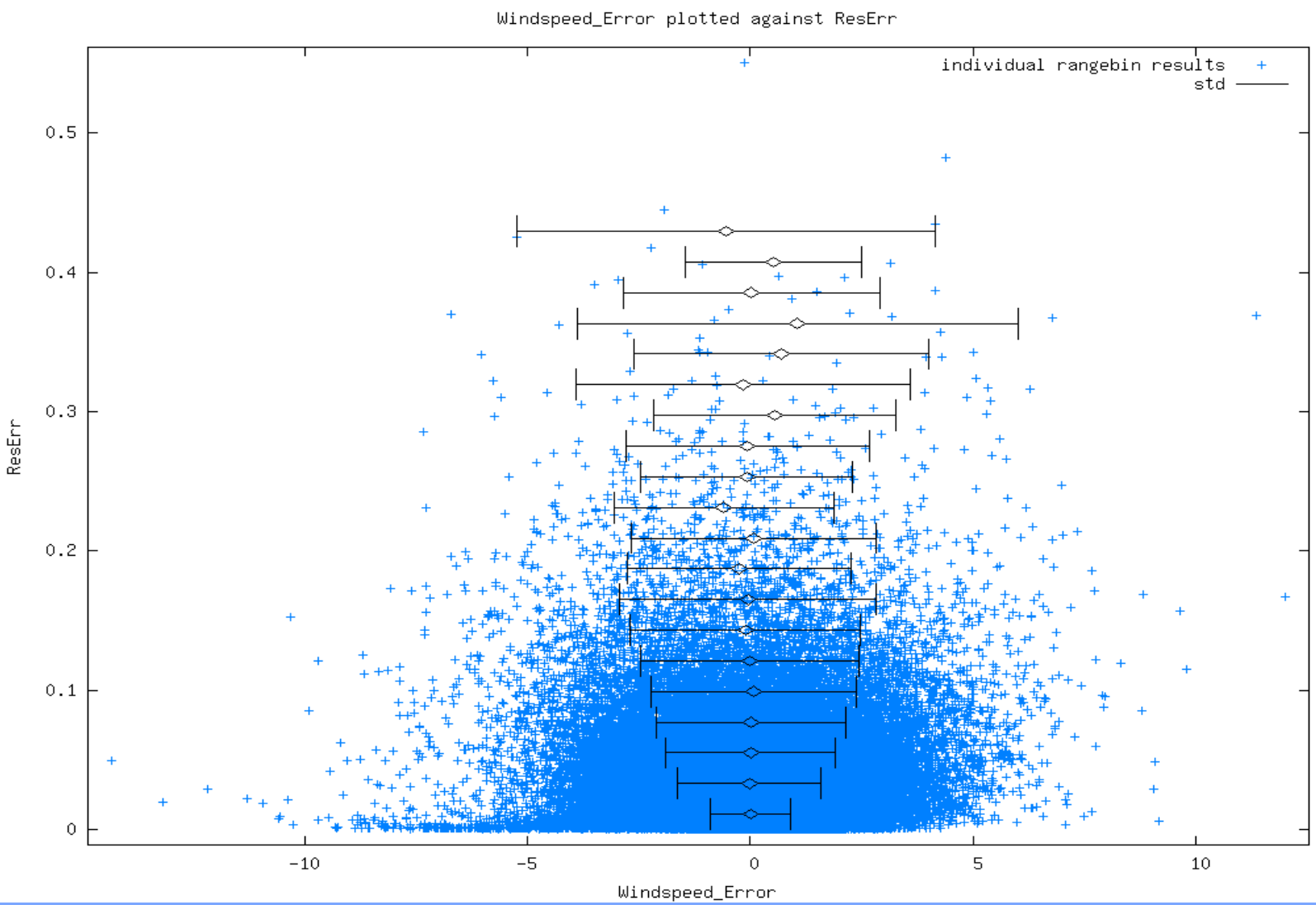
# ••• SNR below 100



## SNR below 100

- Now data with SNR between 10 and 32 has std > 1 m/s in windspeed error
- All higher SNR values have smaller std in windspeed error
- So when applying a threshold if for example SNR=32, datapoints with std < 1 m/s are selected, and the average data quality will improve significantly

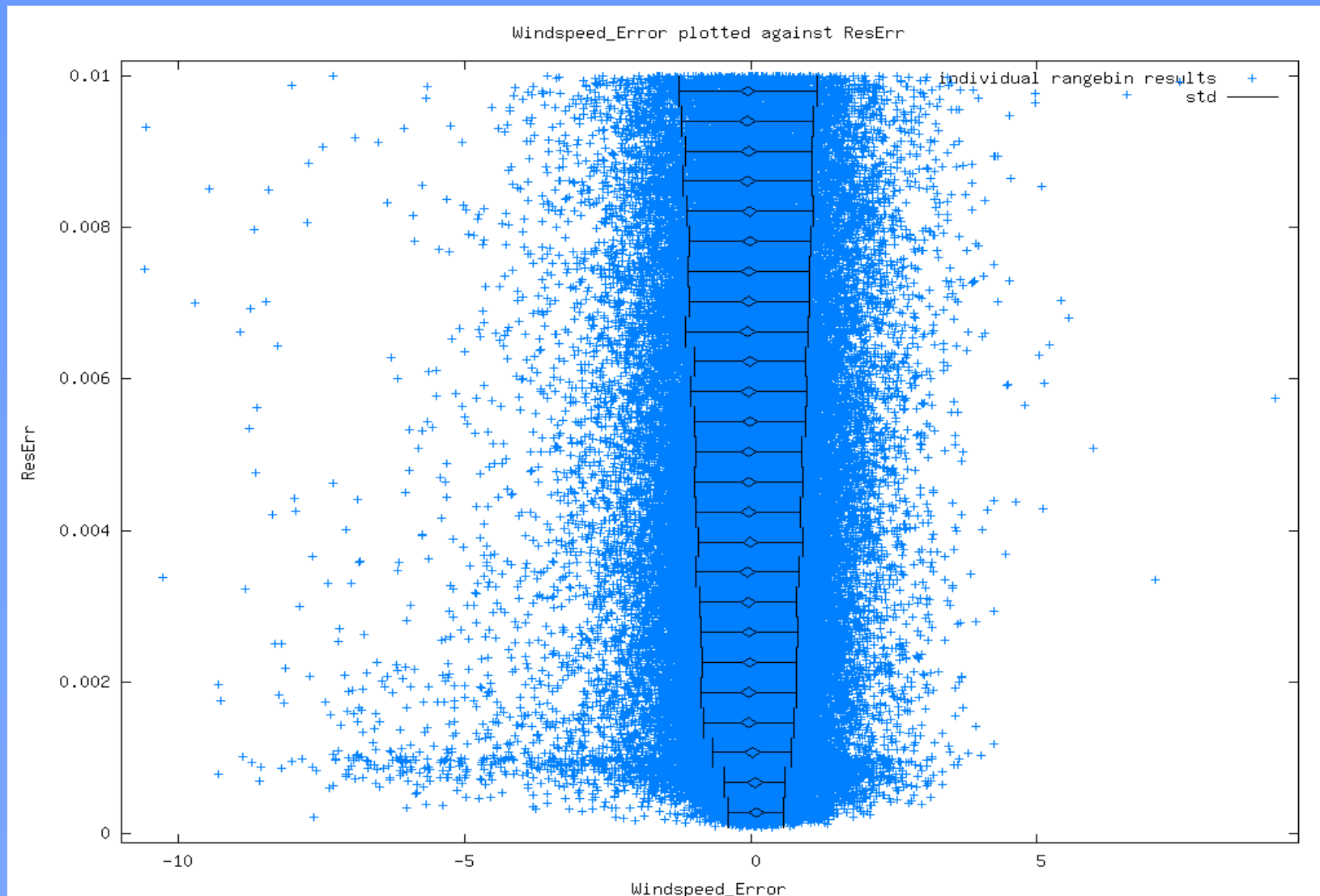
# Residual Error: mean and std



## Residual Error: mean and std

- For most Residual Error values std in windspeed\_error is far above 1 m/s.
- This is caused by the fact that extremely bad (high) values seem to dominate in this plot, even though this forms just a small part of all data
- Only for Res.Err. below 0.022 the std is below 1 m/s (0.913 m/s)
- So zoom in on the bulk of all data (Res.Err. below 0.01)

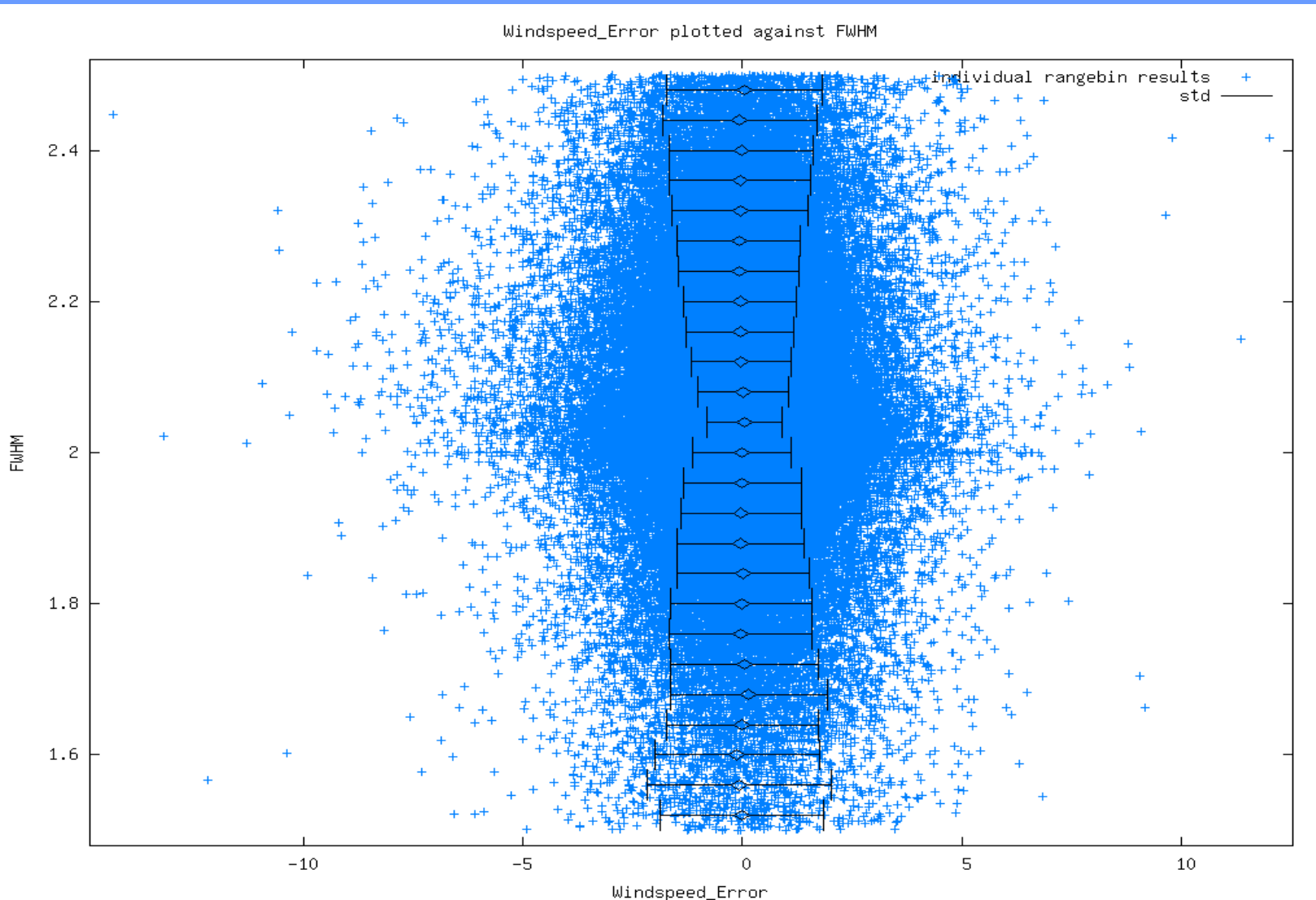
# Residual Error below 0.01



## Residual Error below 0.01

- Now data with Res.Err. below 0.0055 has  $\text{std} < 1$  m/s in windspeed error
- Almost all higher Res.Err. values have larger std in windspeed error
- So when applying a threshold if for example Res.Err.=0.005, datapoints with  $\text{std} < 1$  m/s are selected, and the average data quality will improve significantly

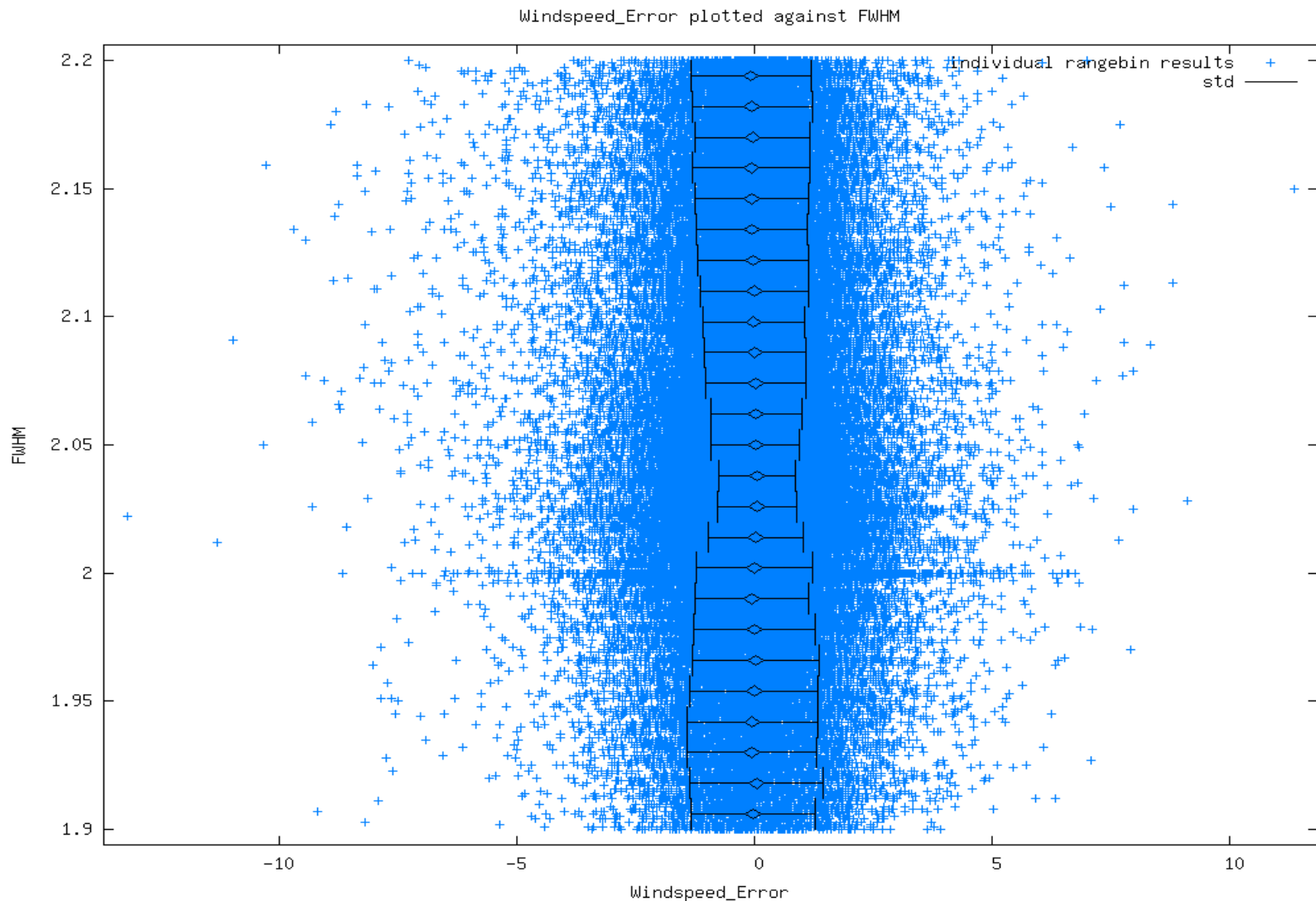
# FWHM: mean and std



## FWHM: mean and std

- For most FWHM values std in windspeed\_error is far above 1 m/s.
- In this plot this is unfortunately true for most of the data
- Only for FWHM between 2.02 and 2.06 the std is below 1 m/s (0.85 1 m/s)
- So zoom in on the region  $1.90 < \text{FWHM} < 2.20$

# FWHM between 1.90 and 2.20

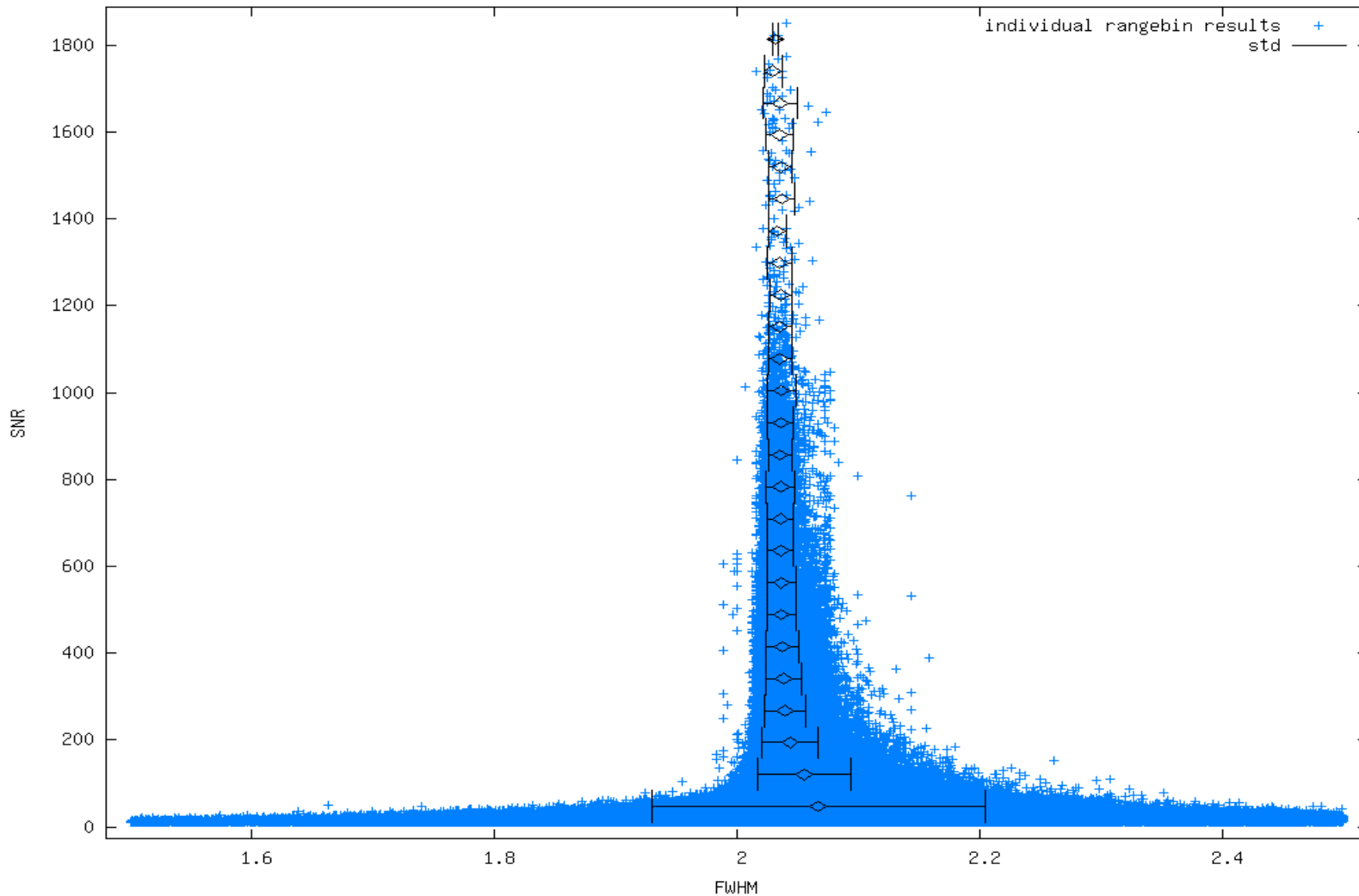


## FWHM between 1.90 and 2.20

- Now data with FWHM between 2.01 and 2.07 has  $\text{std} < 1$  m/s in windspeed error
- All other FWHM values have larger  $\text{std}$  in windspeed error
- So when applying a threshold if for example  $2.01 < \text{FWHM} < 2.07$ , datapoints with  $\text{std} < 1$  m/s are selected, and the average data quality will improve significantly
- However, this rejects the majority of all data now

# Relation FWHM and SNR

FWHM plotted against SNR



## Conclusions

- selecting data on statistical grounds **is possible** and will improve the average quality of the remaining data
- Typical thresholds could be:
  - $SNR > 32$
  - Residual Error  $< 0.005$
  - $2.01 < FWHM < 2.07$
- these 3 selections reduce the std in windspeed error to 1 m/s.
- when combining these thresholds the individual values may probably be relaxed a bit to get the same end result

## Summarising the effect of these Thresholds

Condition	Number of accepted datapoints	Percentage of accepted datapoints	Std in windspeed error
SNR>10 and ValFlag=True	223.226	100.00%	1.148 m/s
Additional conditions			
SNR>32	120.045	54.00%	0.733 m/s
ResErr<0.005	116.766	52.00%	0.730 m/s
2.01<FWHM<2.07	93.124	42.00%	0.882 m/s
all 3 combined	66.091	30.00%	0.590 m/s

## Conclusions (2)

- High SNR values lead mainly to high assignment errors
- Moderate SNR values may also show broadening of the Mie peak
- Horizontal wind gradients have similar effects as vertical wind shear, when single range bins are considered. Therefore this is not studied in more detail.
- The same argument holds for convective cases.

## Todo's:

- QC on the Rayleigh channel
  - this requires an accurate absolute calibration of the useful signal levels, which is currently not implemented in the L2B software. Therefore this cannot be done right now.



# The end

- questions ?











# Spare slide 1

$-U$
$0$
$U$

Case: vertical shear, transparent atmosphere

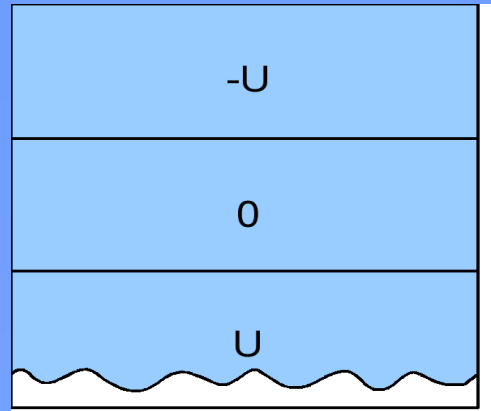
$-U$	$0$	$U$
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Case: horizontal shear, transparent atmosphere

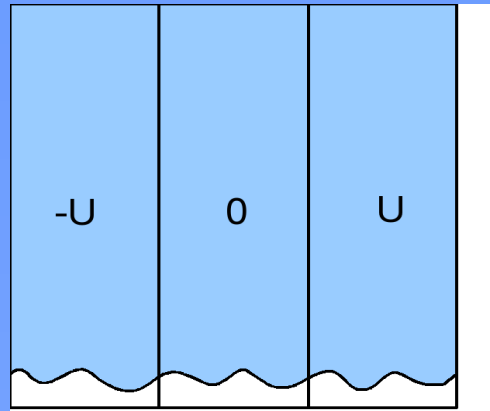
$U/\sqrt{2}$ 	$U$ 	$U/\sqrt{2}$ 
$0$ 	$0$	$0$ 
$-U/\sqrt{2}$ 	$-U$ 	$-U/\sqrt{2}$ 

Case: convection, transparent atmosphere

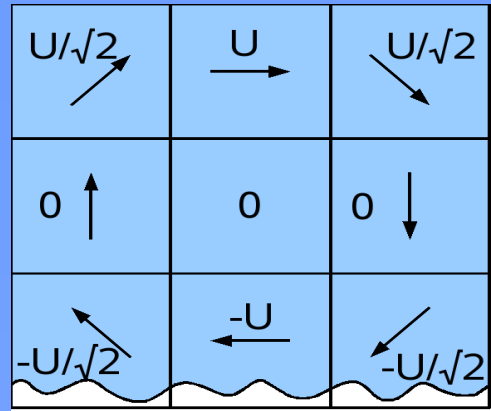
# Spare slide 2



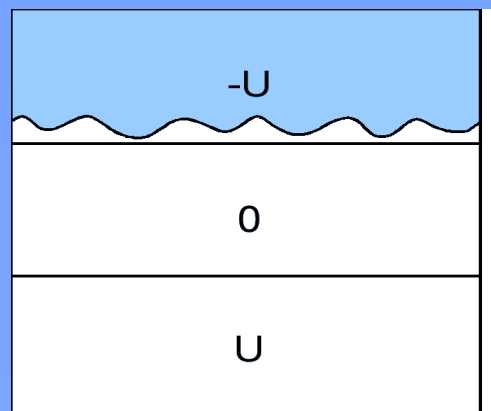
Case: vertical shear, dense cloud in lower part rangebin



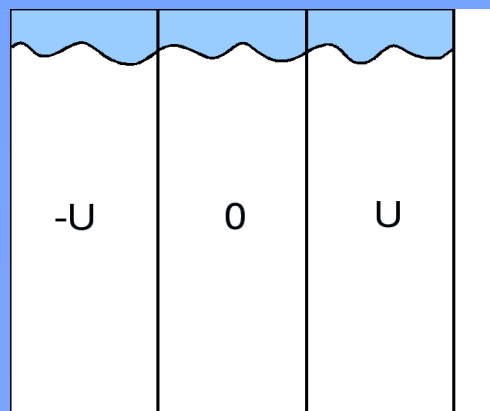
Case: horizontal shear, dense cloud in lower part rangebin



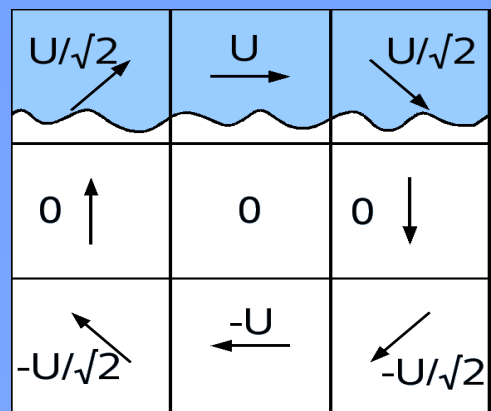
Case: convection, dense cloud in lower part rangebin



Case: vertical shear, dense cloud in upper part rangebin

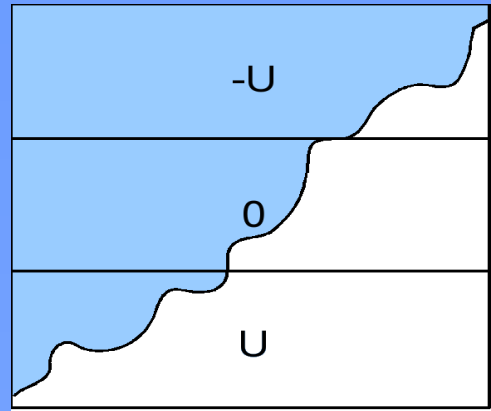


Case: horizontal shear, dense cloud in upper part rangebin

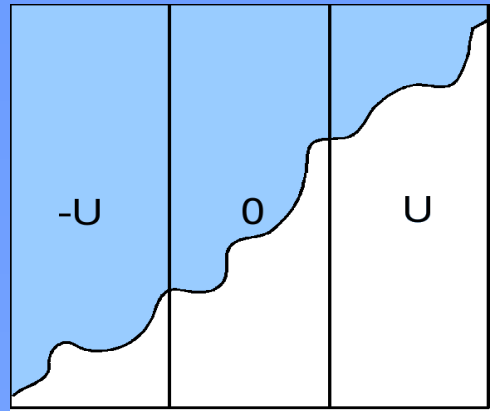


Case: convection, dense cloud in upper part rangebin

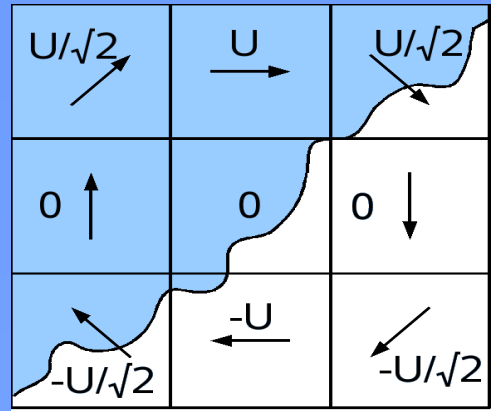
# Spare slide 3



Case: vertical shear, dense diagonal cloud



Case: horizontal shear, dense diagonal cloud



Case: convection, dense diagonal cloud