

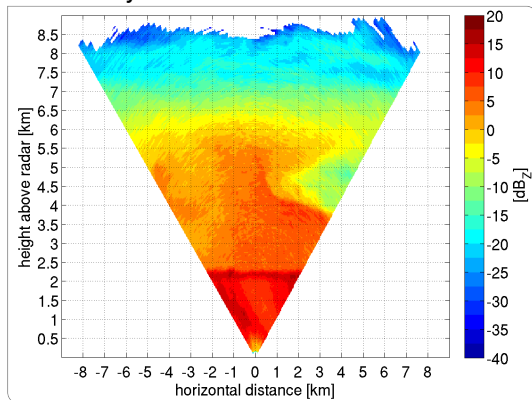
Identifying Dynamic Structures Using Residual Velocities

An Application on RHI Cloud Radar Data
(Jan Handwerker | May 14th, 2011)

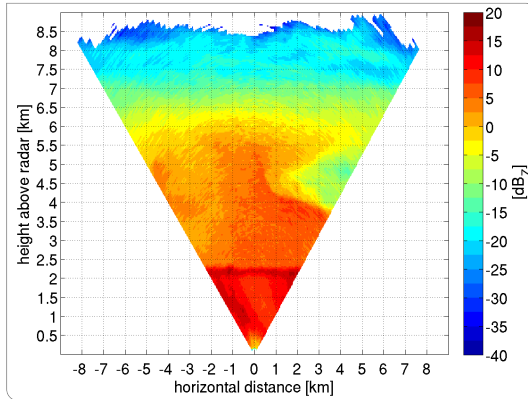
Institut for Meteorology and Climate Research



Reflectivity

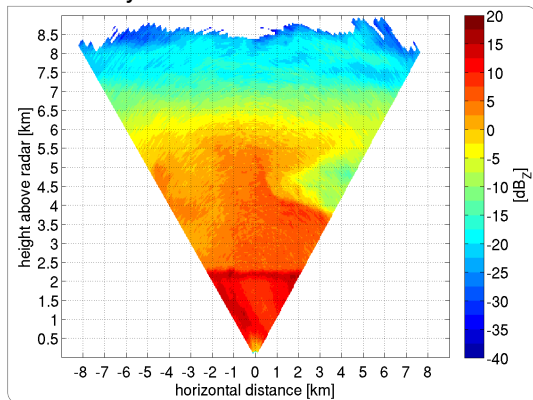


Reflectivity



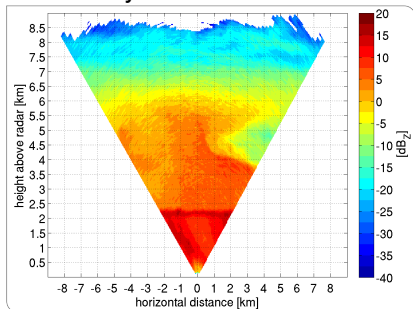
RHI in wind direction
(from PPI)
BB at 2.2 km

Reflectivity

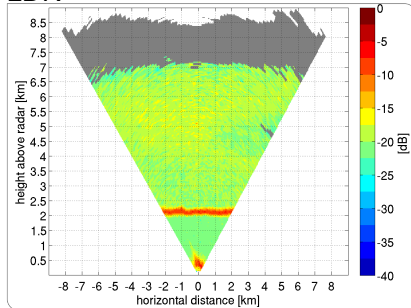


RHI in wind direction
(from PPI)
BB at 2.2 km
Boring! Isn't it?

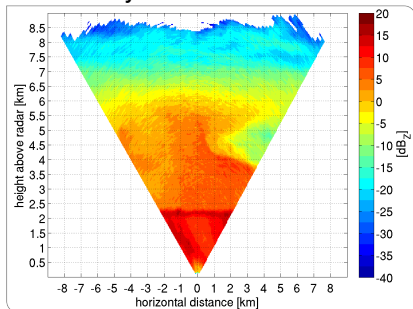
Reflectivity



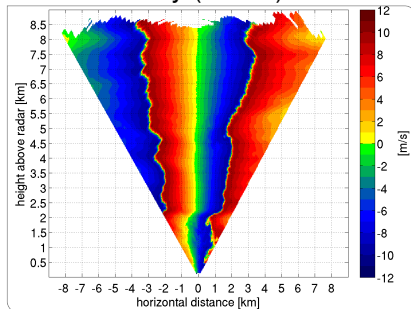
LDR



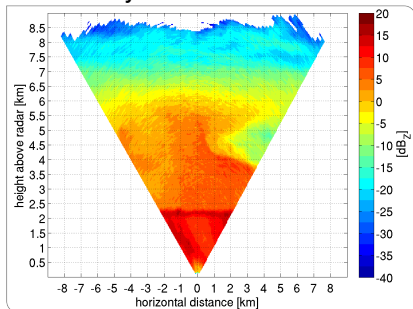
Reflectivity



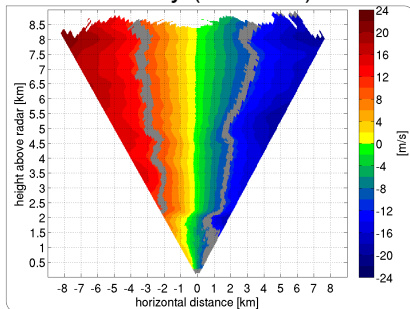
Radial Velocity (folded)



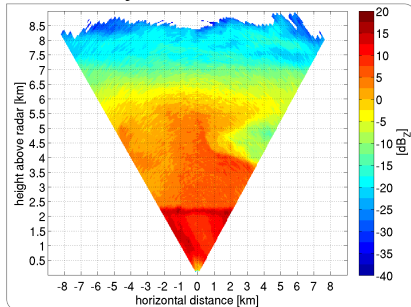
Reflectivity



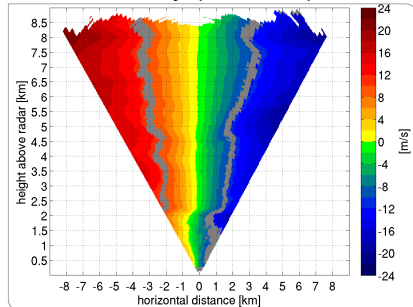
Radial Velocity (unfolded)



Reflectivity



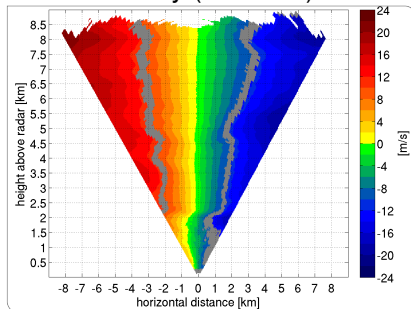
Radial Velocity (unfolded)



How do we learn something about the dynamics?

$$V_{\text{rad}} = V_{\text{rad,ls}} + V_{\text{res}}$$

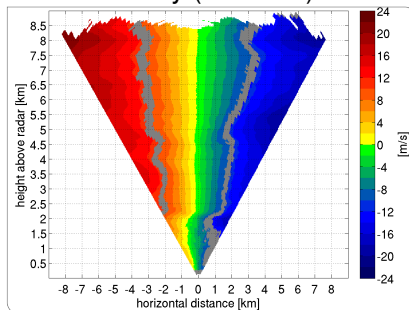
Radial Velocity (unfolded)



$$V_{\text{rad}} = V_{\text{rad,ls}} + V_{\text{res}}$$

$V_{\text{rad,ls}}$: radial velocity, large scale

Radial Velocity (unfolded)

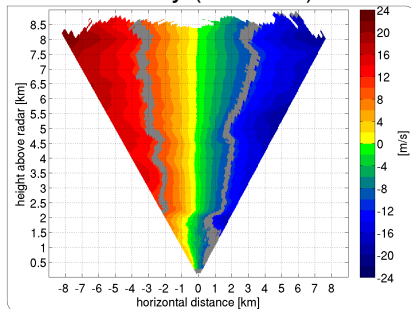


$$V_{\text{rad}} = V_{\text{rad,ls}} + V_{\text{res}}$$

$V_{\text{rad,ls}}$: radial velocity, large scale

consists of mean horizontal and vertical wind (u , w) and their horizontal gradients ($\partial u / \partial x$, $\partial w / \partial x$), projected to line of sight.

Radial Velocity (unfolded)



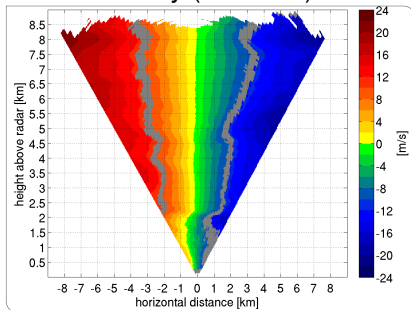
$$V_{\text{rad}} = V_{\text{rad,ls}} + V_{\text{res}}$$

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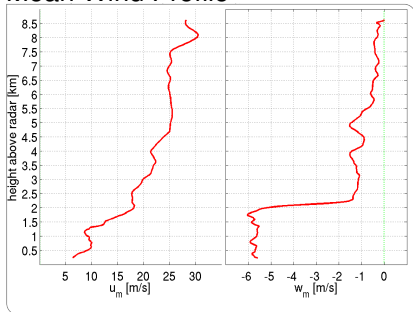
consists of mean horizontal and vertical wind (u , w) and their horizontal gradients ($\partial u/\partial x$, $\partial w/\partial x$), projected to line of sight.

Least Square Fit in each height level leads to estimates for u , w , and $\partial u/\partial x$ in each height level. $\partial w/\partial x$ is neglected.

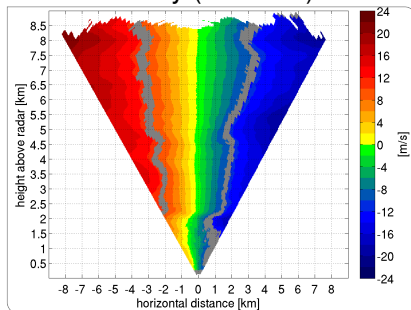
Radial Velocity (unfolded)



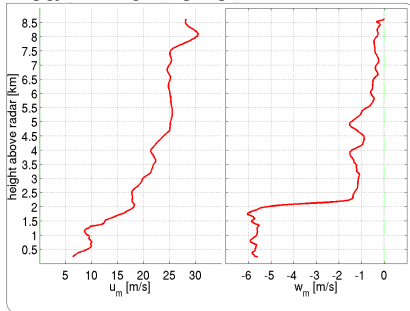
Mean Wind Profile



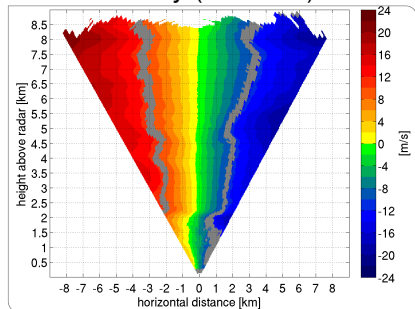
Radial Velocity (unfolded)



Mean Wind Profile

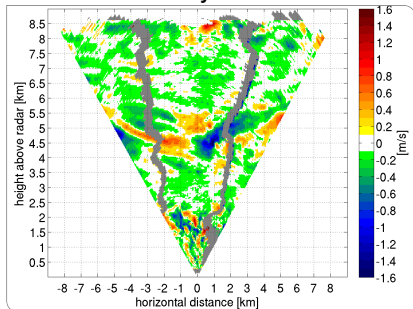


Radial Velocity (unfolded)

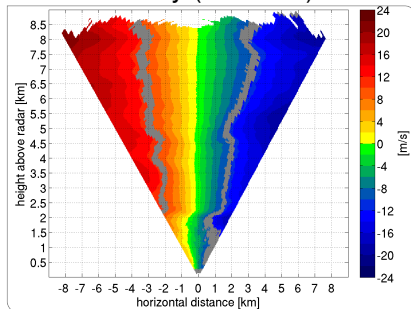


And now subtract the mean wind from the radial velocity. . .

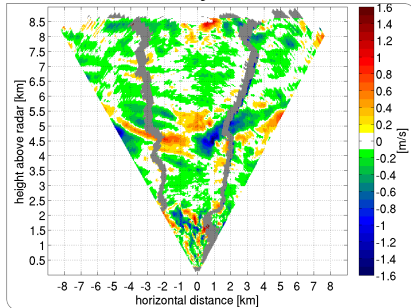
Residual Velocity



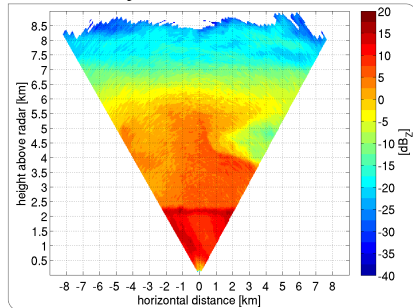
Radial Velocity (unfolded)



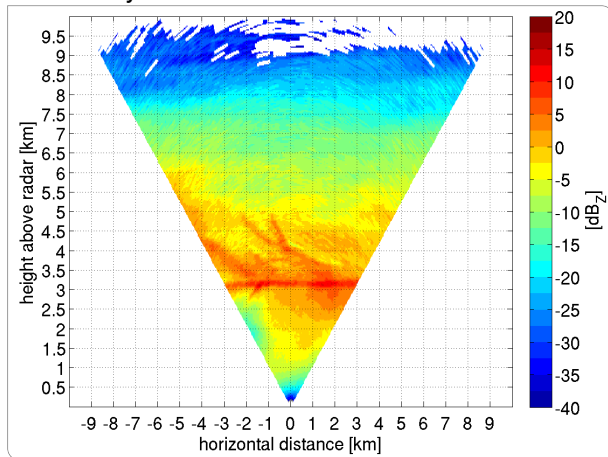
Residual Velocity



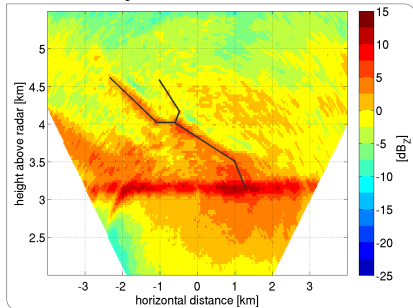
Reflectivity



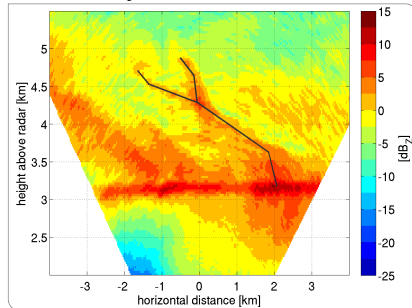
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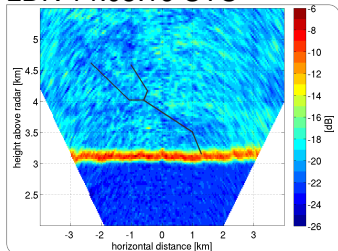
Reflectivity 14:08:16 UTC



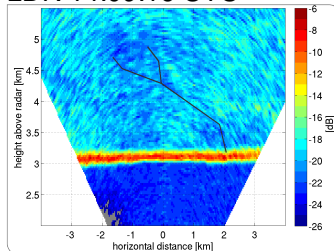
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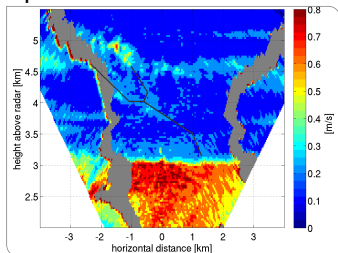
LDR 14:08:16 UTC



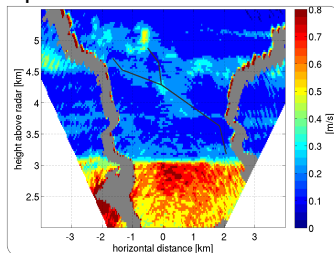
LDR 14:09:16 UTC



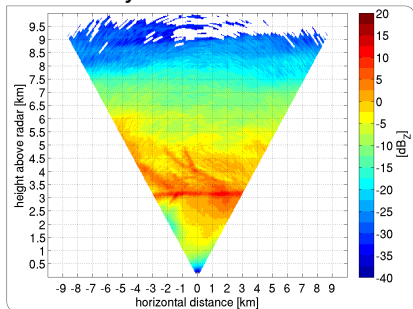
Spectral Width 14:08:16 UTC



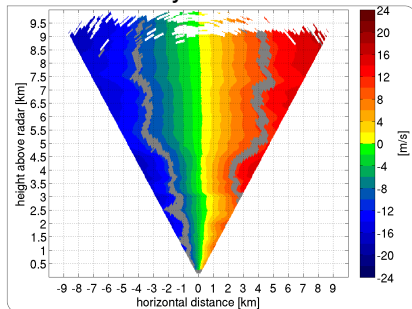
Spectral Width 14:09:16 UTC



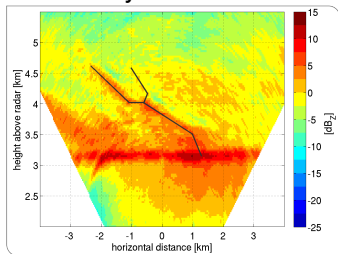
Reflectivity 14:08:46 UTC



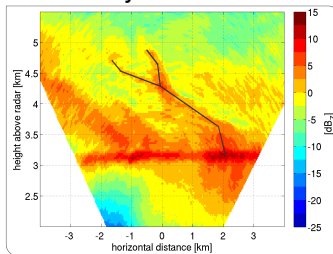
Radial Velocity 14:08:46 UTC



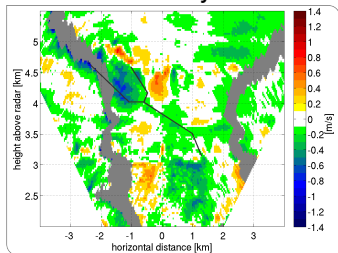
Reflectivity 14:08:16 UTC



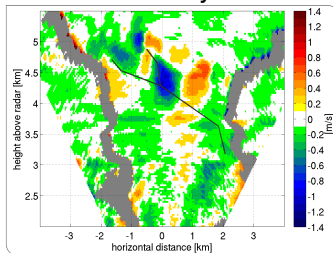
Reflectivity 14:09:16 UTC



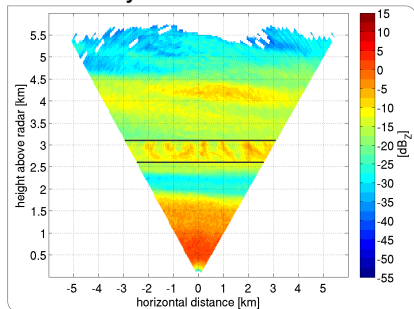
Residual Velocity 14:08:16 UTC



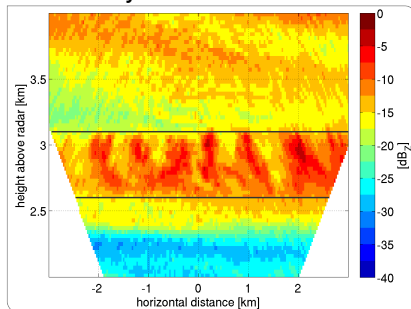
Residual Velocity 14:09:16 UTC



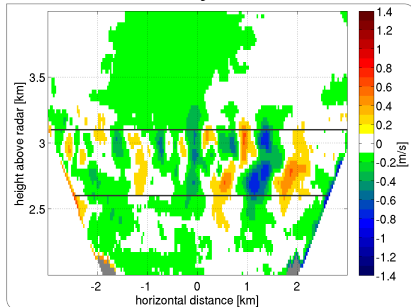
Reflectivity 13:44:31 UTC



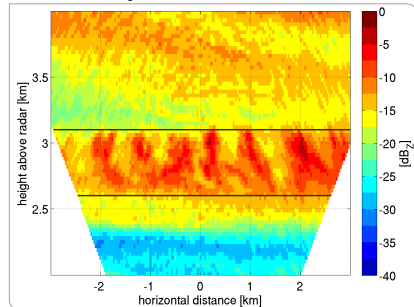
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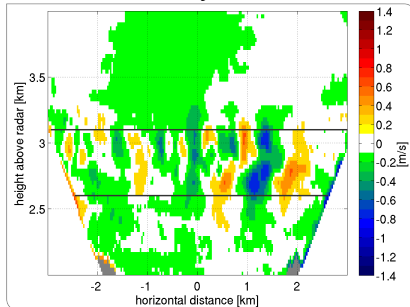
Residual Velocity 13:44:31 UTC



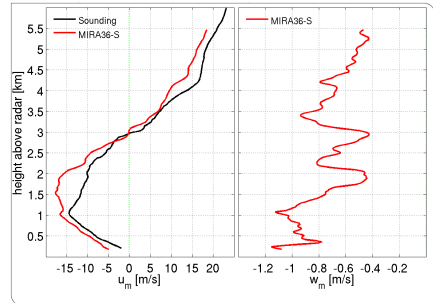
Reflectivity 13:44:31 UTC



Residual Velocity 13:44:31 UTC



Wind Profile 13:44:31 UTC



- Residual velocities provide information on the small scale dynamics motion.
- Nevertheless, interpretation is **not** straight forward, because you have to regard (at least)
 - residual velocity,
 - large scale velocity, and
 - sedimentation of particles.

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Thank you!