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A TOOL TO DETECT INNER CLOUD TOP DYNAMICS OF DEEP CONVECTIVE SYSTEM

Renato Galante Negri[1], Luiz Augusto Toledo Machado[1], Régis Borde[2]

[1] Instituto Nacional de Pesquisas Espaciais / Centro de Previsão de Tempo e Estudos Climáticos - INPE/CPTEC

[2] European Organisation for the Exploitation of Meteorological Satellites - EUMETSAT

Technique definition:

This technique is based on the use of SEVIRI channels combinations (ex. 6.7µm – 10.8µm) to identify specific structures of the Deep Convection Clouds (DCC) tops and then track this structures.

Is expected to detect winds at different levels in a same area.

Expansion/retraction of areas with specific microphysical properties can also be monitored.

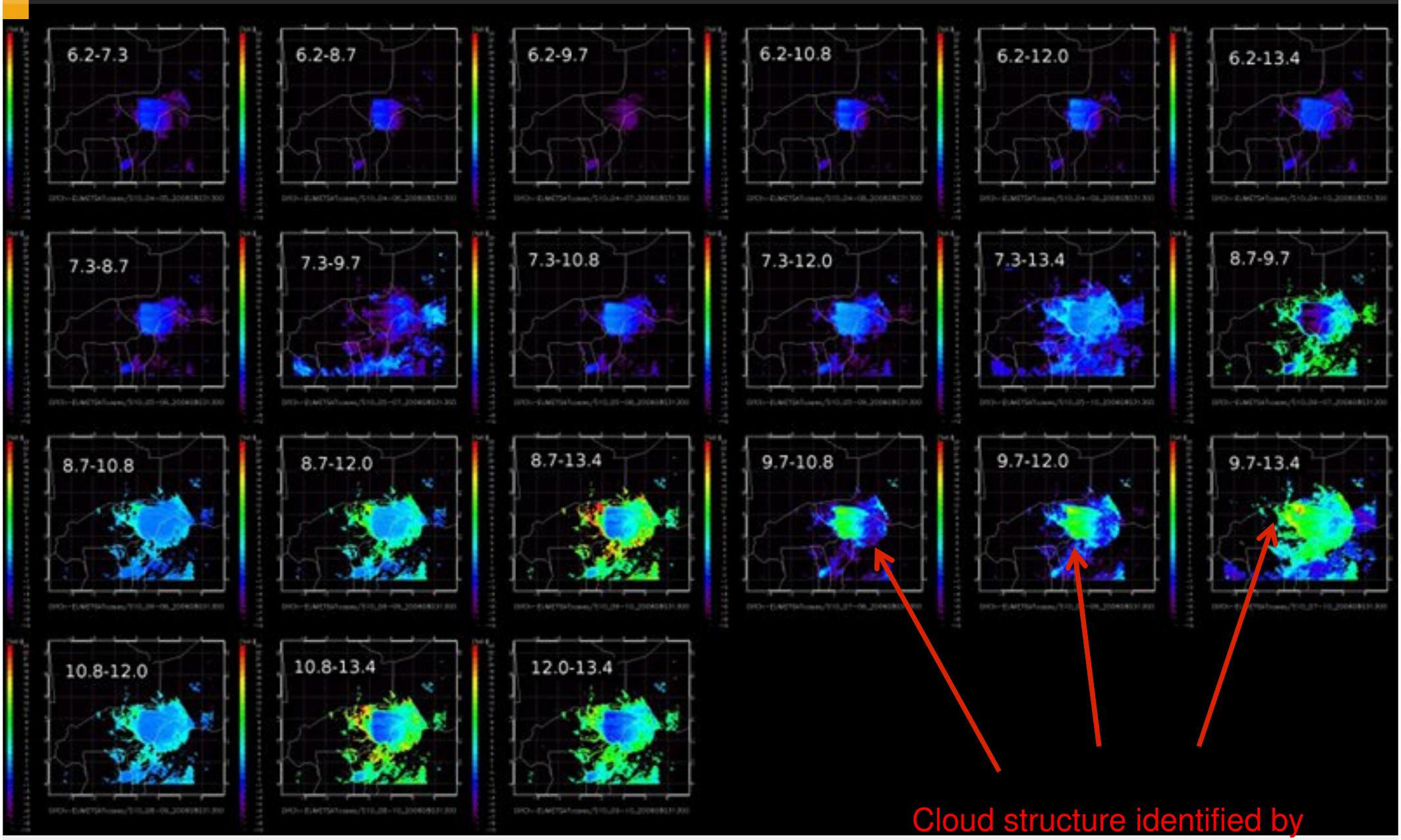
Technique brief:

- Apply the operational INPE/CPTEC cloud tracking algorithm with the following modifications:
  - Use channel difference images instead a SEVIRI IR image
  - Use pair of image differences; no HA
  - Target windows allows having an overlap to those in neighborhood (*to increase the probability to find a pattern in tracking process*)
  - Only the pixels within the chosen interval difference are used for tracking
  - Target windows must contain a minimum amount of pixels to be used

To define:

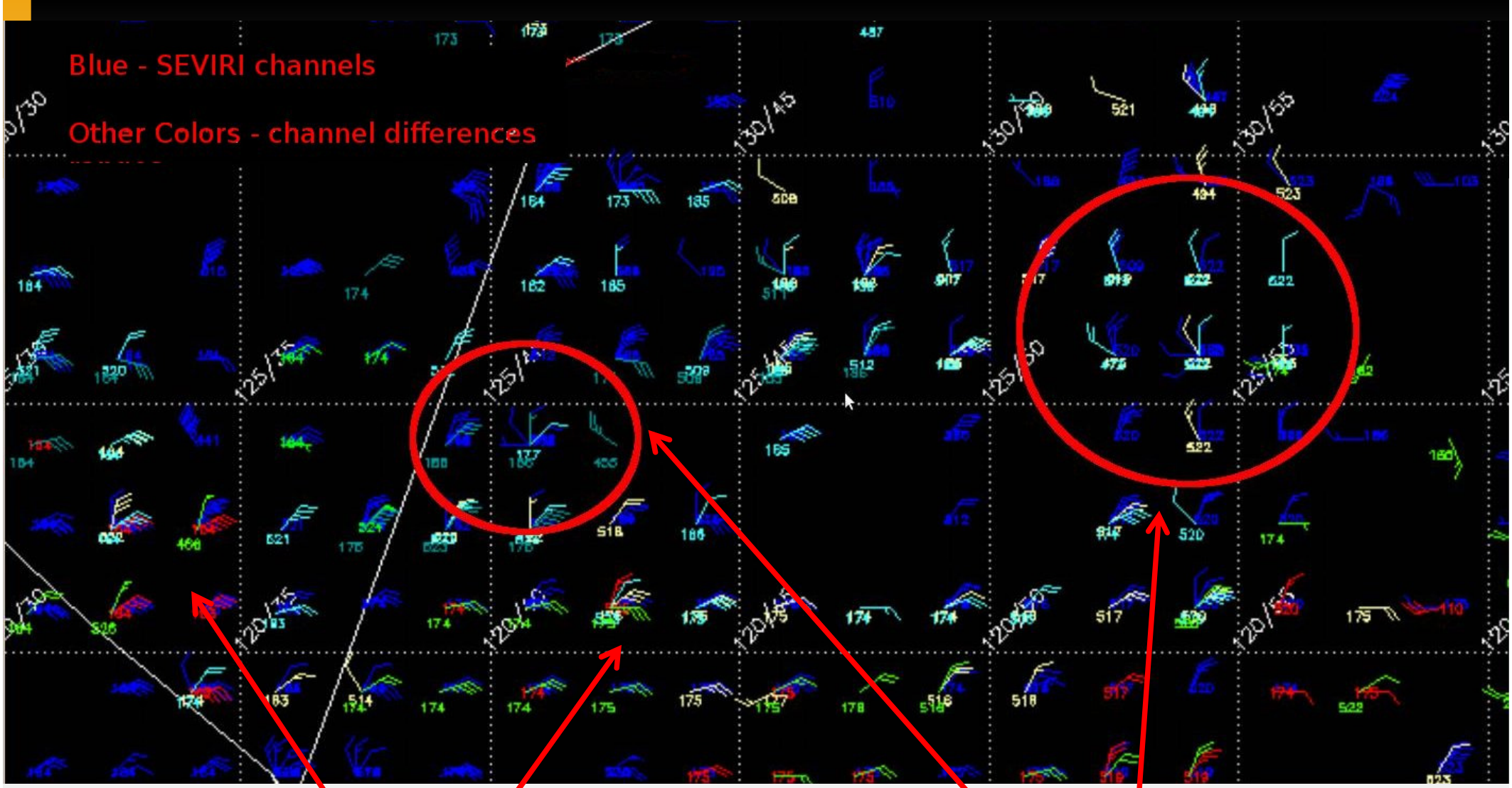
- Which intervals can be used to select a specific cloud area (mainly large droplets, ice crystals, developing or dissipation area). A PhD is being done at INPE focusing on this issue.
- Target window size (6x6, 8x8, 10x10, 20x20?).
- Minimum pixel amount allowed to be tracked.
- Overlap between target windows.

SEVIRI channel combinations for a same scene



Cloud structure identified by channel's difference – good contrast

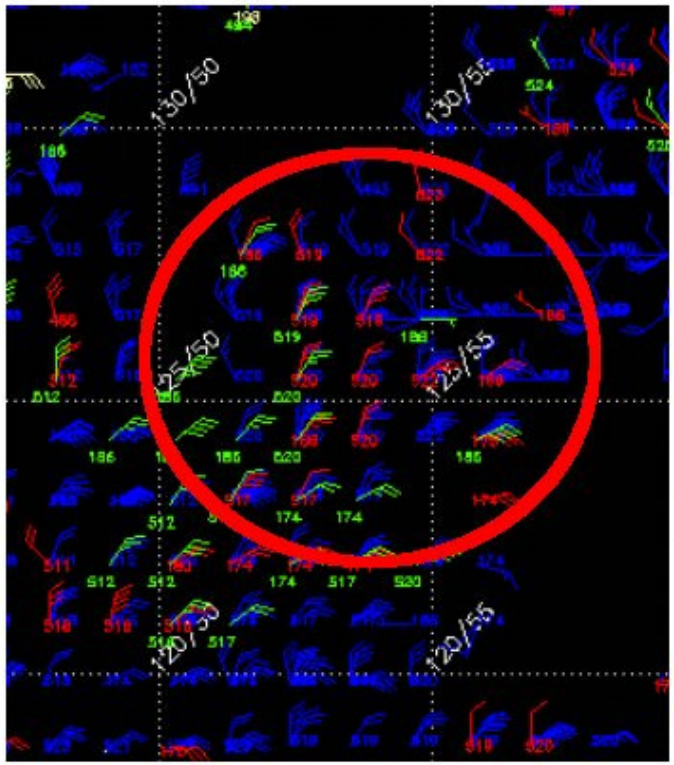
Colorbar: -25 K (purple) to 10 K (red)



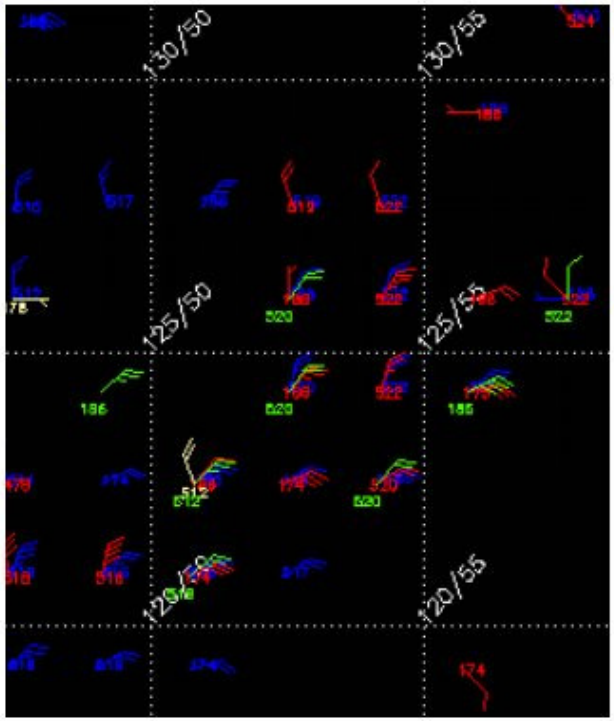
The signal detected using channel difference is not the same as using SEVIRI single channels.

But sometimes any single SEVIRI channel give a different signal too

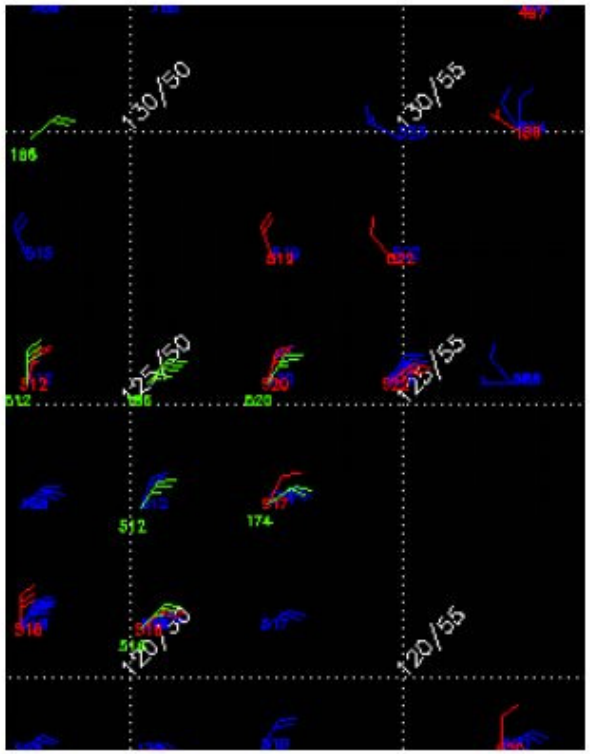
Light blue: -10 to -6 K Red: -2 to 2 K
Green: -8 to -4 K White: -4 to 0 K



50% overlap



25% overlap

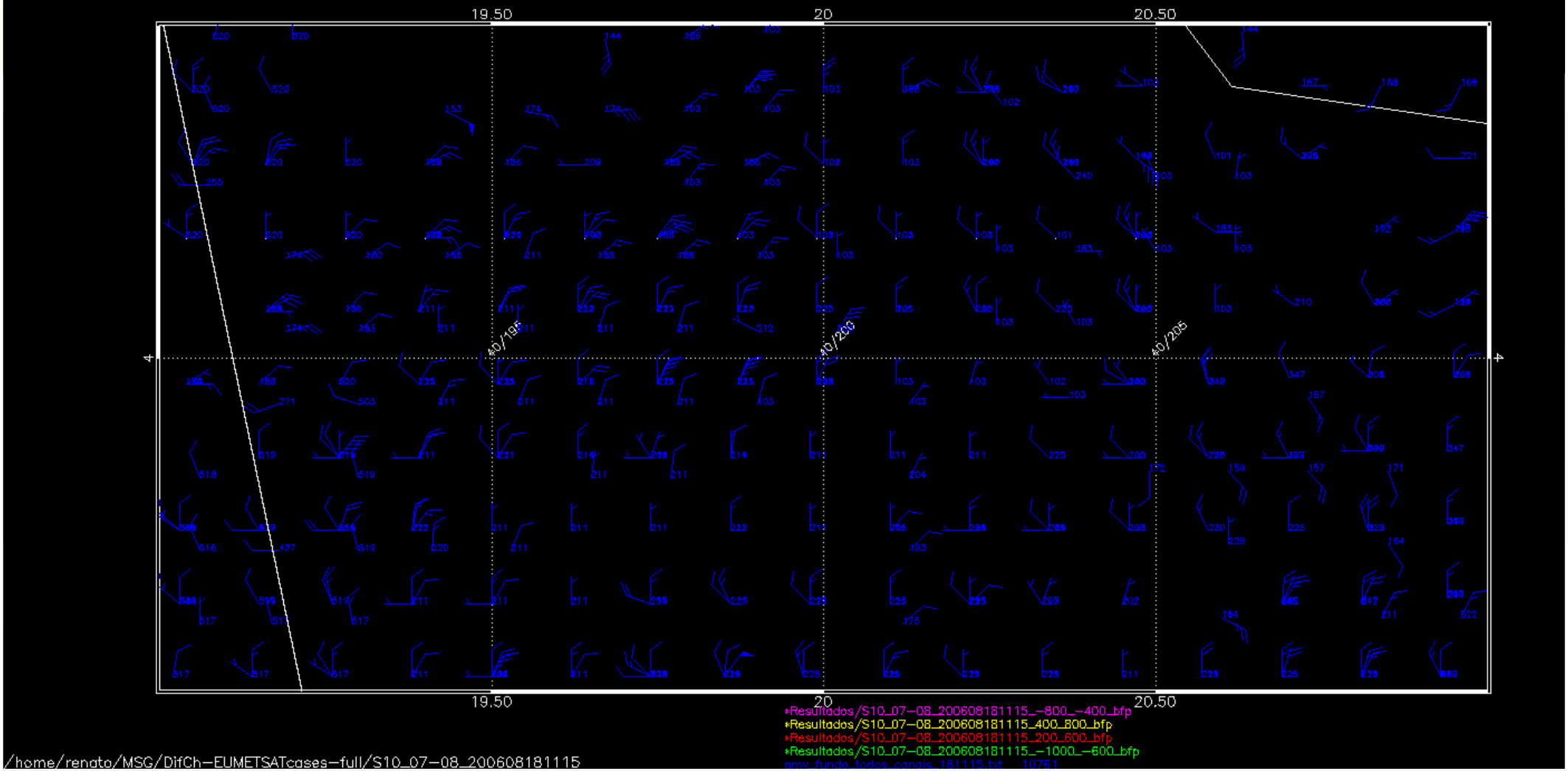


without overlap

Target window overlap – increase the probability to find a well defined pattern.

Using only target windows that have a minimum amount of pixels with useful values makes very improbably have more than one vector to the same structure (in case of the structure was in a corner of a TW).

9.7 µm – 10.8 µm 2006 aug 18 11:15 UTC – overlap 50% - TW 10x10



Pink: -8 to -4 K

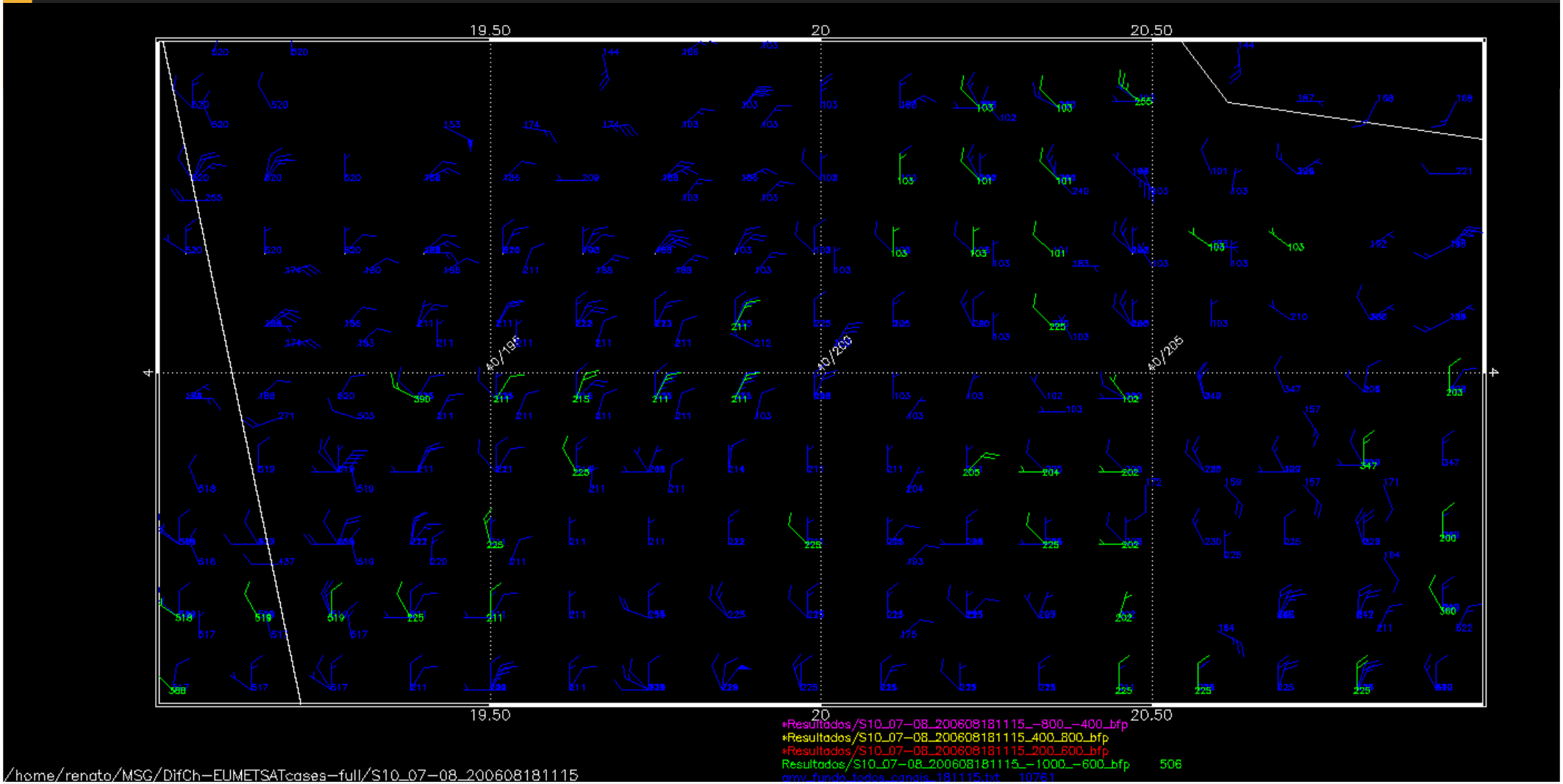
Yellow: 4 to 8 K

Red: 2 to 6 K

Green: -10 to -6 K

Blue: 6.3 8.7 9.7 10.8 12.0 SEVIRI channels together

9.7 µm – 10.8 µm 2006 aug 18 11:15 UTC – overlap 50% - TW 10x10



Pink: -8 to -4 K

Yellow: 4 to 8 K

Red: 2 to 6 K

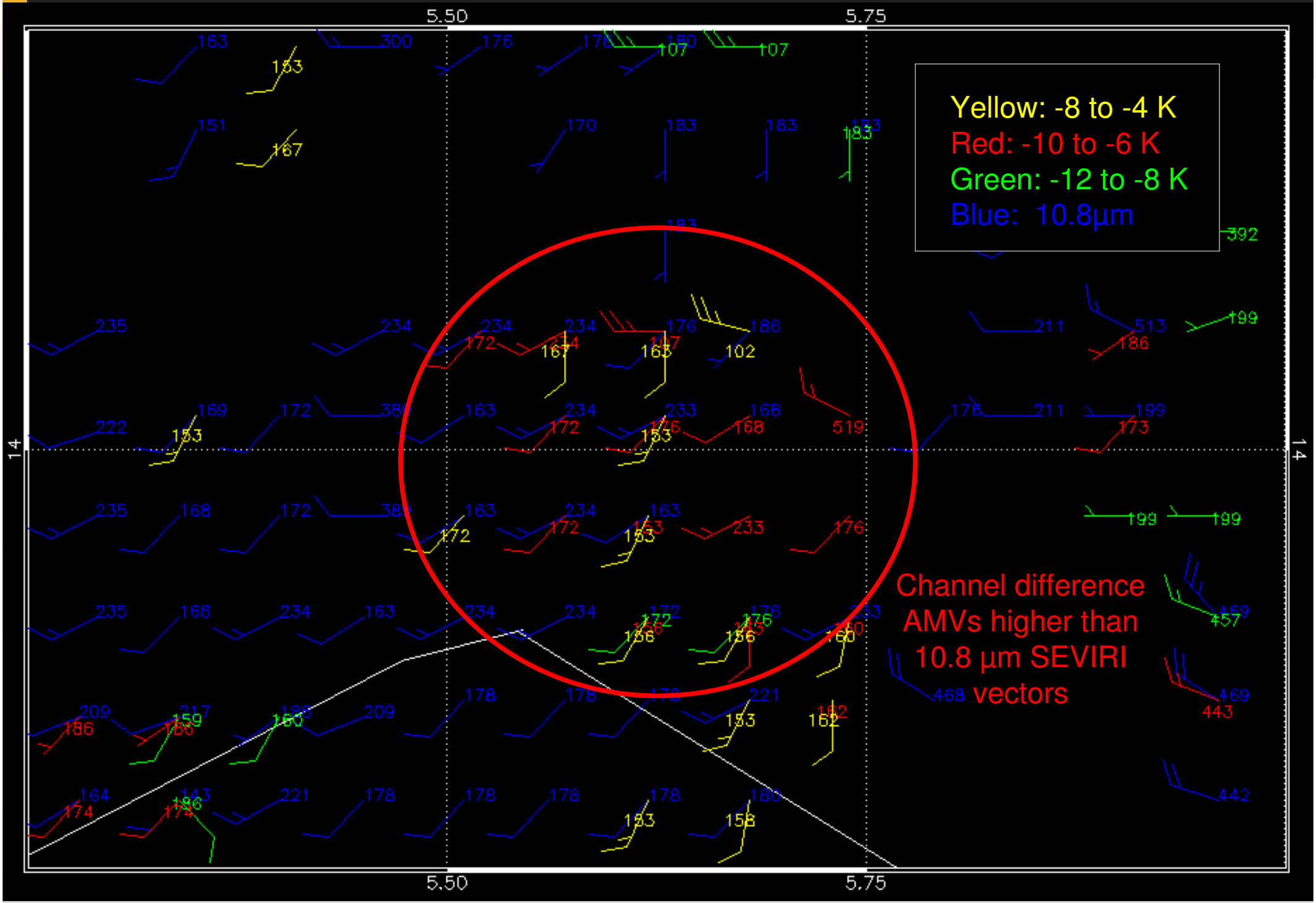
Green: -10 to -6 K

Blue: 6.3 8.7 9.7 10.8 12.0 SEVIRI channels together

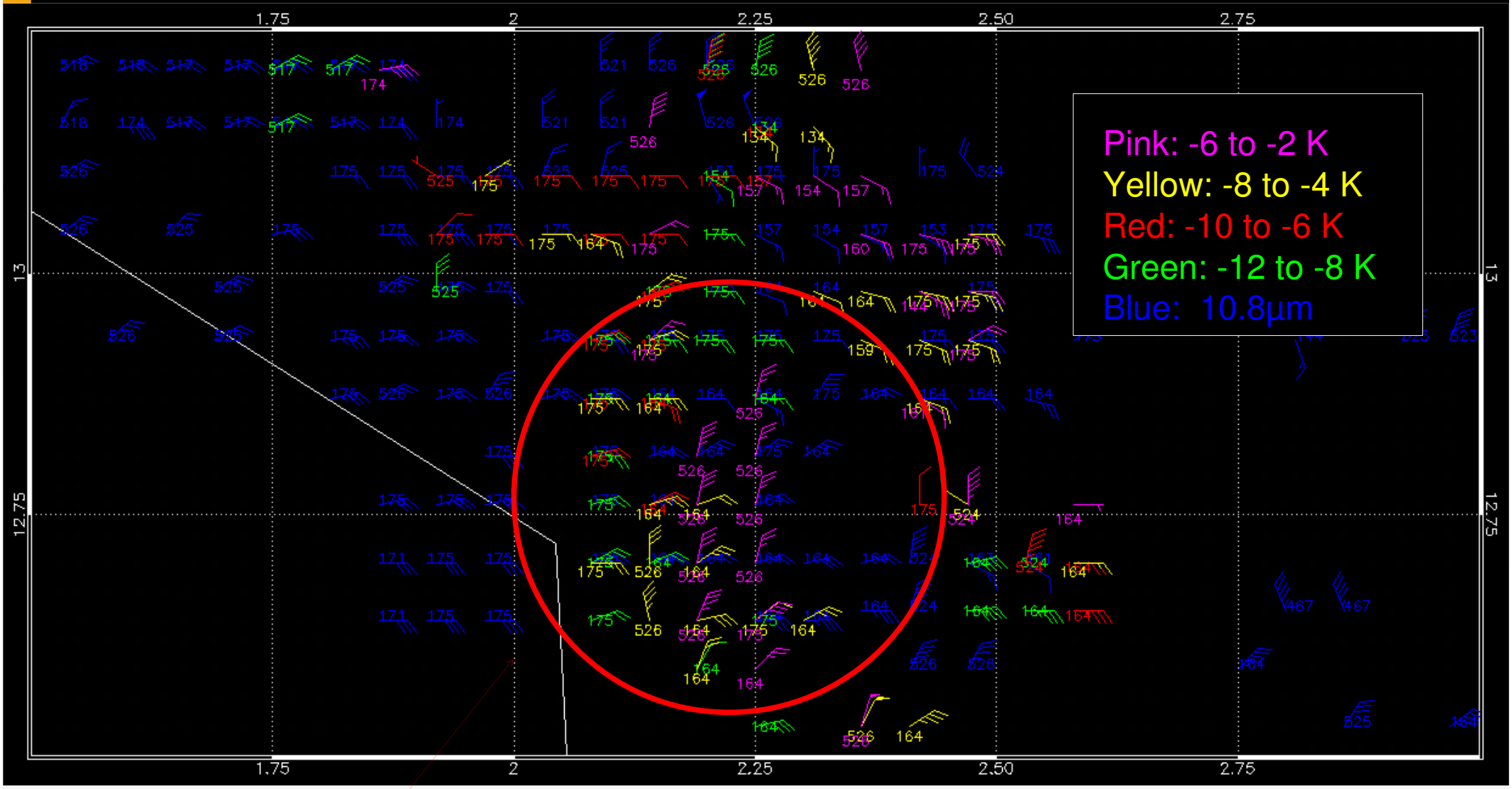
NWP best fit adjust - EUMETSAT visit

- Each channel difference AMV was adjusted to a NWP vector to verify if the technique can detect the wind shear in the deep convection towers.
- NWP profile used: ECMWF – 91 levels, 1x1° horizontal resolution.
- Expansion/reduction of regions with specific microphysical properties was not evaluated in this study.

6.2 µm – 10.8 µm channel difference and 10.8 µm for 11:45 UTC – 50% overlap – TW 8x8



6.2 µm – 10.8 µm channel difference and 10.8 µm for 12:45 UTC – 50% overlap – TW 10x10



Here, AMVs are in a lower level than 10.8 µm vectors

Preliminary results

- In some areas of the DCC tops consistent and coherent specific flows have been detected using channel combinations.
- Comparison of AMV derived by the technique against the ECMWF wind profiles showed that many vectors are in good agreement with higher levels forecast winds.
- In some situations, the wind detected by the channels differences are different from wind detected using single channels – The flow detected using channel difference is **generally** not detected using any of the single channels.

Preliminary results

- Combination – first results:
  - **6.2 µm - 10.8 µm** → (overshooting) not give many information about the inner region of the top, mainly on the boundary regions.
  - **9.7 µm - 10.8 µm** → gave more information about the inner region (central area) of the DCC tops.

Next steps

- MIT radar Velocity Volume Parcel (VVP) data from AMMA project.
- Look if exist any relationship between the wind shear rotation (clockwise / anticlockwise) and some area of the cloud tops (newer / older).
- Check if detected motions correspond to cloud areas expansion instead of local winds.
- Height assignment – how this can be done.

Thanks!