Improved Images by Filtering

2004. 1. 17

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Smoothing Operation

- **These algorithms are applied in order to reduce noise and/or to prepare images for further processing such as segmentation.**
  - ***Uniform filter*** **- The output image is based on a local averaging of the input filter where all of the values within the filter support have the same weight.**

$$h_{rect}[j,k] = \frac{1}{25}\begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$$

Smoothing Operation

- ***Median filter*** **- The median statistic was described in Section 3.5.2. A median filter is based upon moving a window over an image (as in a convolution) and computing the output pixel as the median value of the brightness's within the input window.**

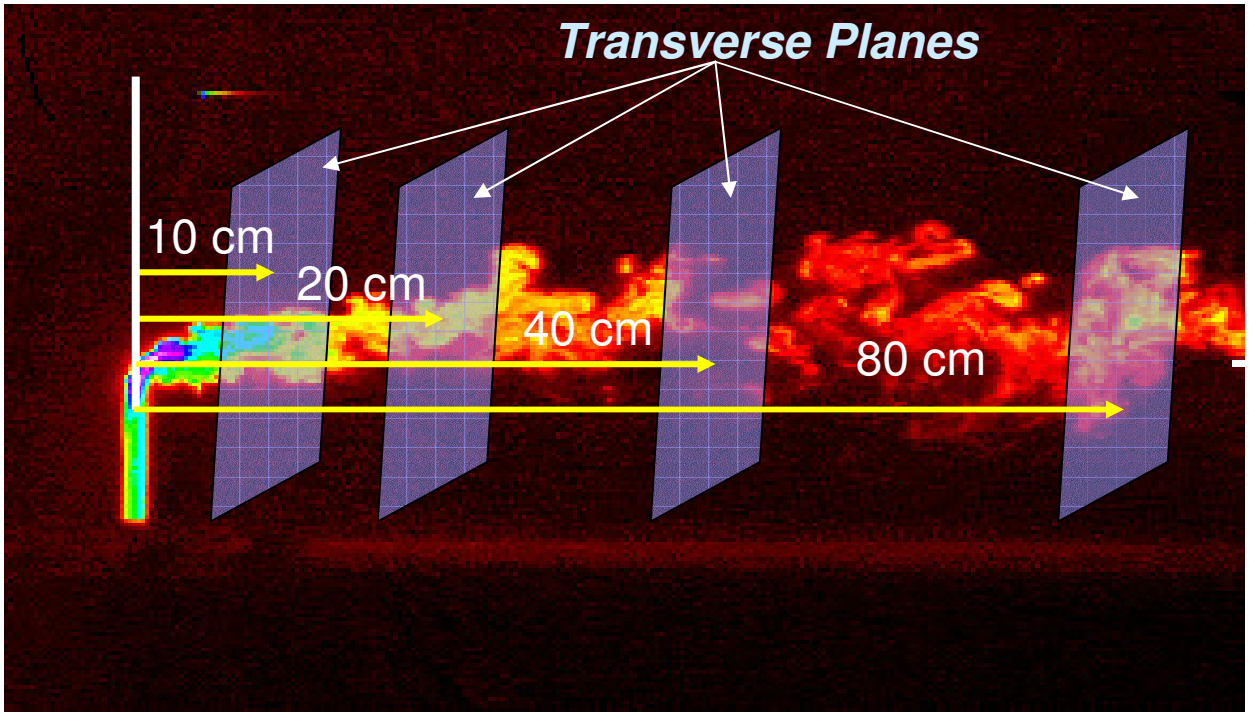
Original Image

RESULTS

Uniform filter

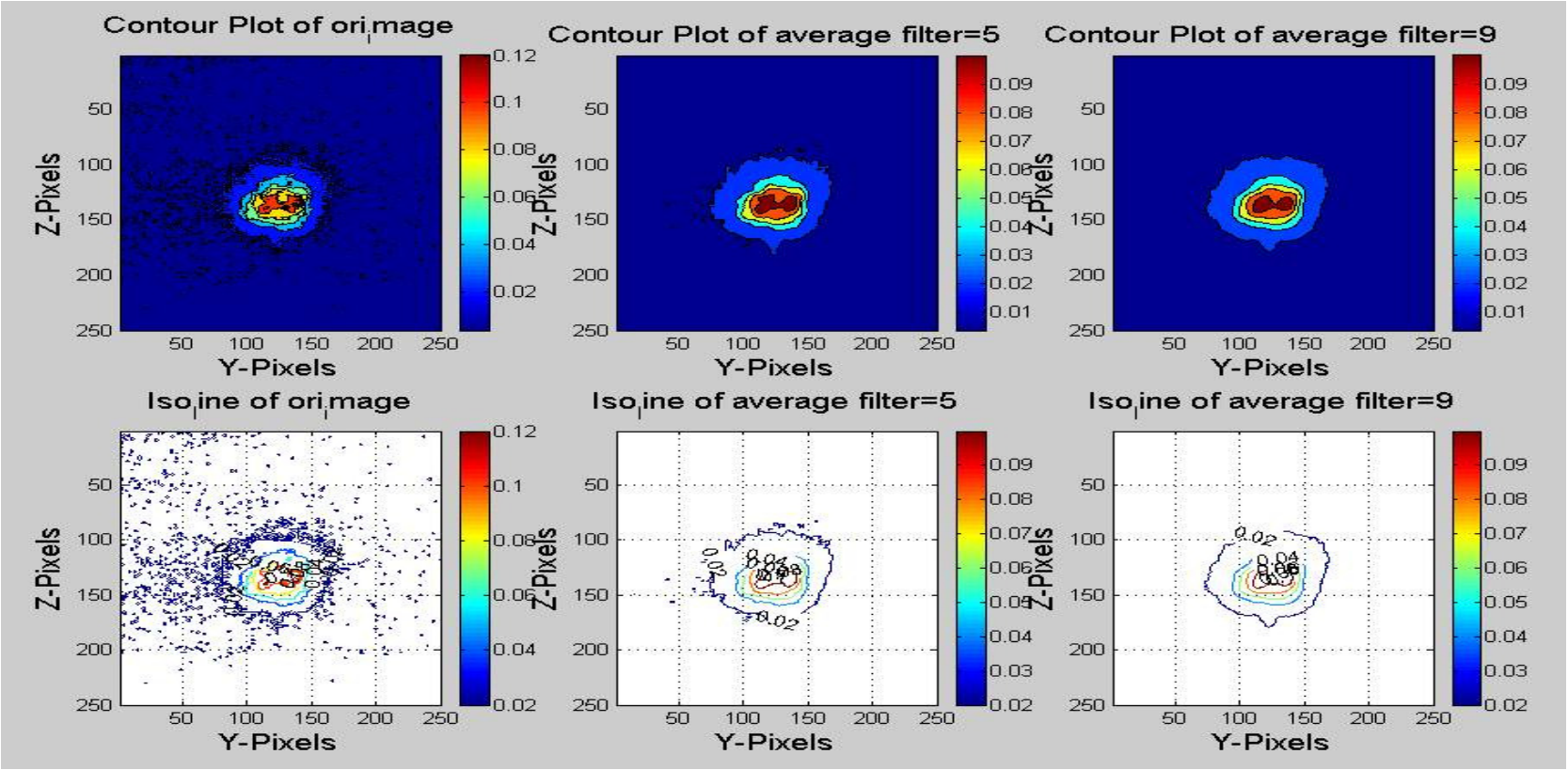
Median filter

Single Plume Transverse Plane



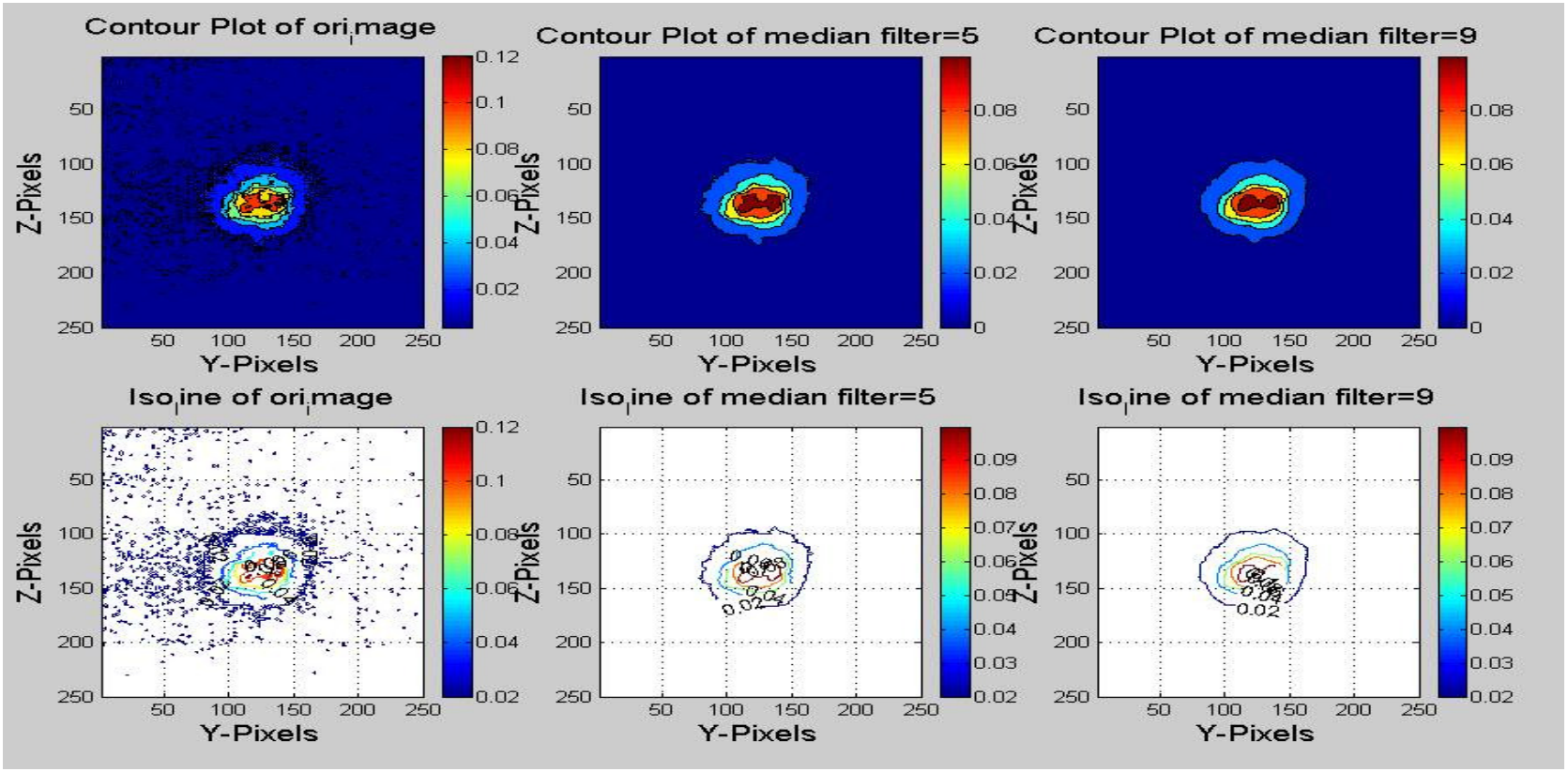
Linear Smoothing Operation (Using Average Filter 5x5, 9x9)

10 cm Plume Average Image



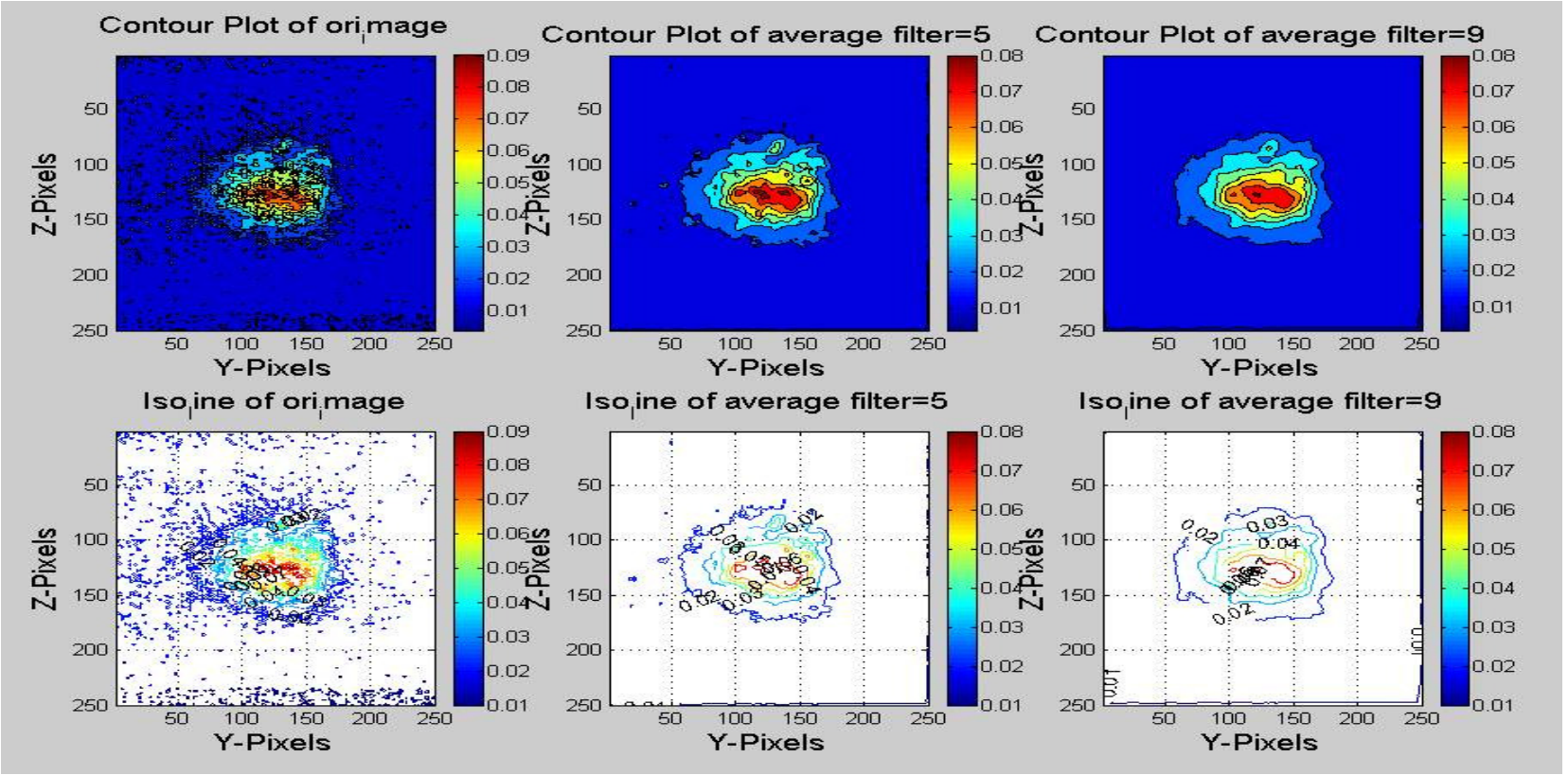
Non-Linear Smoothing Operation (Using Median Filter 5x5, 9x9)

10 cm | Plume Average Image



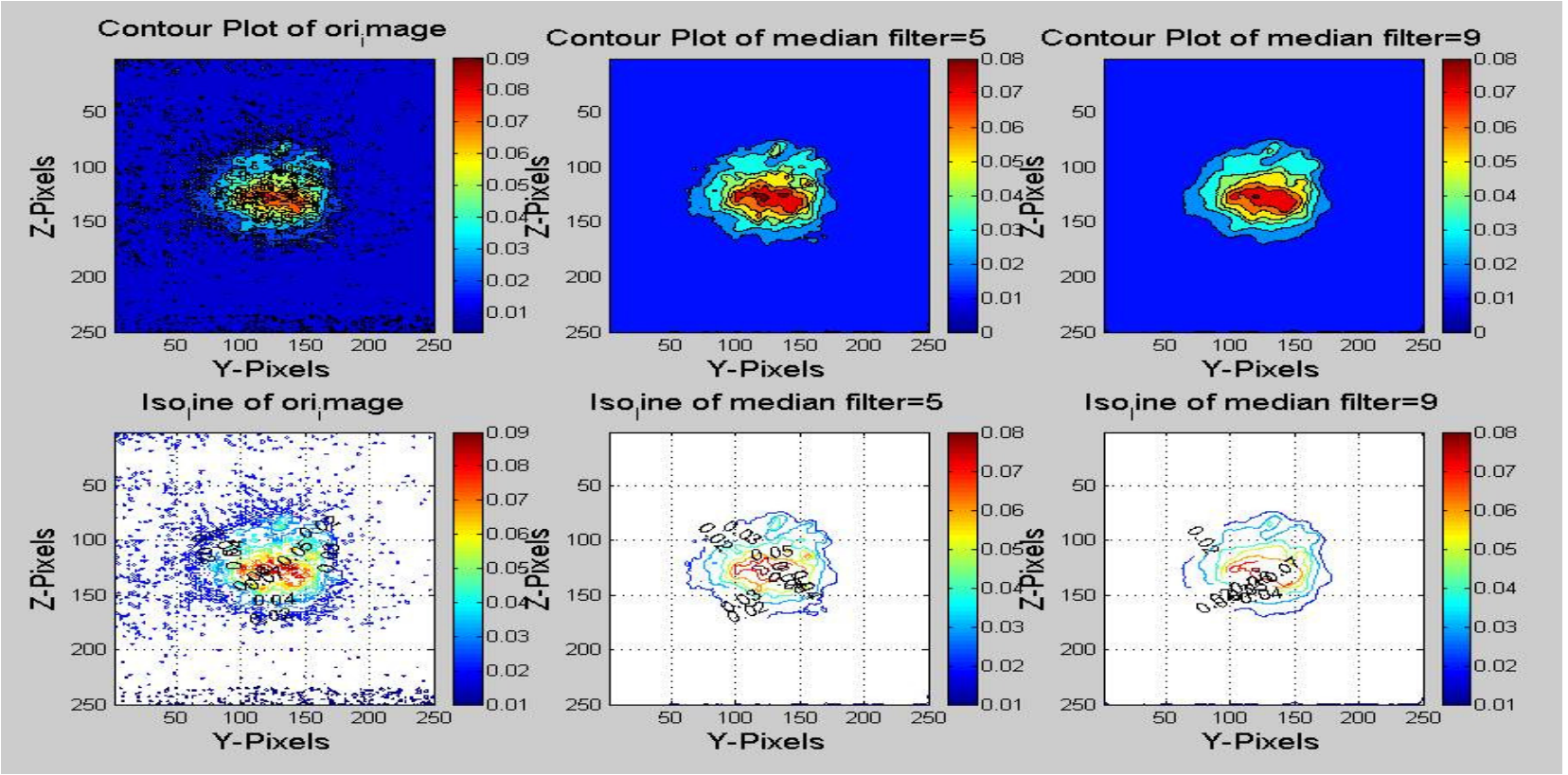
Linear Smoothing Operation (Using Average Filter 5x5, 9x9)

20 cm | Plume Average Image



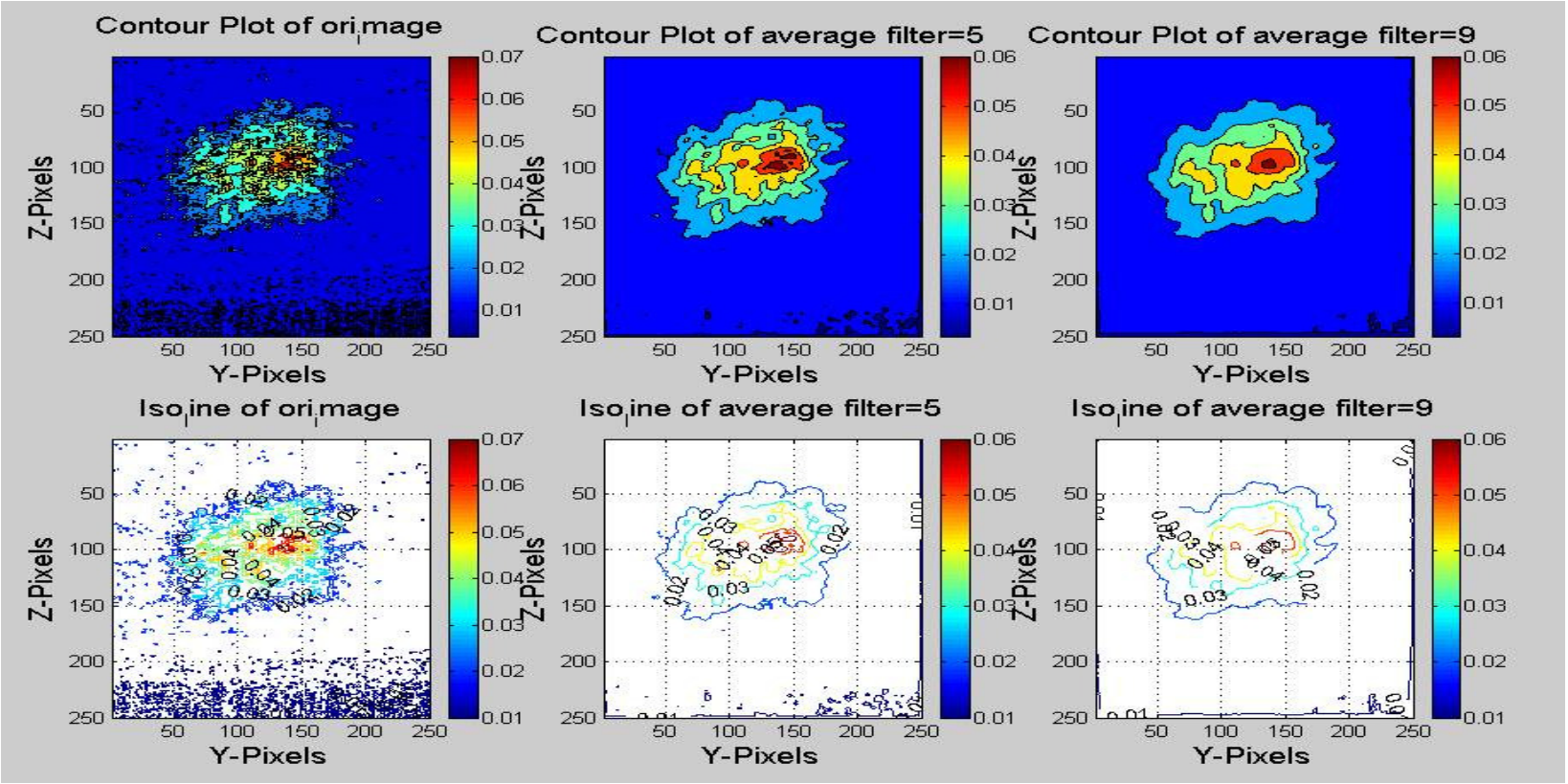
Non-Linear Smoothing Operation (Using Median Filter 5x5, 9x9)

20 cm | Plume Average Image



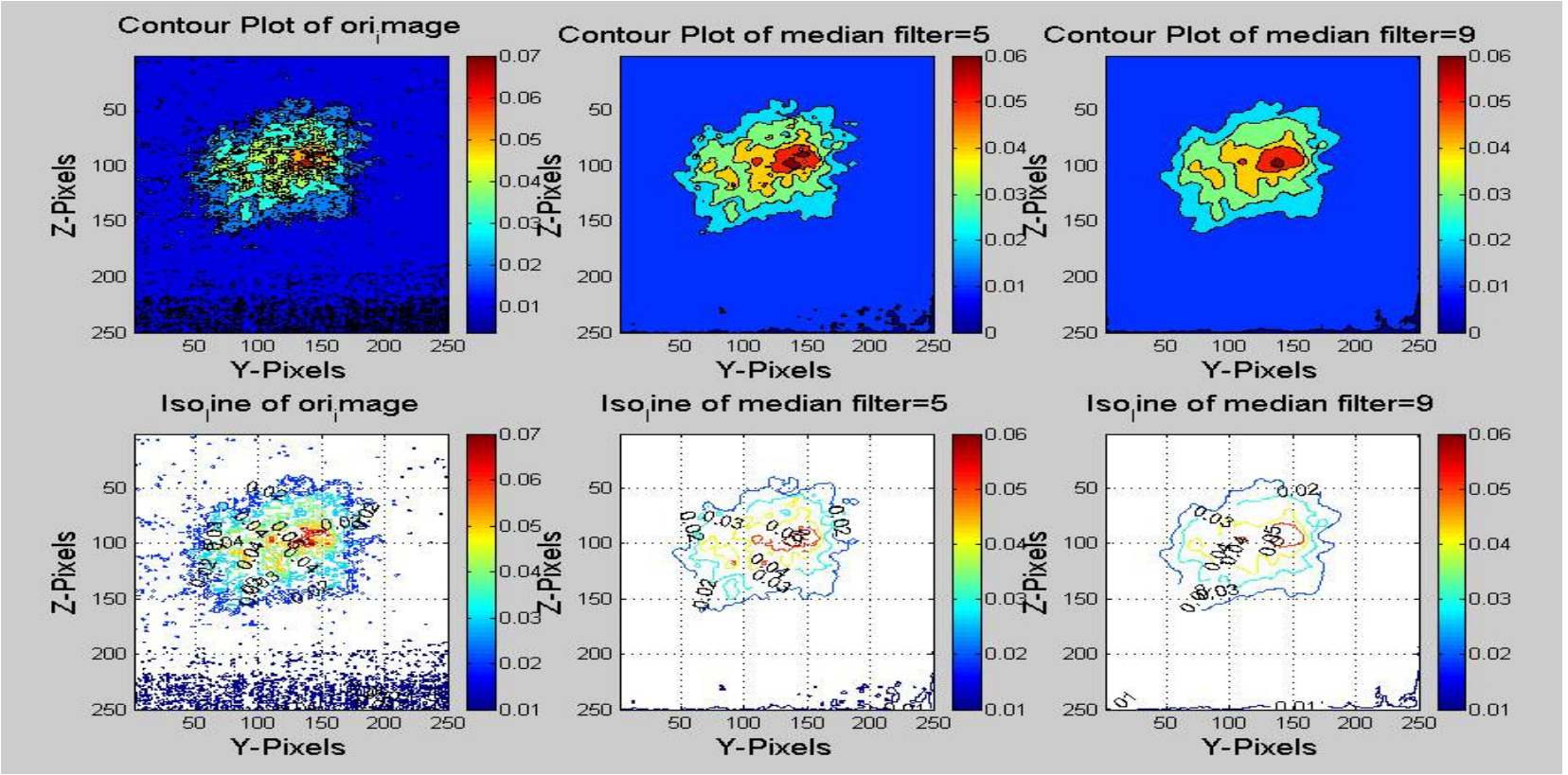
Linear Smoothing Operation (Using Average Filter 5x5, 9x9)

40 cm | Plume Average Image



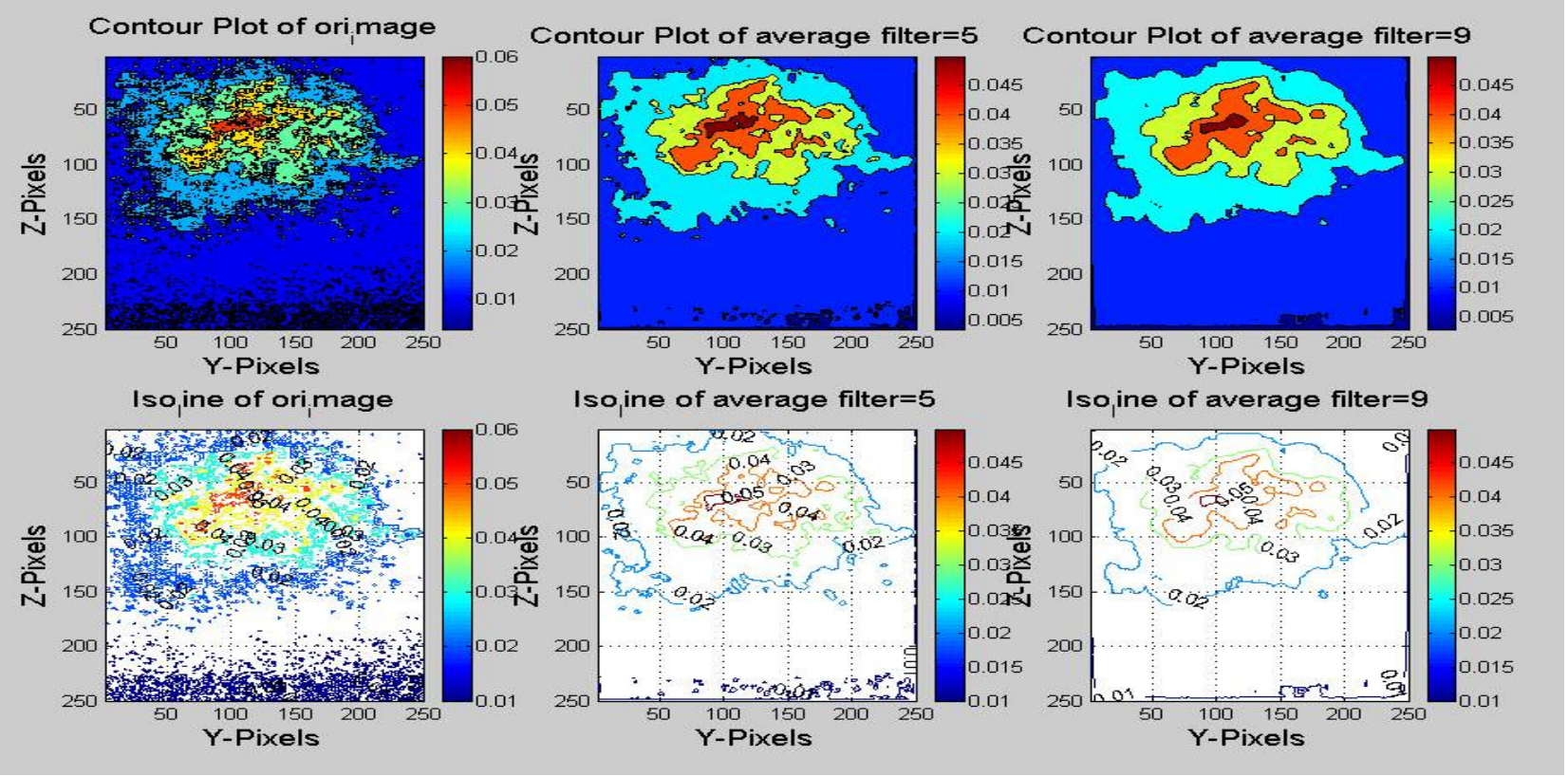
Non-Linear Smoothing Operation (Using Median Filter 5x5, 9x9)

40 cm | Plume Average Image



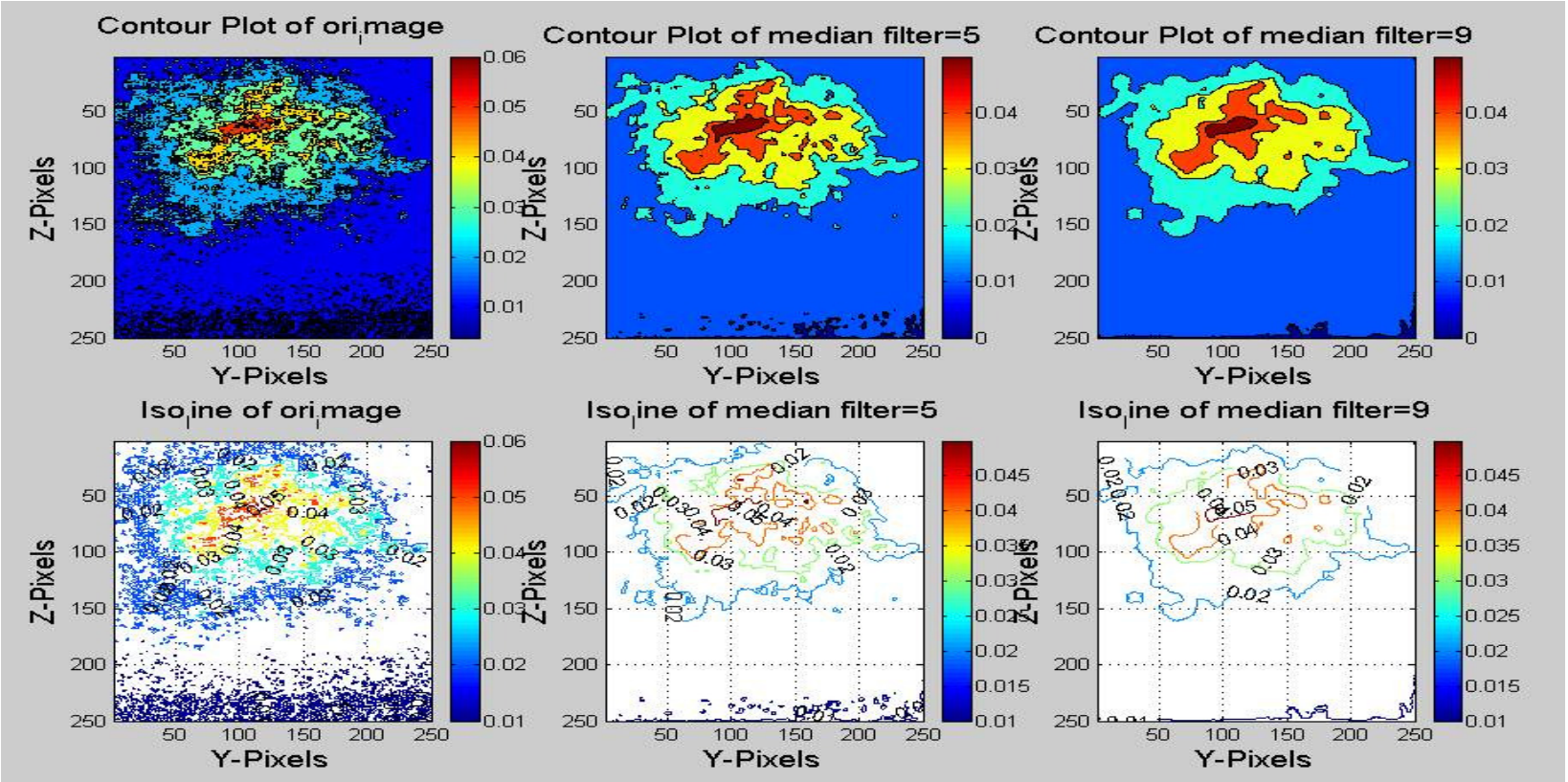
Linear Smoothing Operation (Using Average Filter 5x5, 9x9)

80 cm | Plume Average Image



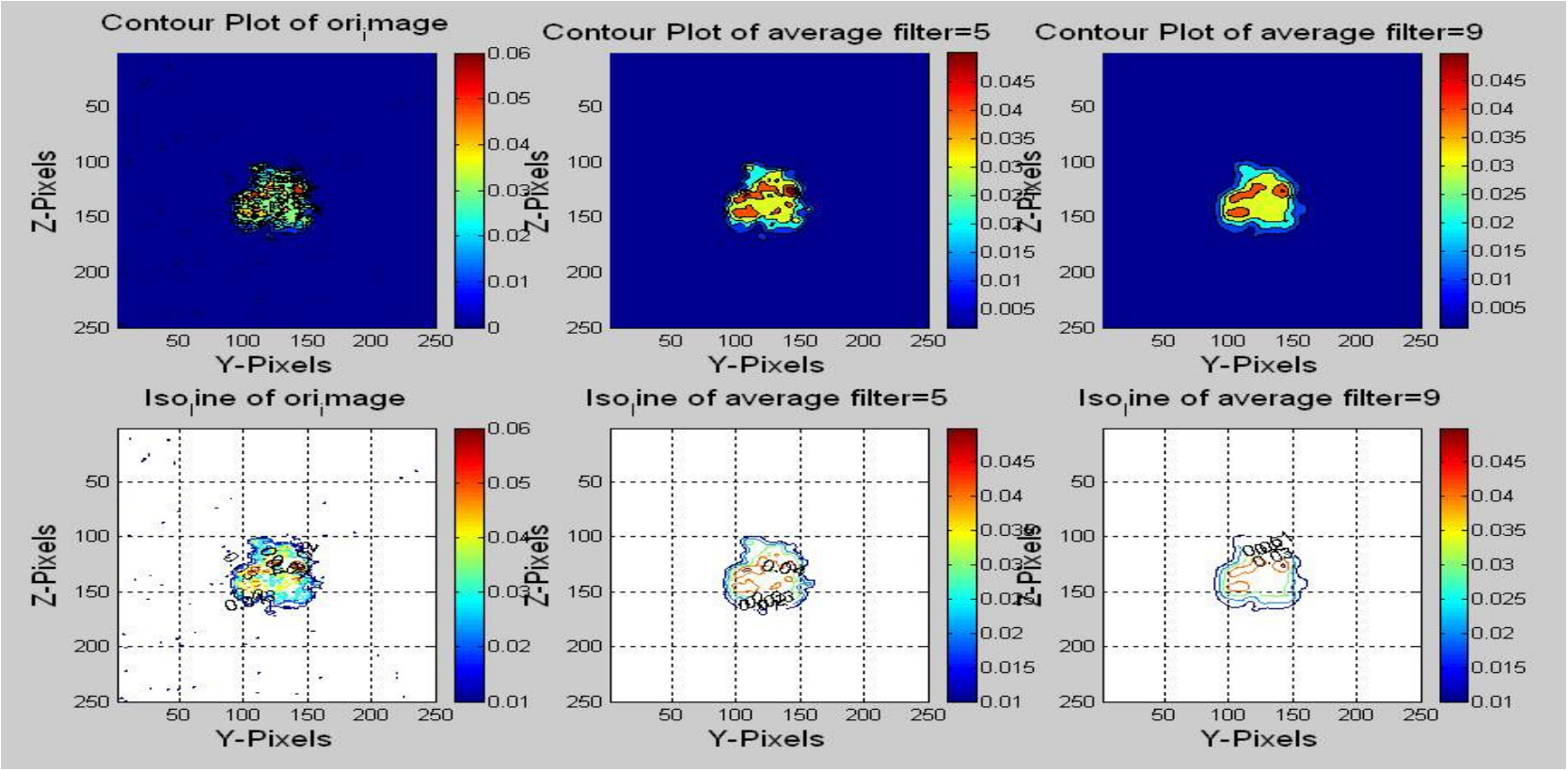
Non-Linear Smoothing Operation (Using Median Filter 5x5, 9x9)

80 cm | Plume Average Image



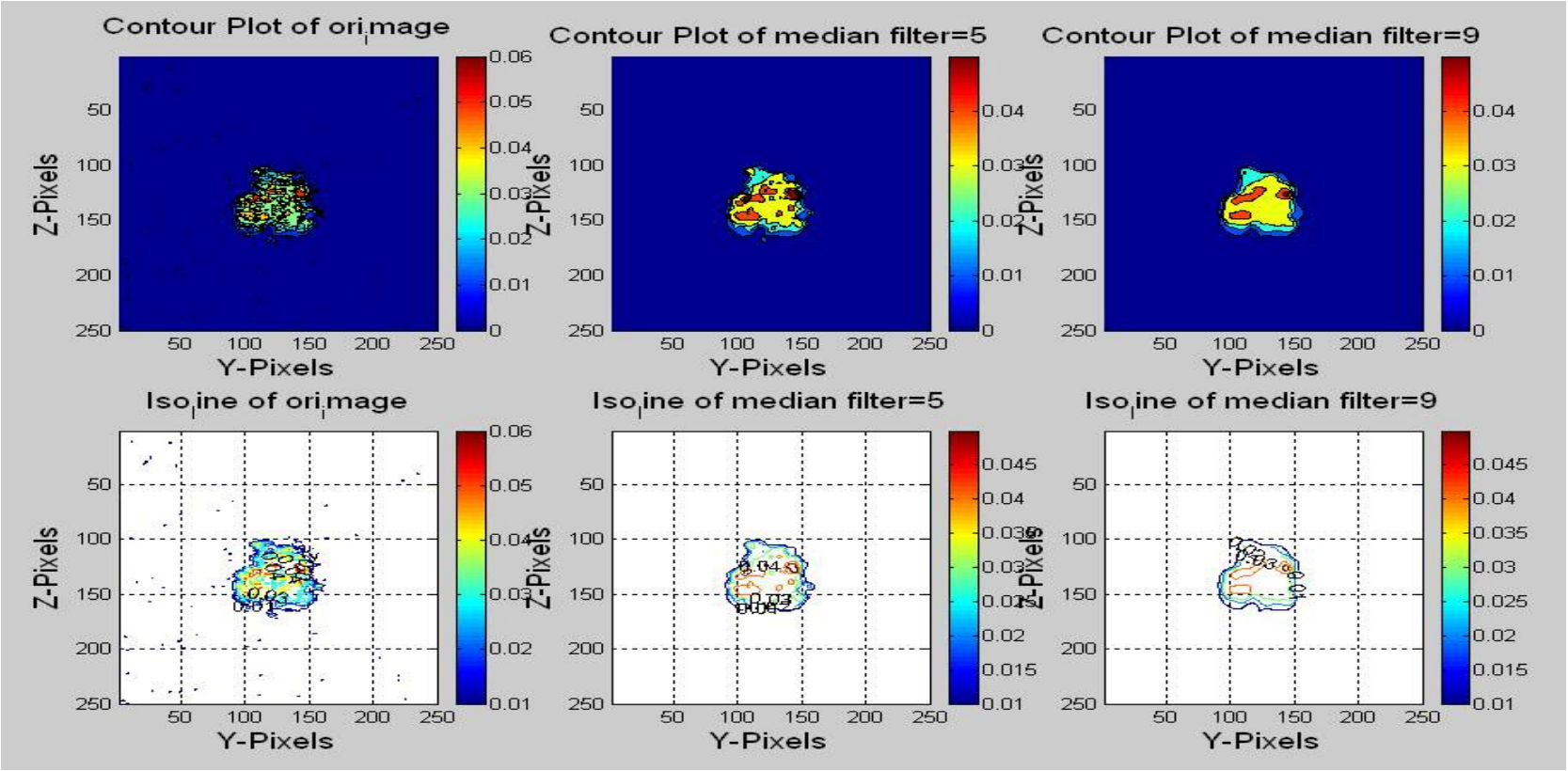
Linear Smoothing Operation (Using Average Filter 5x5, 9x9)

10 cm Plume RMS Image



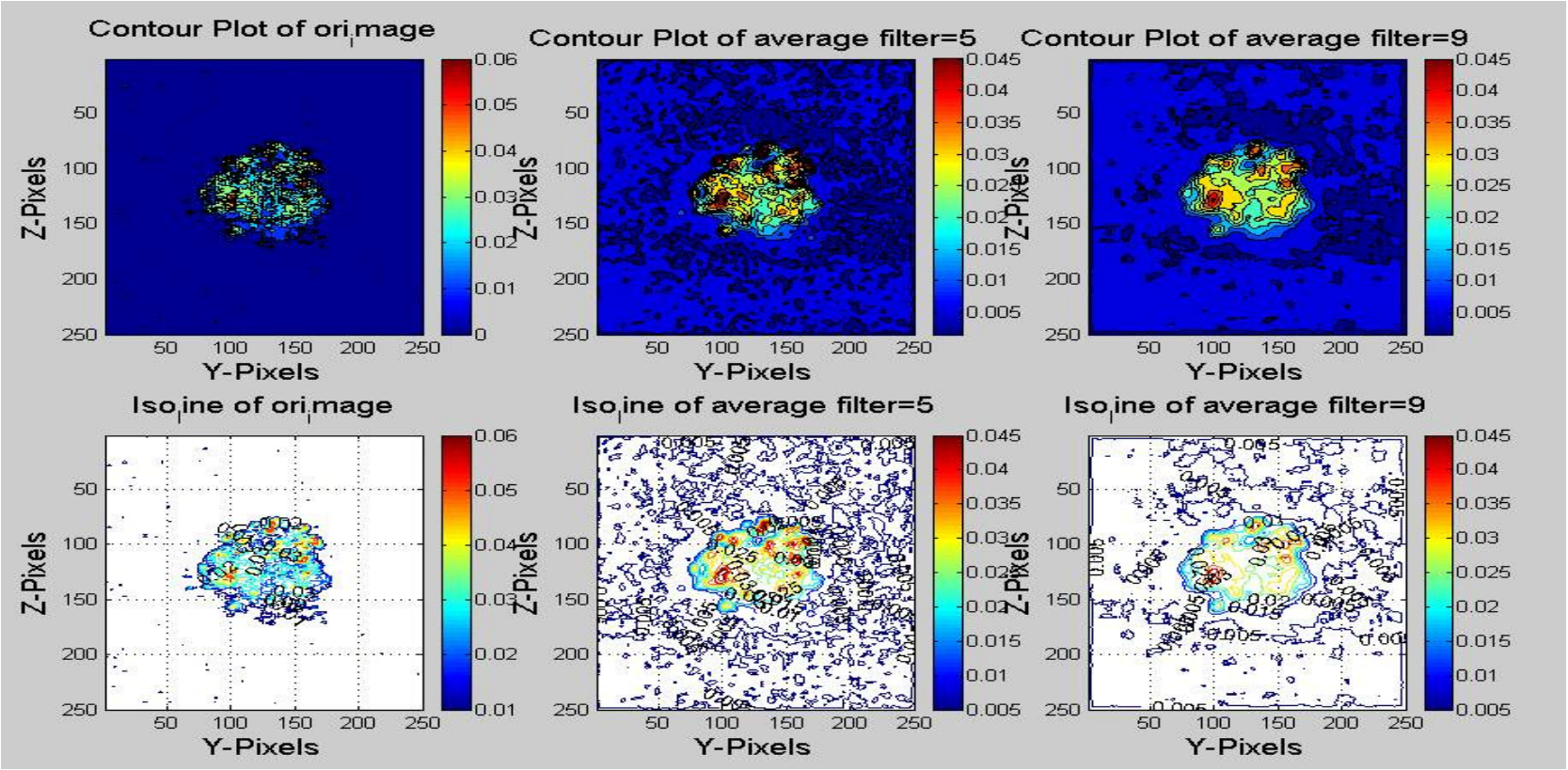
Non-Linear Smoothing Operation (Using Median Filter 5x5, 9x9)

10 cm Plume RMS Image



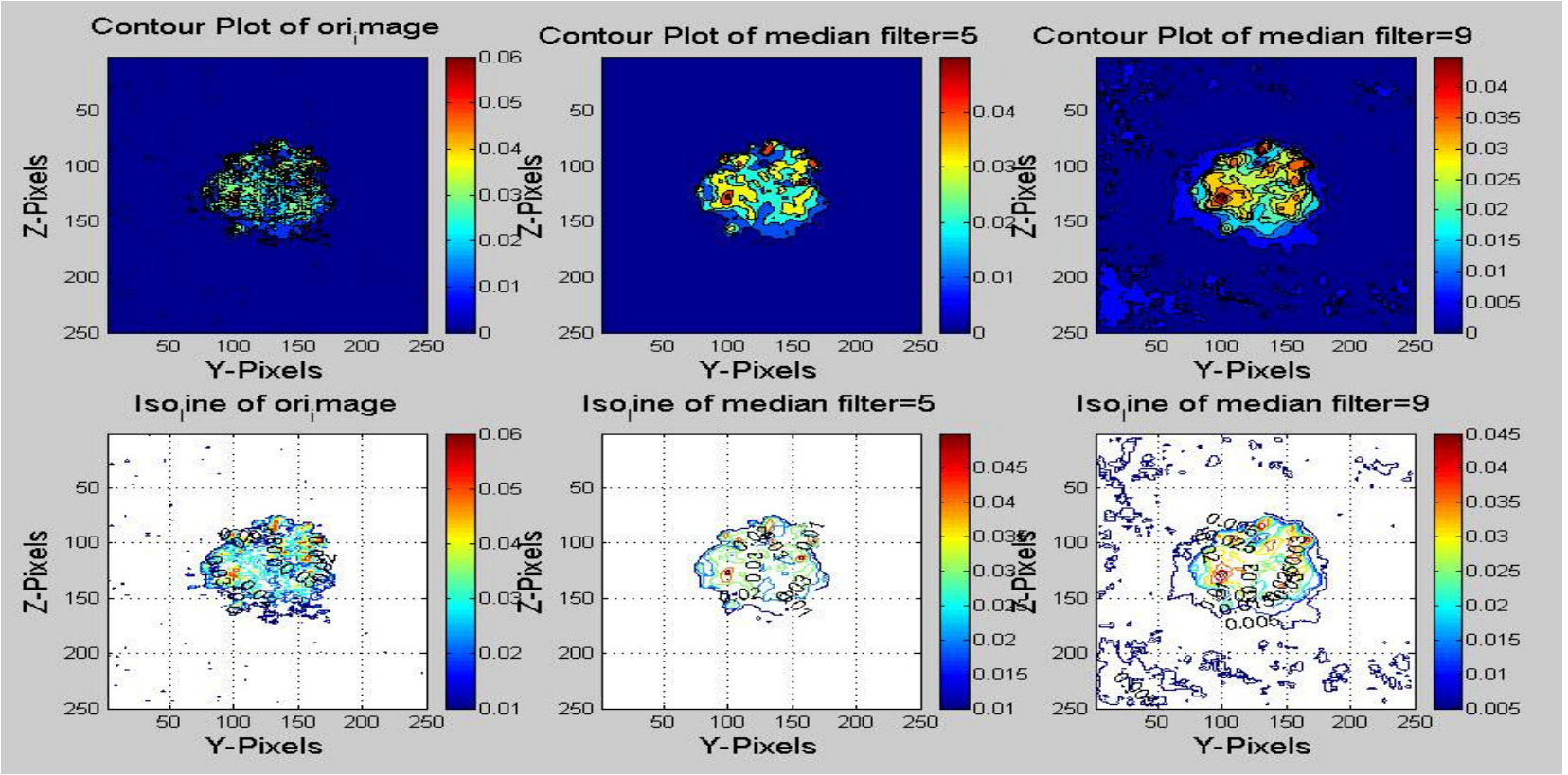
Linear Smoothing Operation (Using Average Filter 5x5, 9x9)

20 cm Plume RMS Image



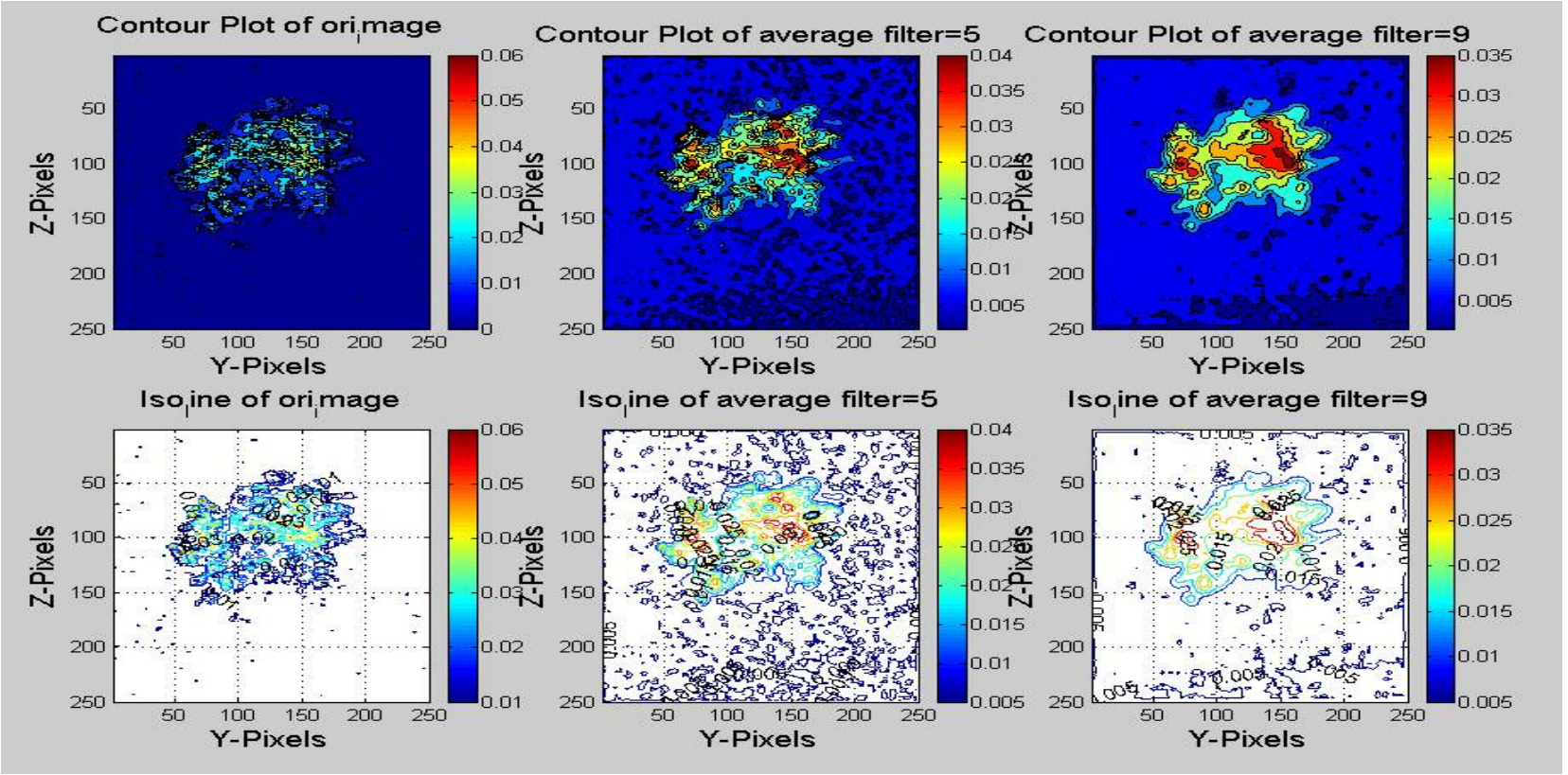
Non-Linear Smoothing Operation (Using Median Filter 5x5, 9x9)

20 cm | Plume RMS Image



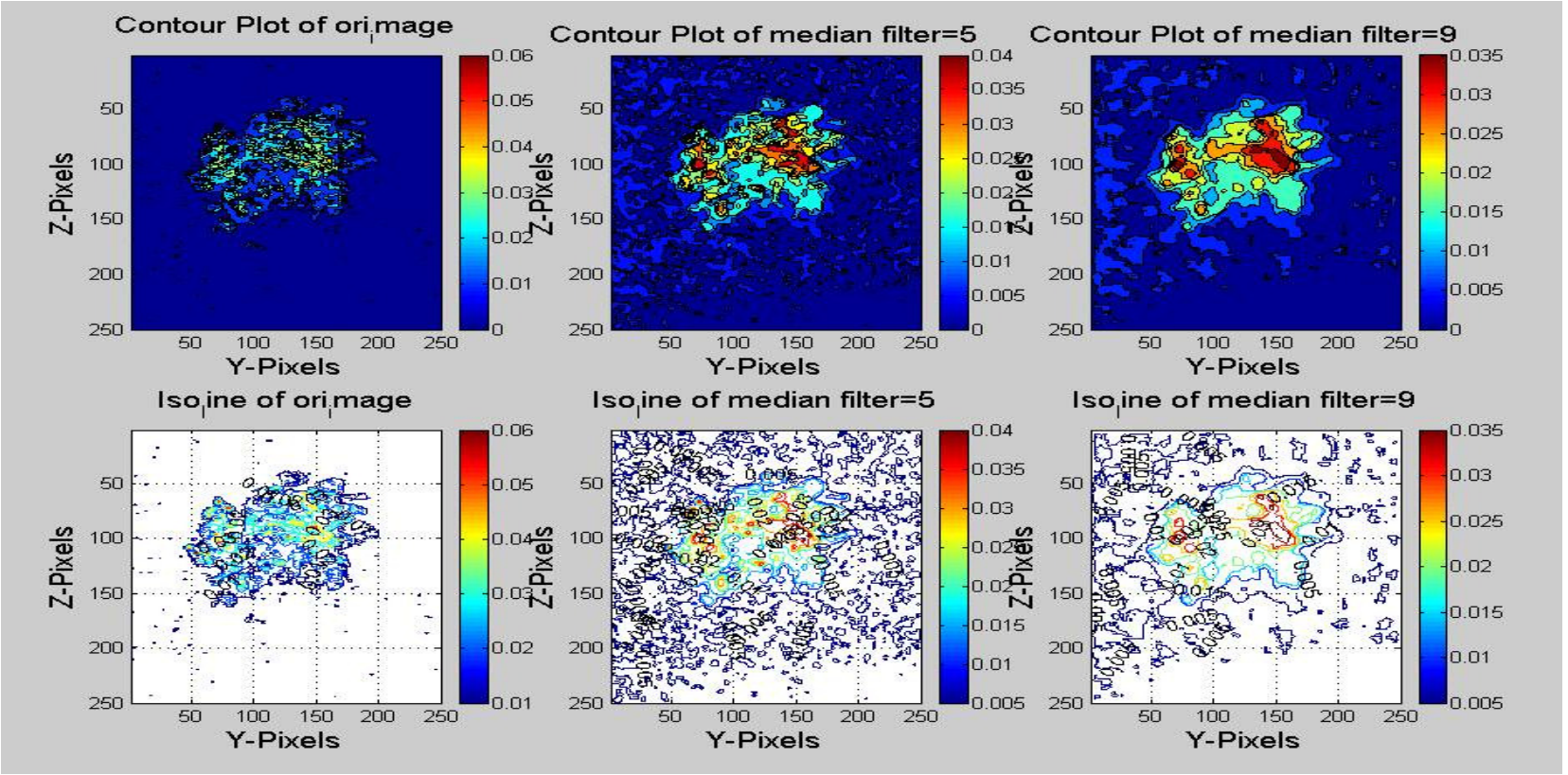
Linear Smoothing Operation (Using Average Filter 5x5, 9x9)

40 cm Plume RMS Image



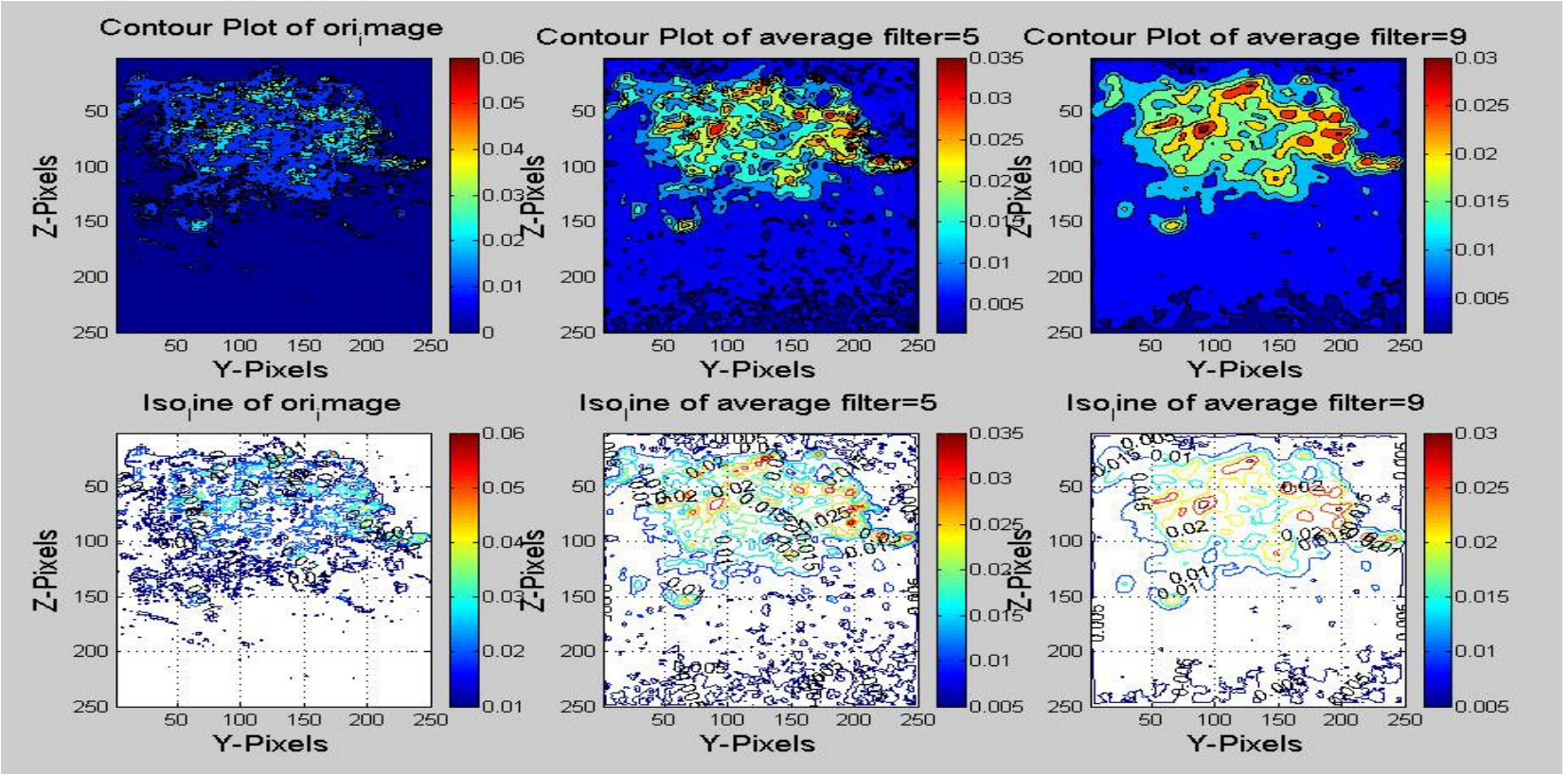
Non-Linear Smoothing Operation (Using Median Filter 5x5, 9x9)

40 cm Plume RMS Image



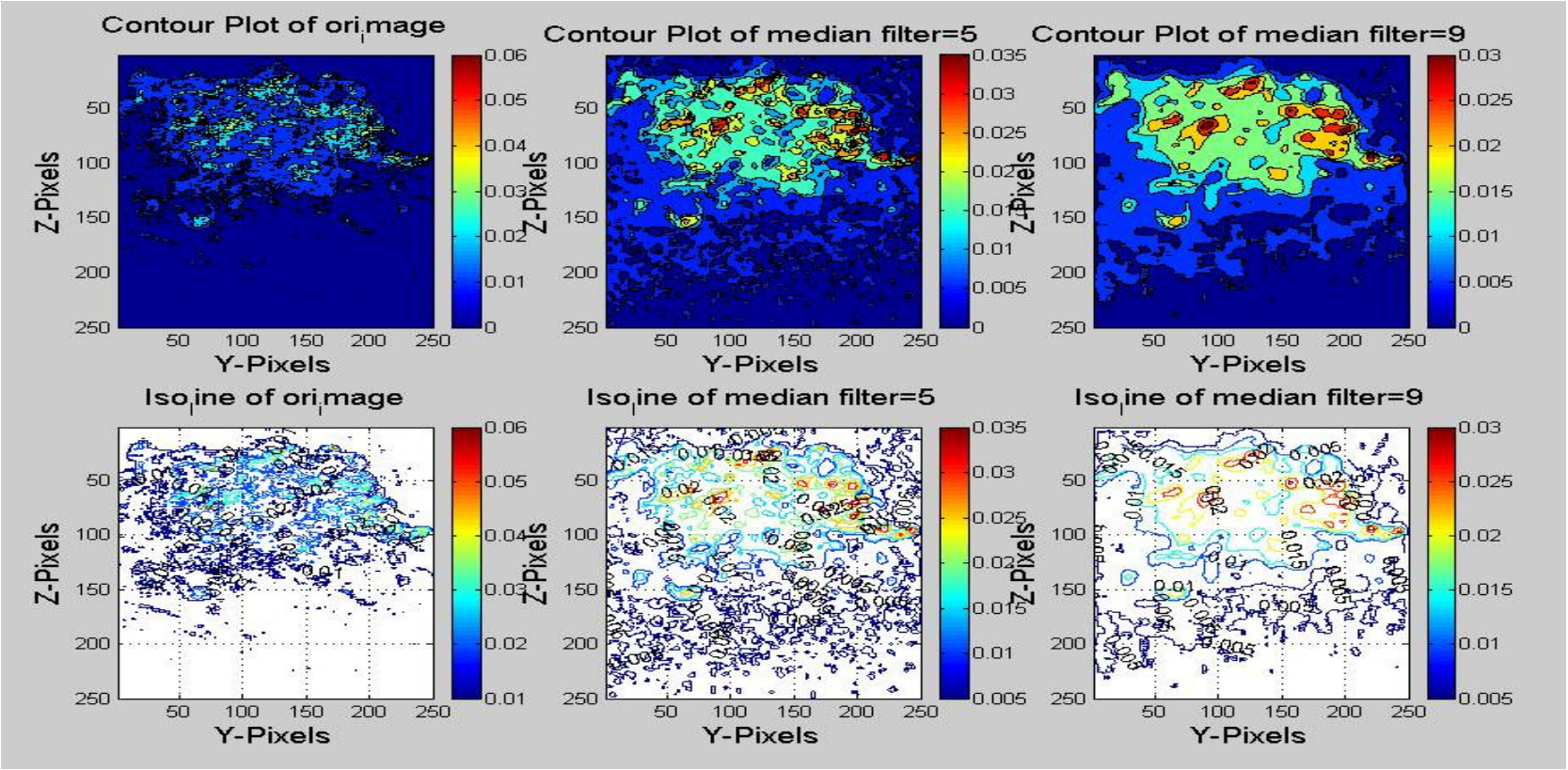
Linear Smoothing Operation (Using Average Filter 5x5, 9x9)

80 cm | Plume RMS Image



Non-Linear Smoothing Operation (Using Median Filter 5x5, 9x9)

80 cm | Plume RMS Image



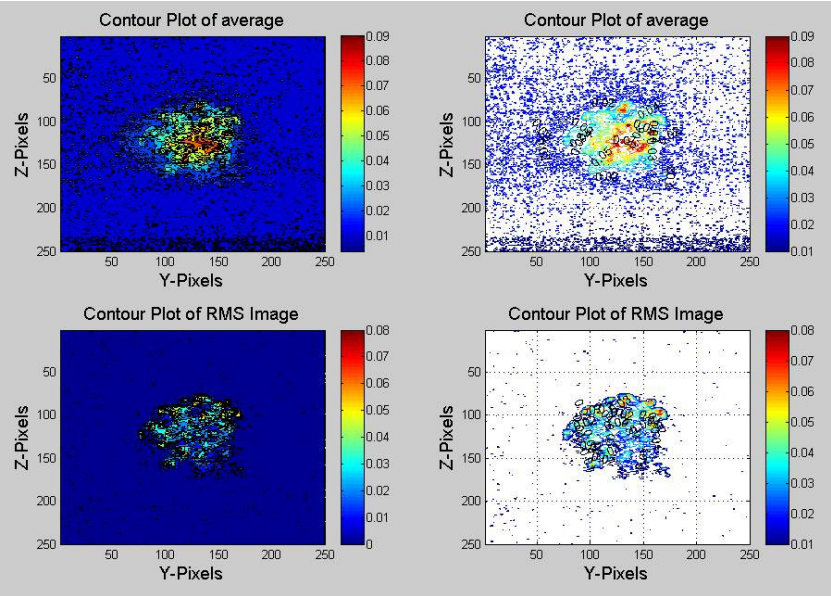
Conclusion of Smoothing Algorithms

- After getting result images, better off smoothing operation
- Filter size (nxn) must be changed as output images
- Linear filter makes simpler image than Non-linear filter's

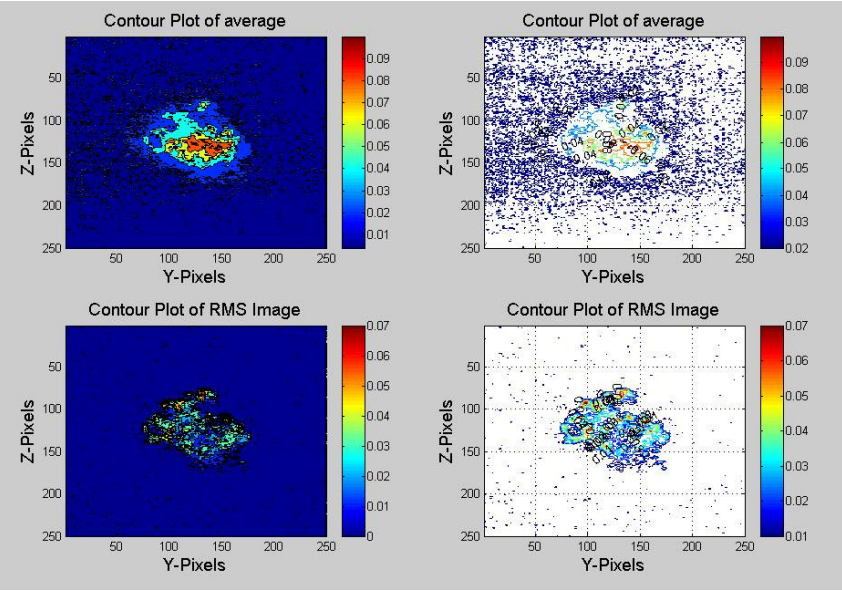
Number of Separate Images required to get a smoothing Images

- Compared 1-min data with 2-min data in 5 images(@ 24 sec) -> ***No Differences***

20 cm 1-min Data



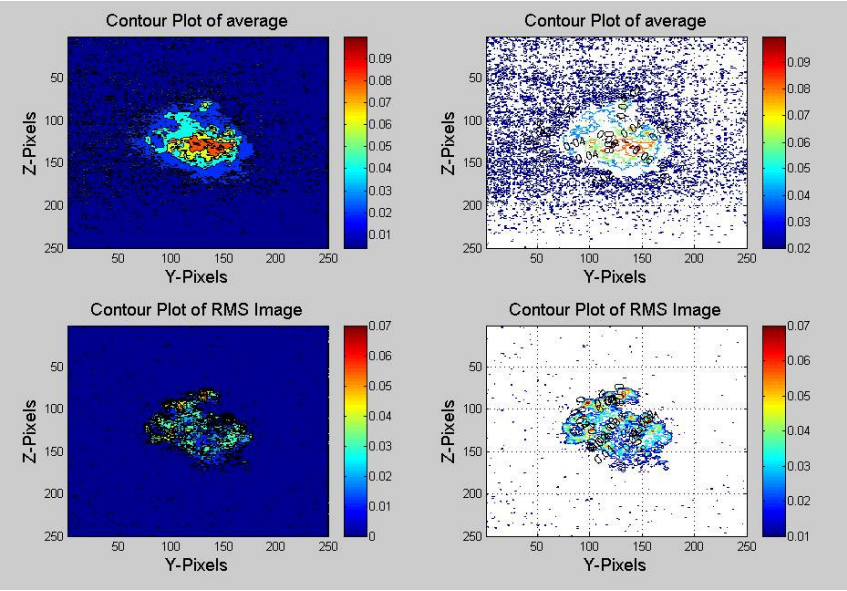
20 cm 2-min Data



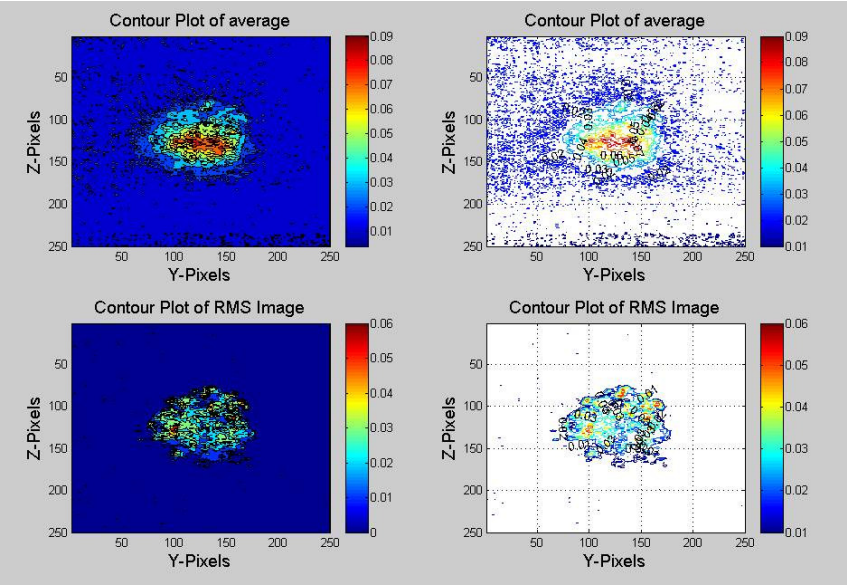
Number of Separate Images required to get a smoothing Images

- Compared 5 images(@ 24 sec) with 10 images (@ 12 sec) in 2-min data -> ***Small differences***

20 cm 5-images



20 cm 10-images



Conclusion of Number of Images

- If the number of images are not enough, the analysis would be meaningless.
- The more images, The more accuracy
- Should be applied a traditional theory, Nyquist sampling theory.