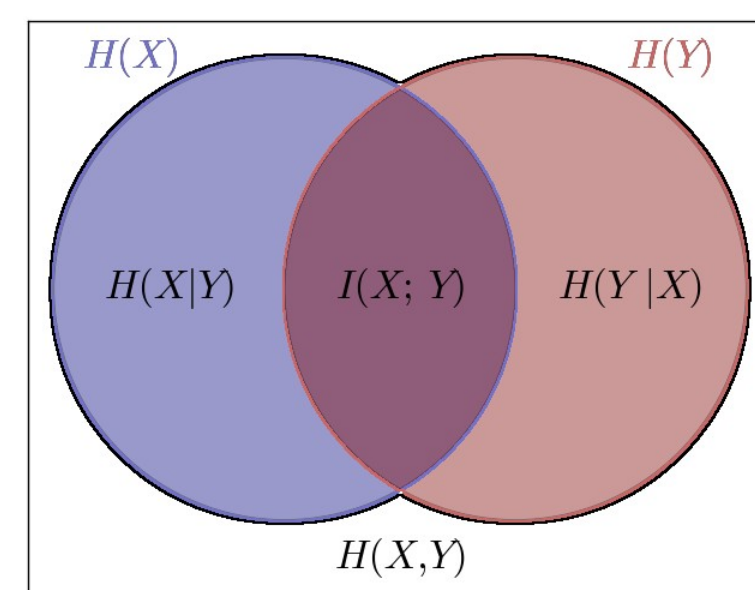


# Increasing the Accuracy of MODIS Snow Product using Quantitative Restoration for MODIS Band 6 on Aqua

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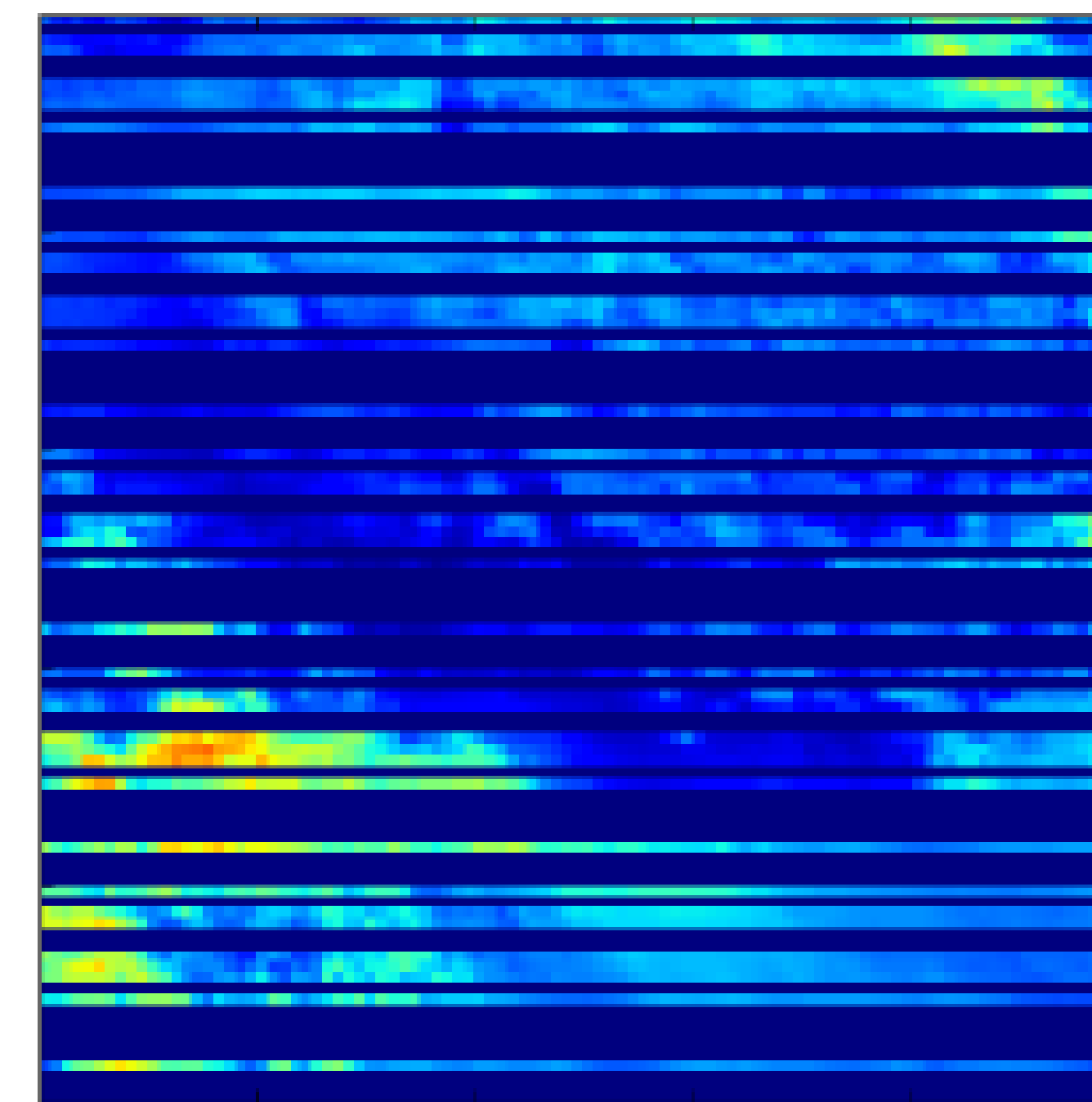
## Mutual Information

- Using the concept of Mutual information we can show that all 500m resolution bands share a significant amount of information with band 6.
- If the bands are independent then their mutual information would be zero and the joint probability distribution will equal the product of marginal distributions for each variable.

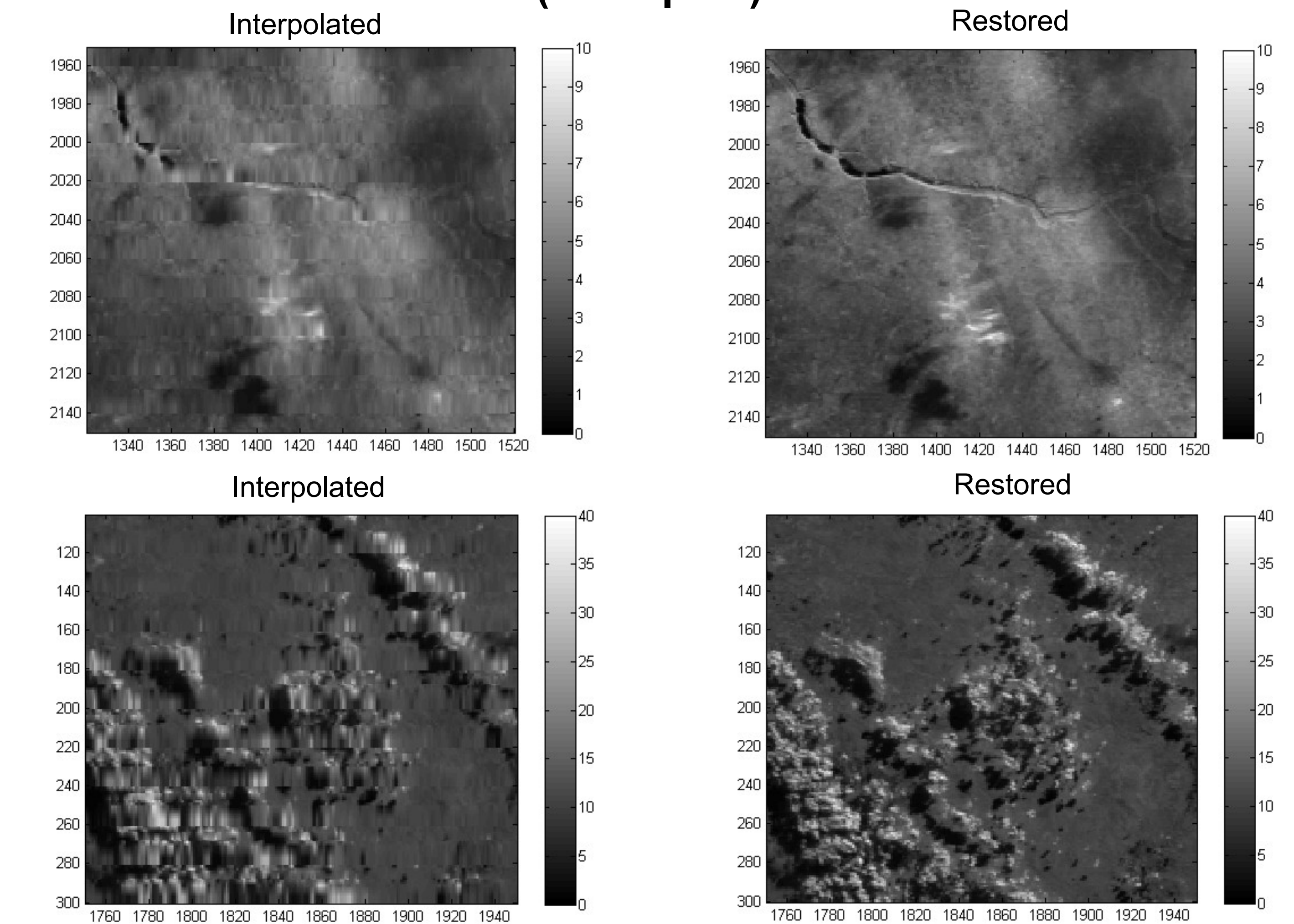


$$I(X, Y) = \sum_{y \in Y} \sum_{x \in X} p(x, y) \log \left( \frac{p(x, y)}{p_1(x)p_2(y)} \right)$$

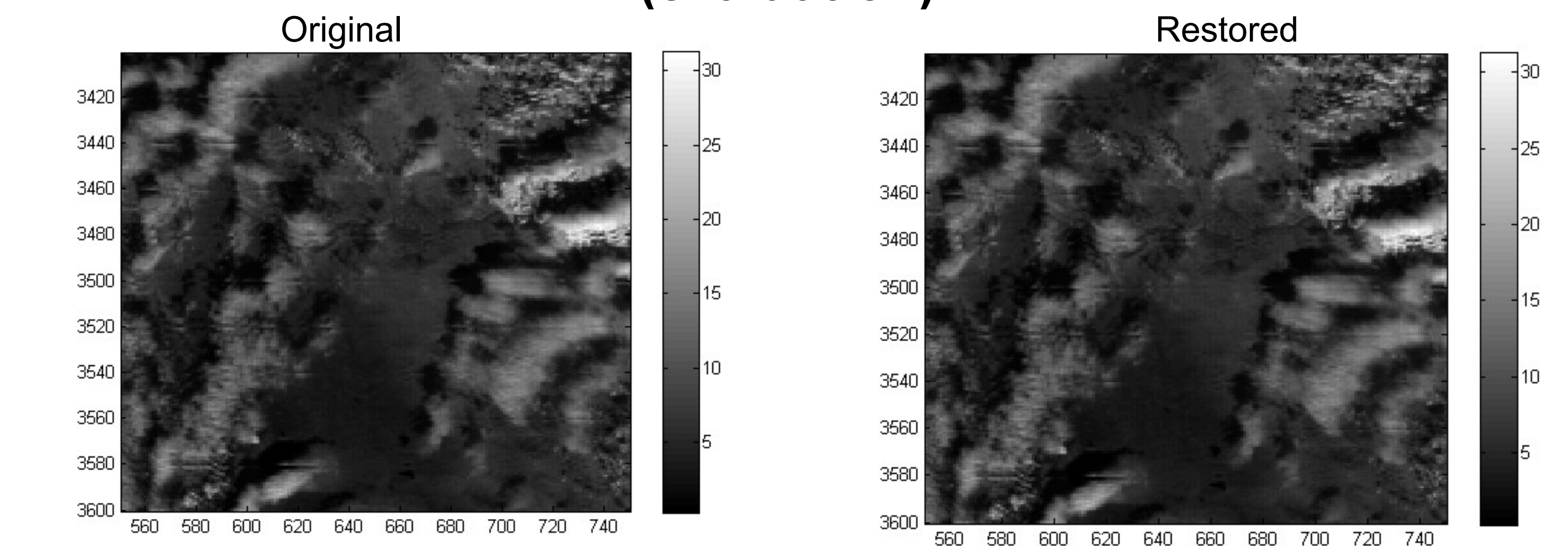
The current NASA Snow Product (MOD10\_L2, MYD10\_L2) Algorithm for MODIS (Moderate Resolution Imaging Spectroradiometer) on both Aqua and Terra uses Band 6 to identify snow covered land. Unfortunately, only 1/4 of the detectors are currently functional for the 500 meter 1.6 micron channel. Currently simple column-wise interpolated radiances are published. However since there are large gaps in the data this results in severe artifacts. Consequently the NASA Snow Product Algorithm has been modified to use band 7 in place of band 6, since these bands are closely related. We propose that a more accurate snow mask product for aqua can be estimated by using not only band 7, but also the good data from band 6 as well as the other 500m bands, band 3, 4 and 5. In this poster we show that all the 500m bands have strong non-linear relationships with band 6 (using a Terra granule as ground truth) using mutual information as a visualization. We have developed an algorithm to restore the broken detectors in band 6, that uses all available spatial and spectral in Aqua's 500m bands. Since band 6 of MODIS on Terra is functional we have used it to evaluate our performance in both restoration and snow product accuracy.



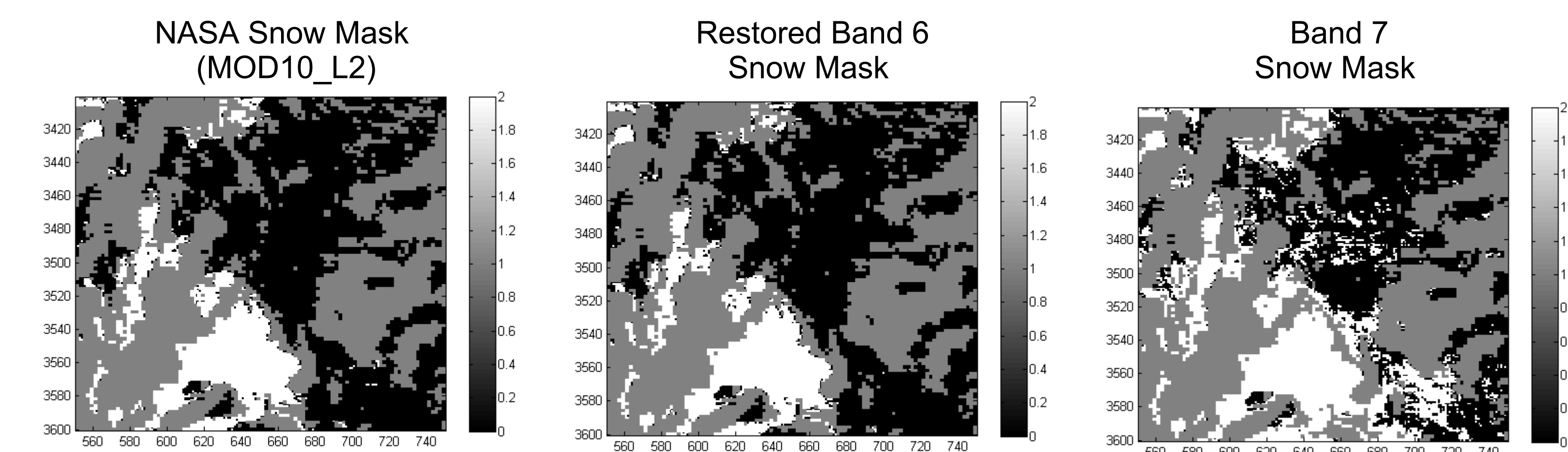
## Restoration on Aqua (examples)



## Restoration on Terra (evaluation)



## Snow Mask Accuracy Improvement

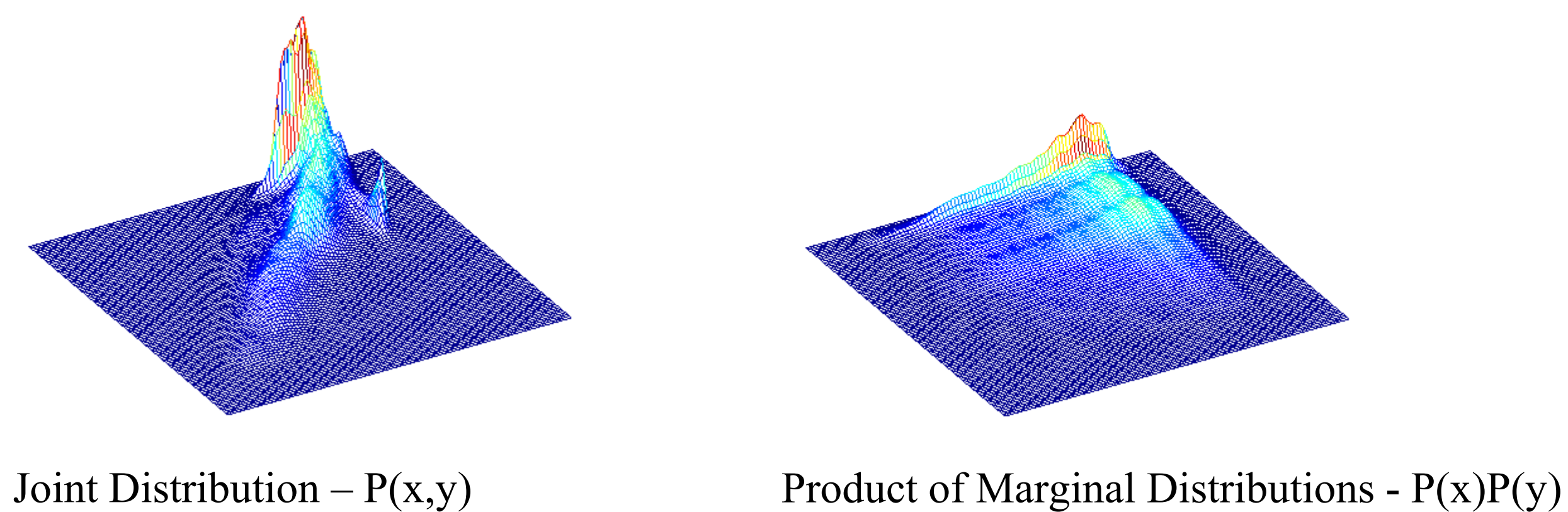


- Mask generated with restored band 6 shows a significant reduction in the amount of False Positives when compared with band 7.
- Overestimation not an issue.

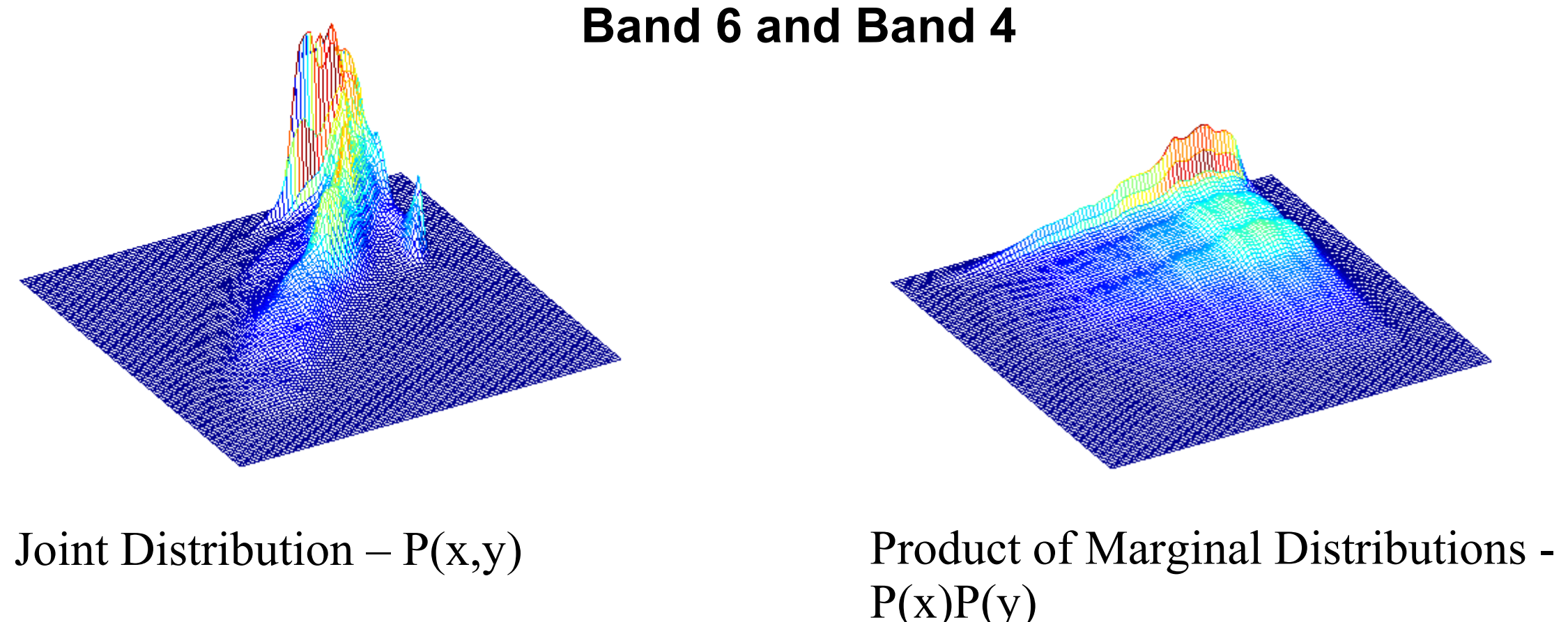
## References

I. Gladkova, M. Grossberg, F. Shahriar, Quantitative Image Restoration, Proceedings of the SPIE, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery, April 2010, Vol. 7695

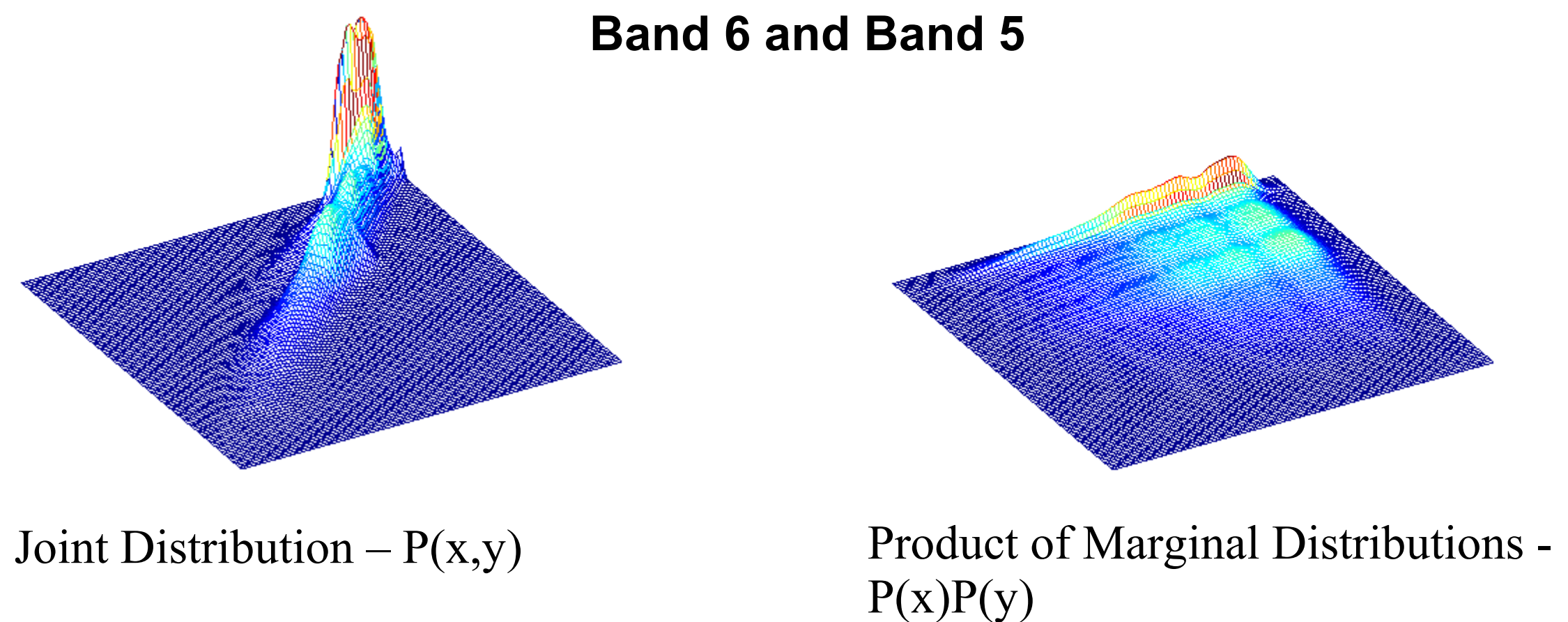
### Band 6 and Band 3



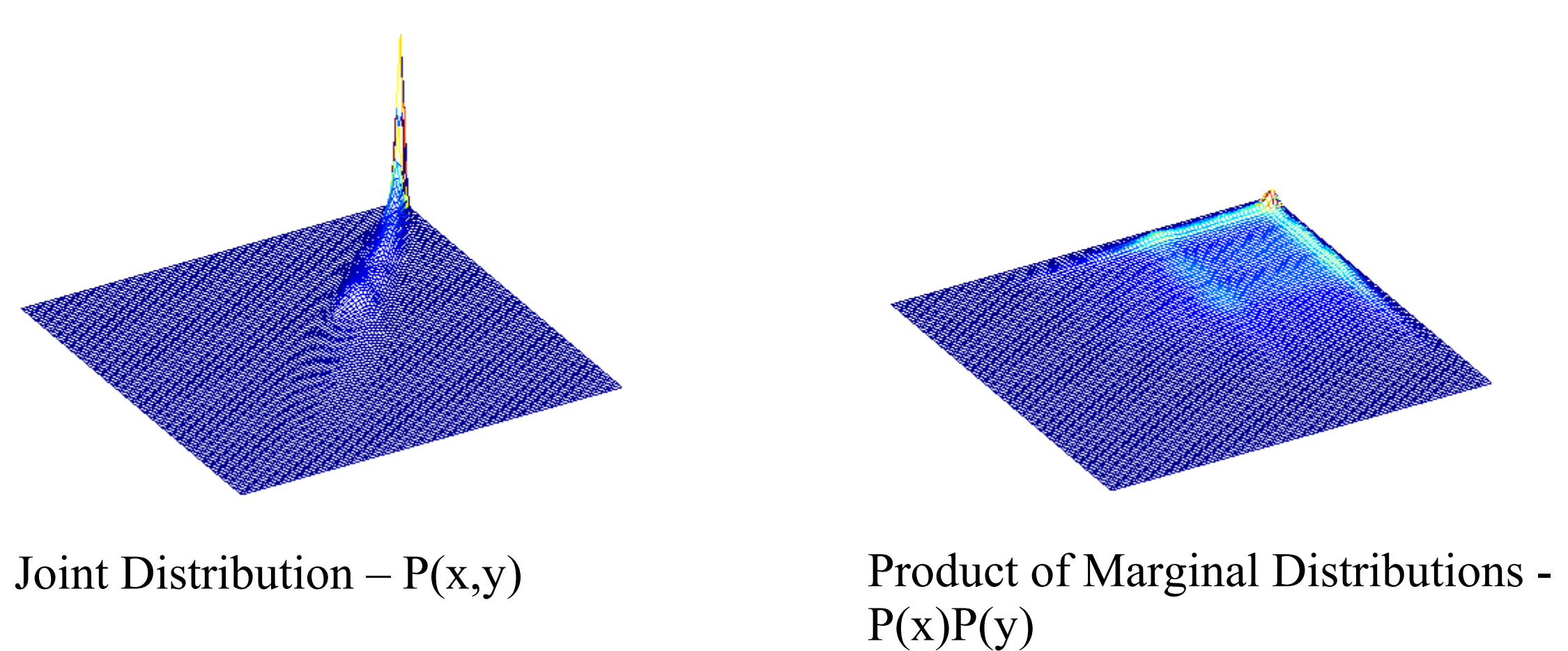
### Band 6 and Band 4



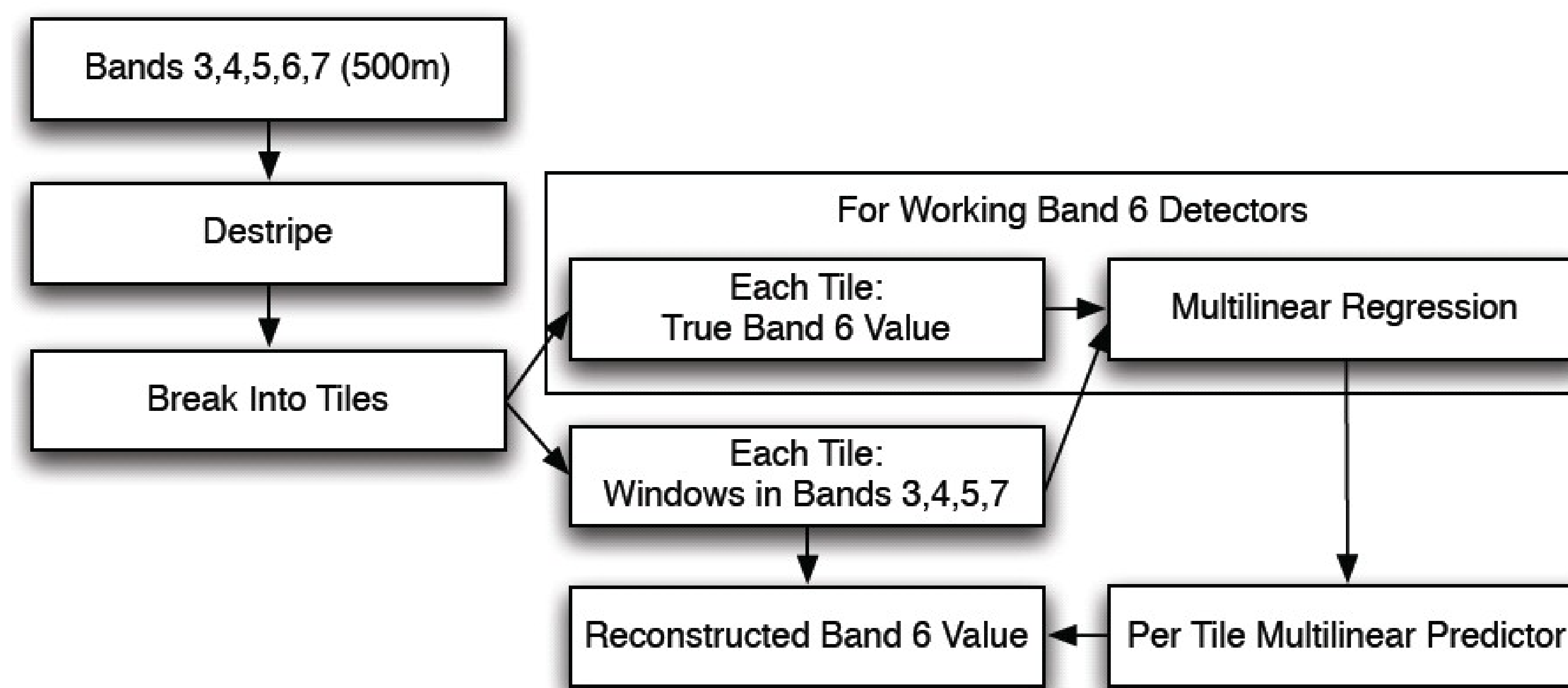
### Band 6 and Band 5



### Band 6 and Band 7



## Train Using Terra



Prediction used for Quantitative restoration

## Tiles and Features

