Analysis of a Possible Calibration Bias

August 5, 2004

Summary of the Issue

At the 2004 MODIS Science Team meeting, it was postulated that the seasonal cycle seen in the MODIS-Aqua/SeaWiFS nLw ratios might be due to a calibration bias. An analysis was suggested to test this idea which consisted of plotting the MODIS nLw values versus the SeaWiFS nLw values to see if there is a non-zero intercept.

Analysis

Two sets of monthly SMI files (June and December 2003) for each sensor were created. Scatter plots and two-dimensional histograms (linear and log scaled) were made comparing MODIS to SeaWiFS for 10-degree zones between 50N and 50S. Since the scaling is the same for both sensors and does not affect the distribution, the data were not scaled to geophysical values.
A plot of zonal median ratios vs latitude was also generated.

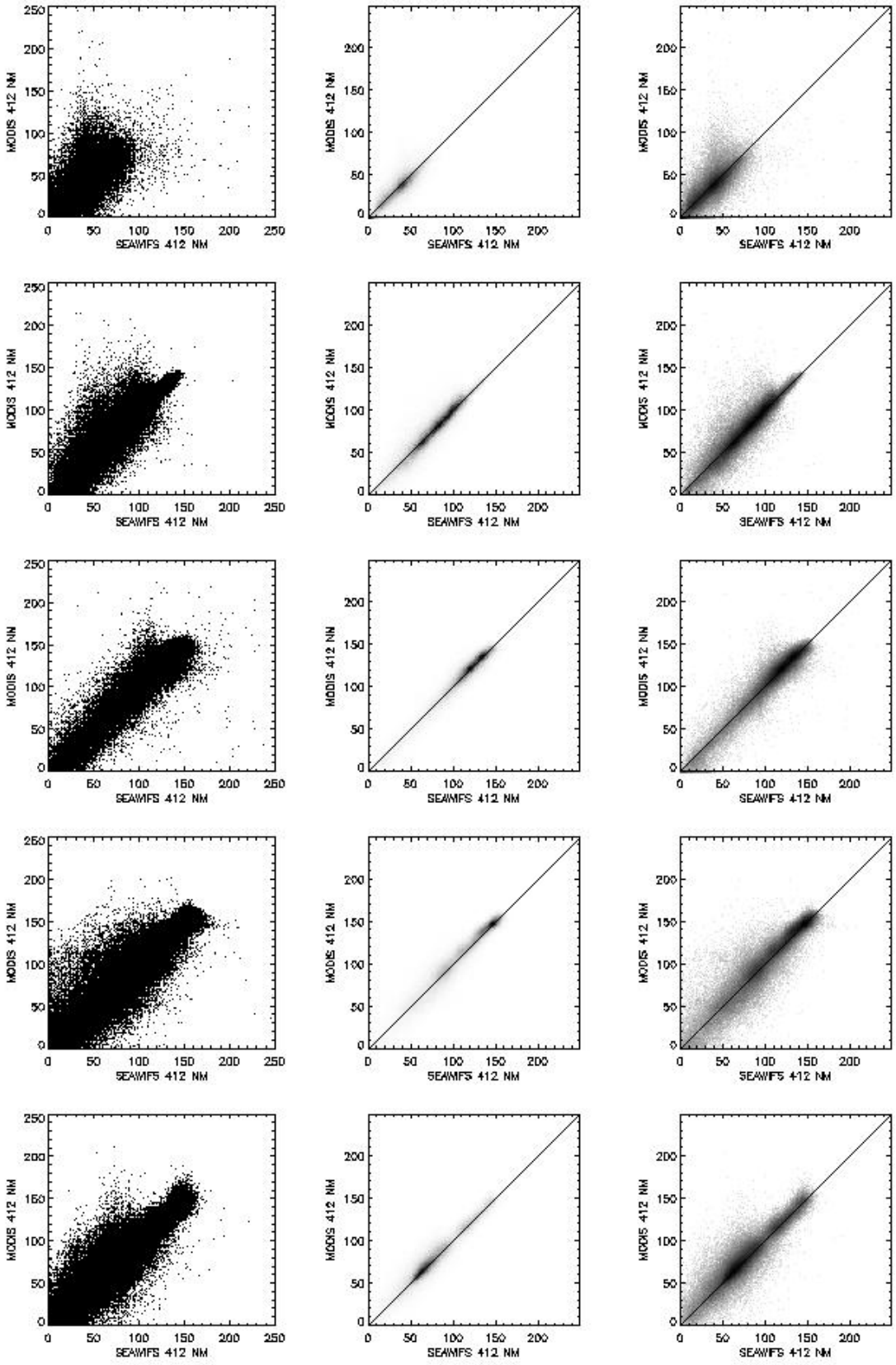
Results

The scatter plots tend to emphasize the noise and outliers (there are up to 400,000 points on each plot). They do show that there is no obvious bias in the distribution at the low end. They also illustrate how a linear regression might easily be dominated by outliers, unless great care is taken.
The linear 2-D histograms show that the large majority of the points are well correlated between the two sensors. The variations in the average ratio, above or below unity, are clearly seen as the distribution shifts above or below the 1:1 line. The correlation breaks down in the extreme winter latitude zone (-50 to -40 in June and 40 to 50 in December).
The log histograms show more of the distribution, but still show pretty good correlation, at all but the extreme winter latitudes.

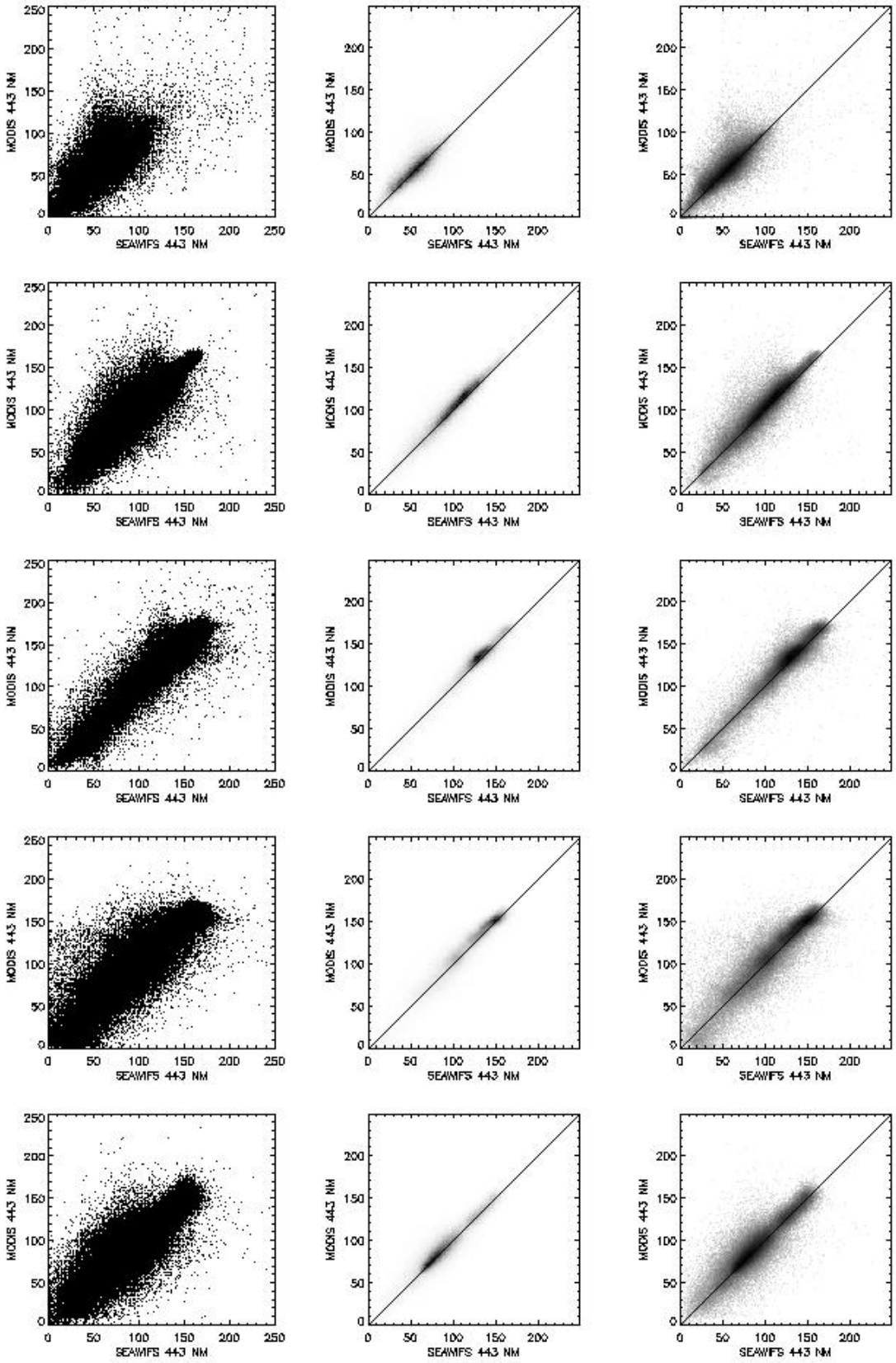
Conclusion

The seasonal/zonal variations in the MODIS/SeaWiFS ratios are real, systematic effects, and not a statistical artifact. Also, the zonal median ratios peak around the subsolar latitude. This is consistent with a previous analysis, and suggests the trend is driven by an as yet unaccounted for solar zenith angle dependence on the data.

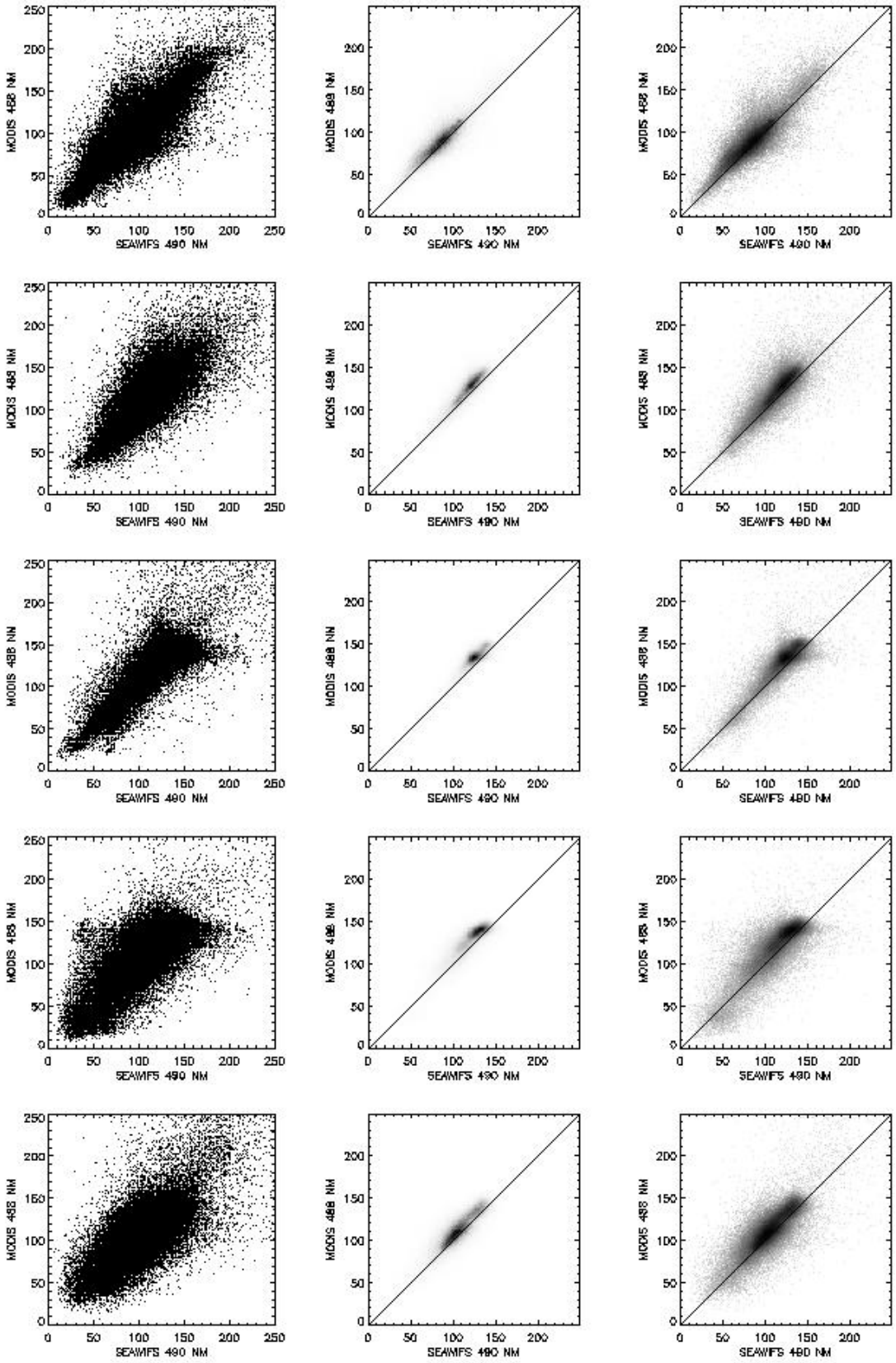
June 2003 – Northern Hemisphere – 412nm



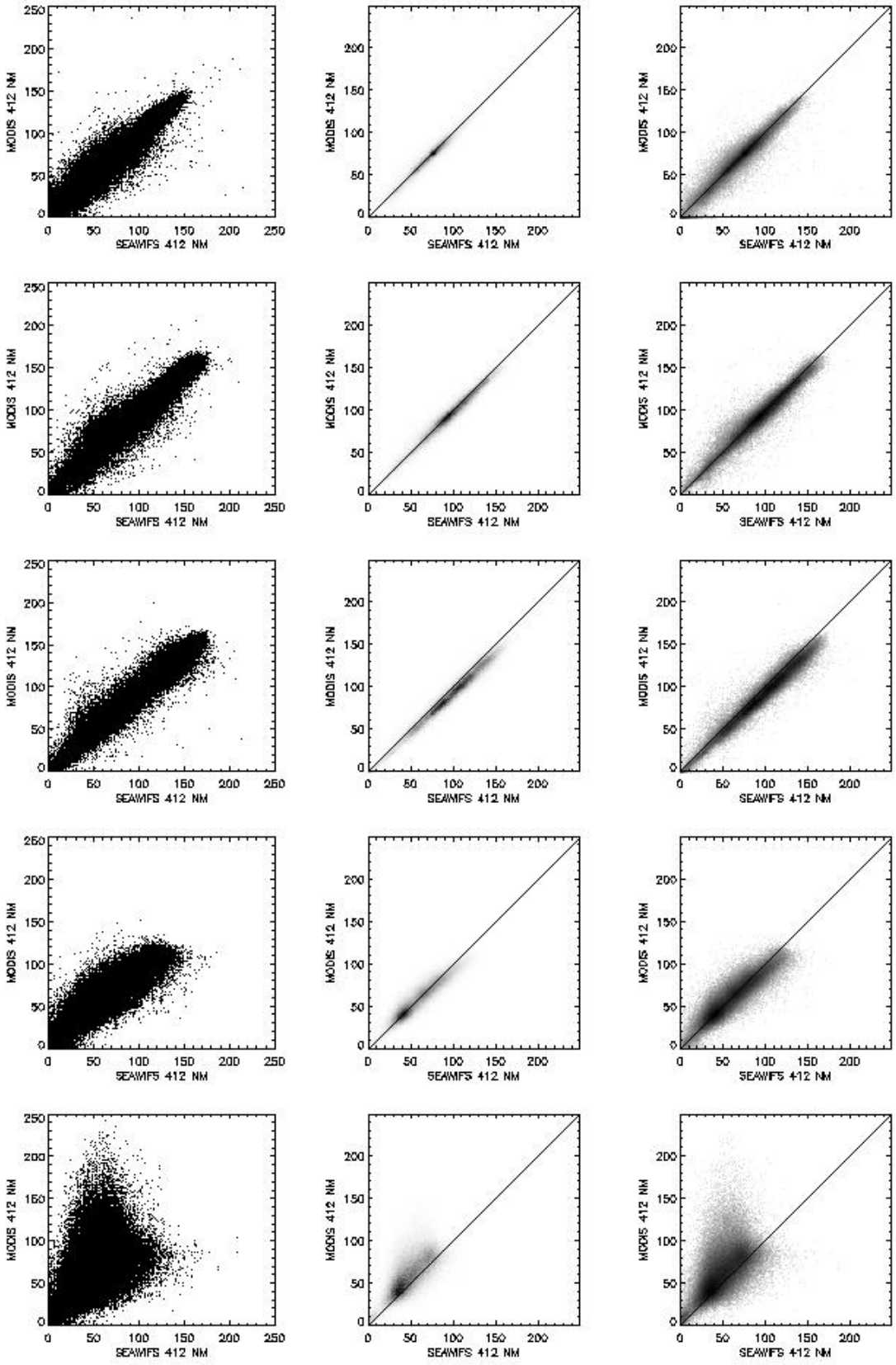
June 2003 – Northern Hemisphere – 443nm



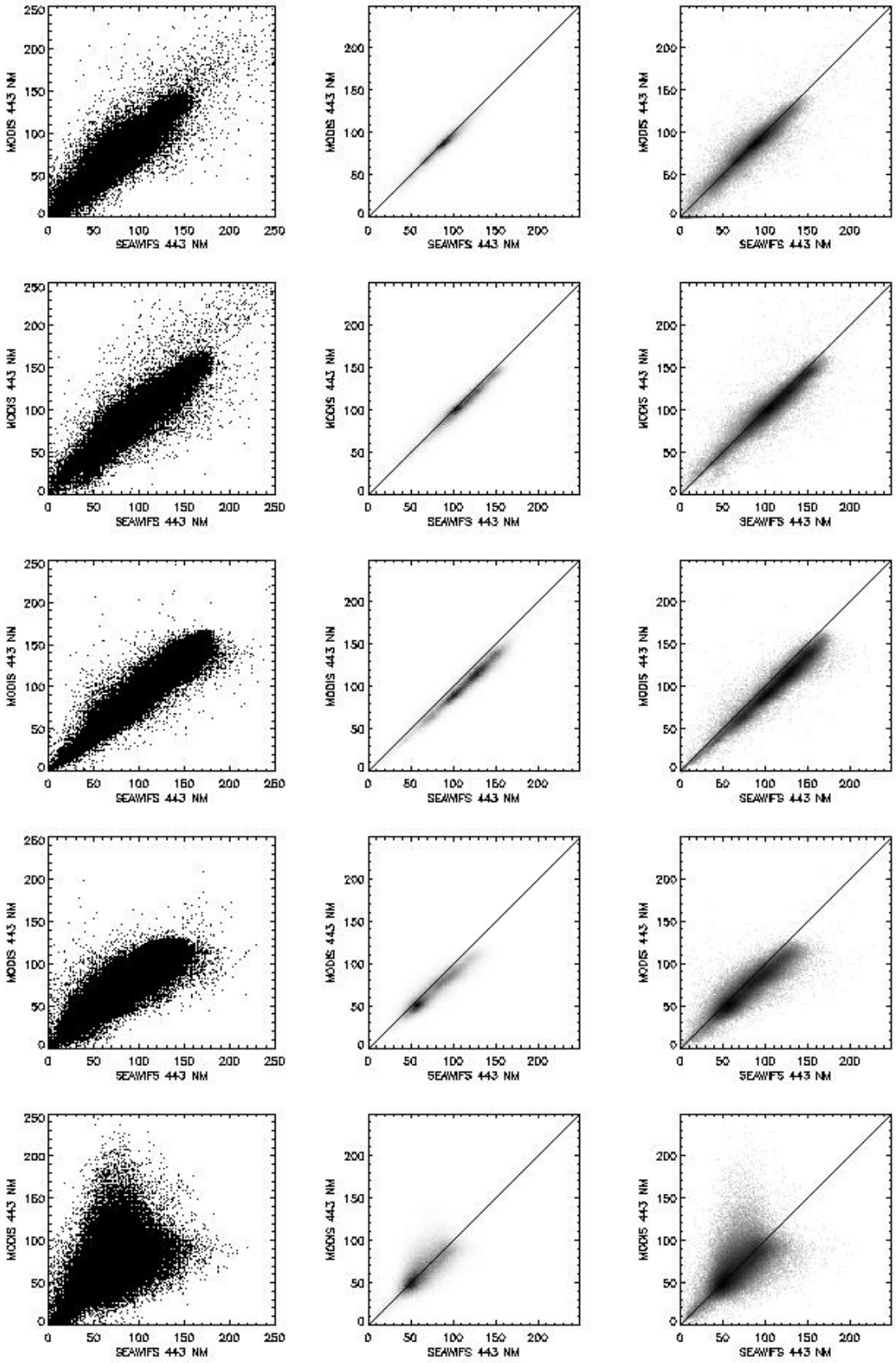
June 2003 – Northern Hemisphere – 488nm



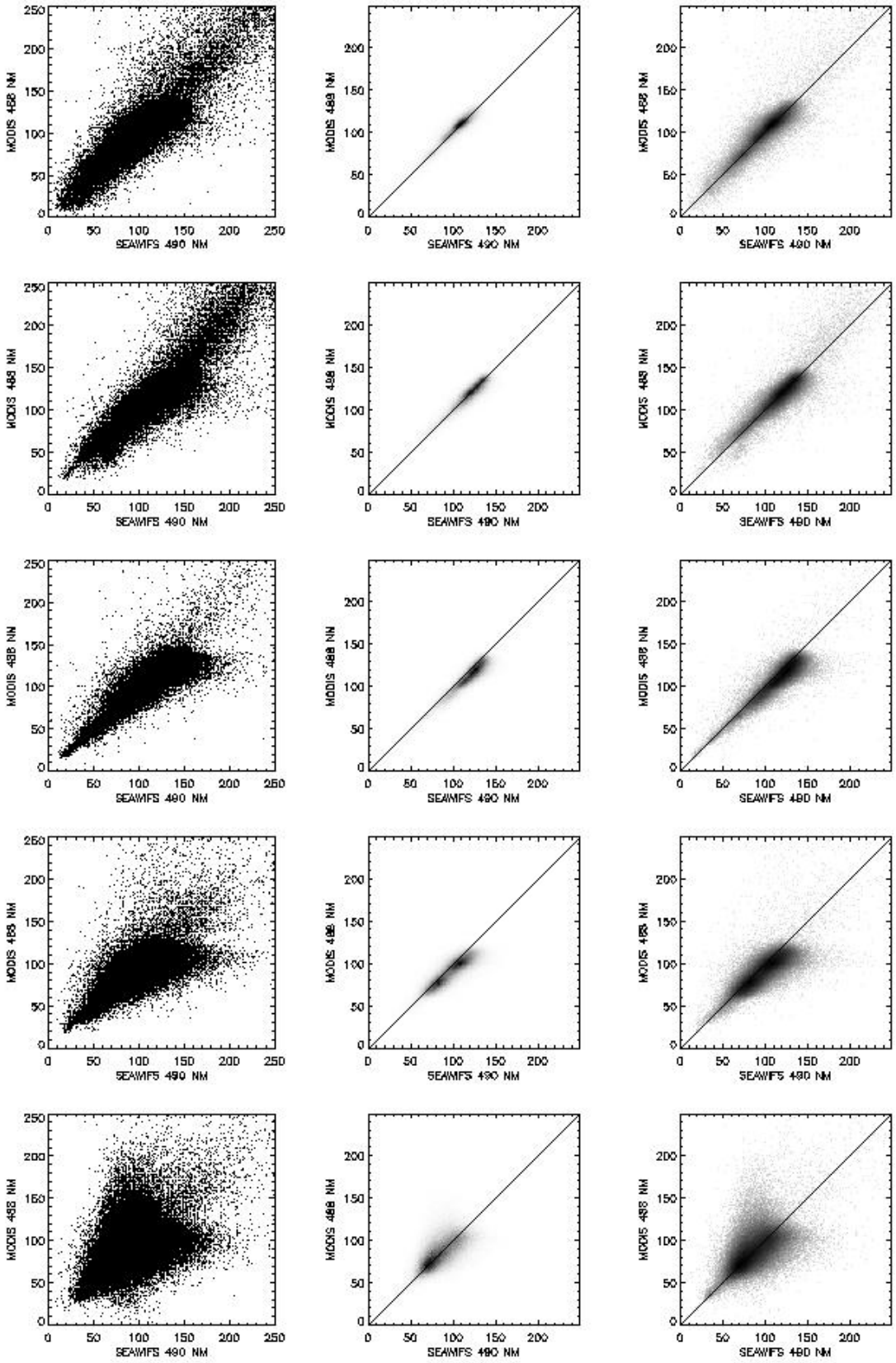
June 2003 – Southern Hemisphere – 412nm



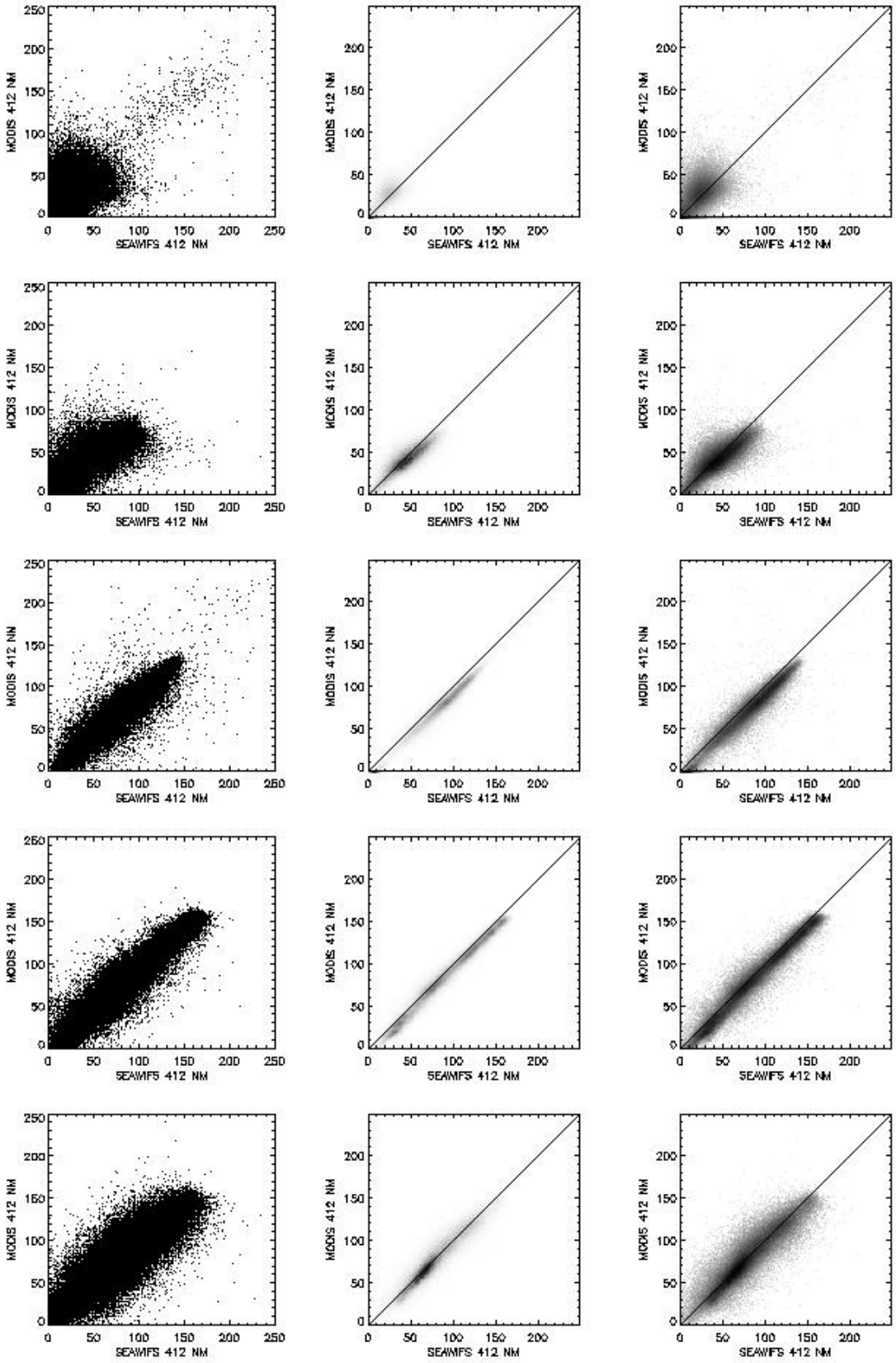
June 2003 – Southern Hemisphere – 443nm



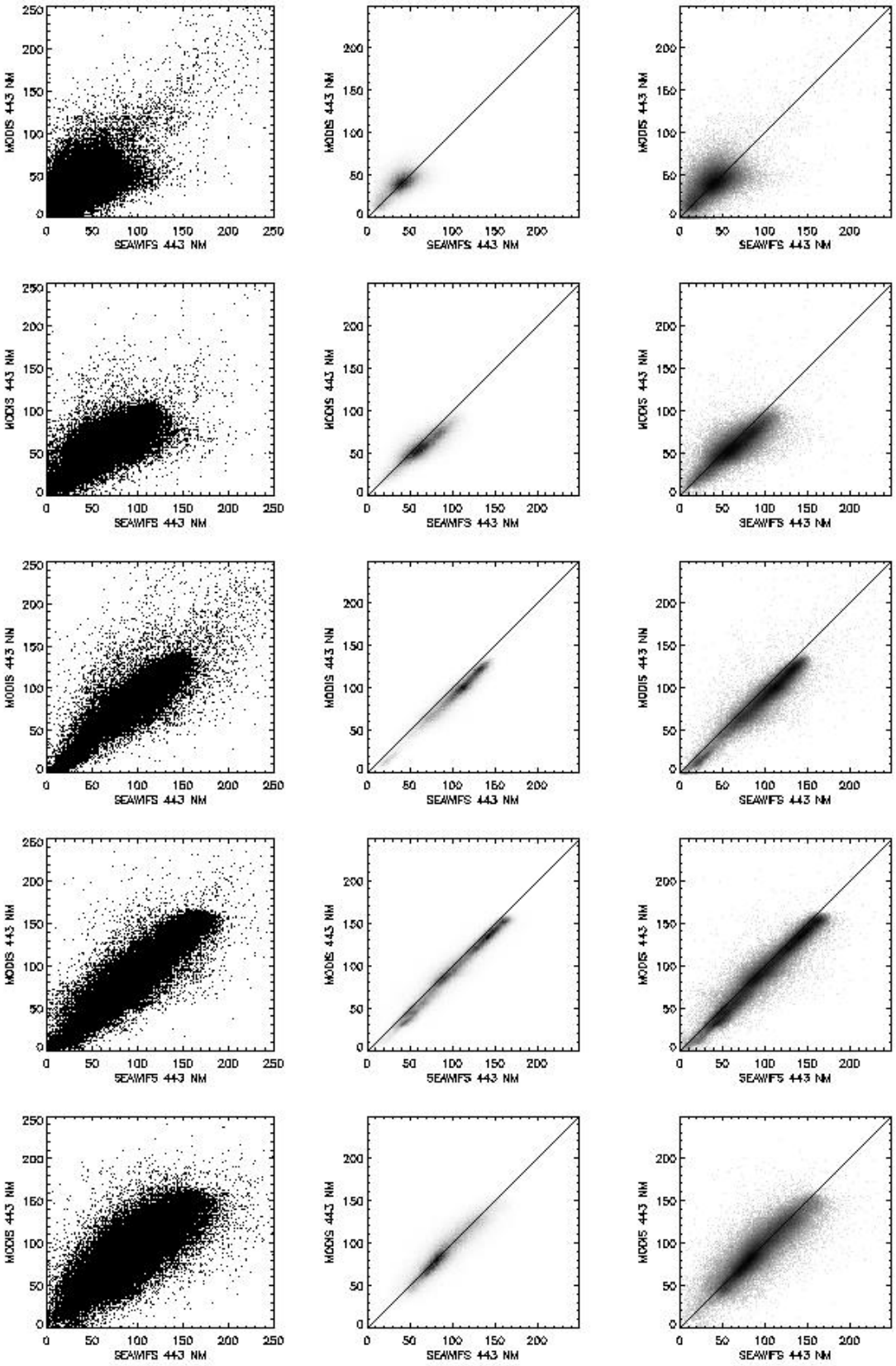
June 2003 – Southern Hemisphere – 488nm



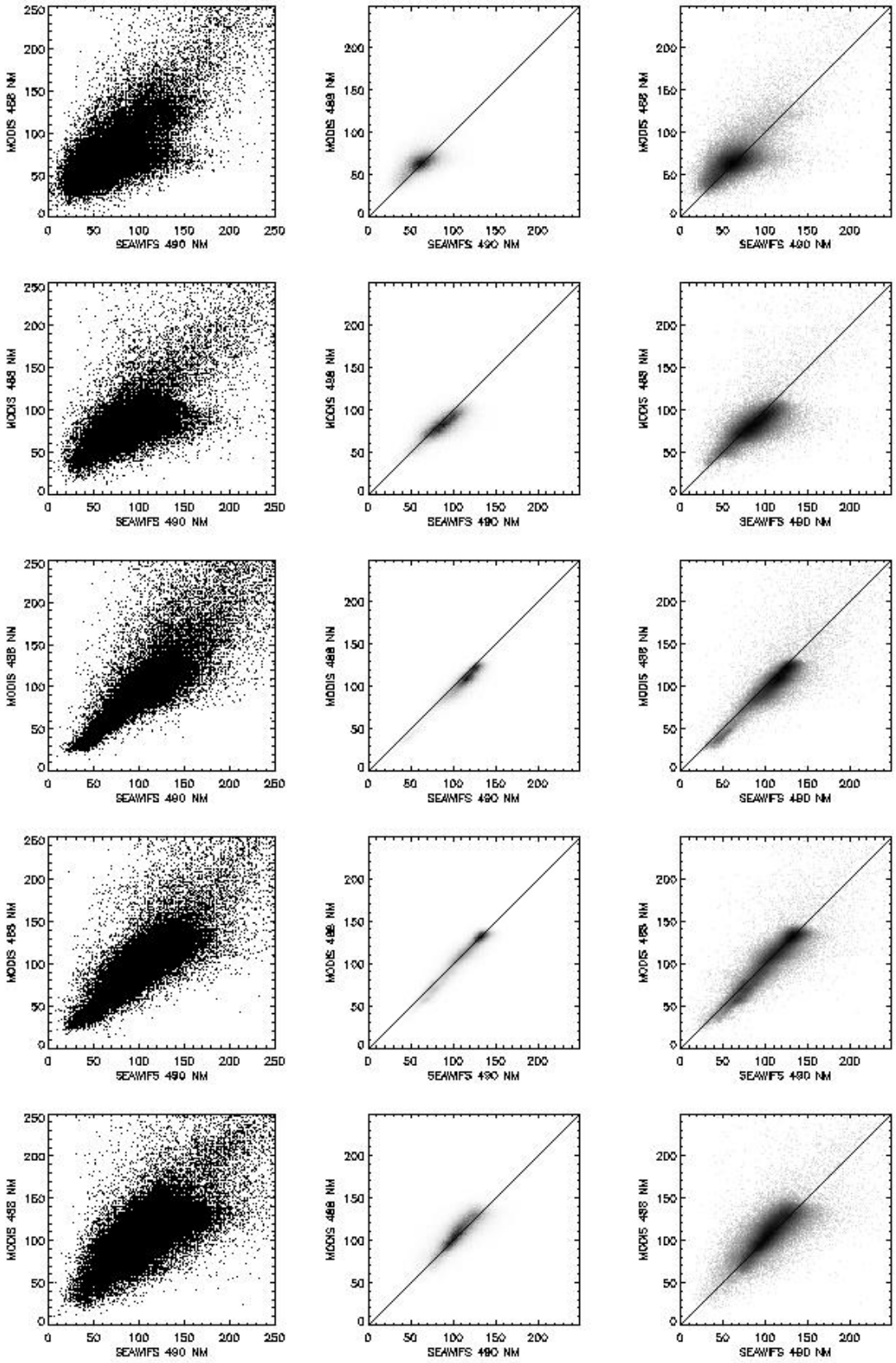
December 2003 – Northern Hemisphere – 412nm



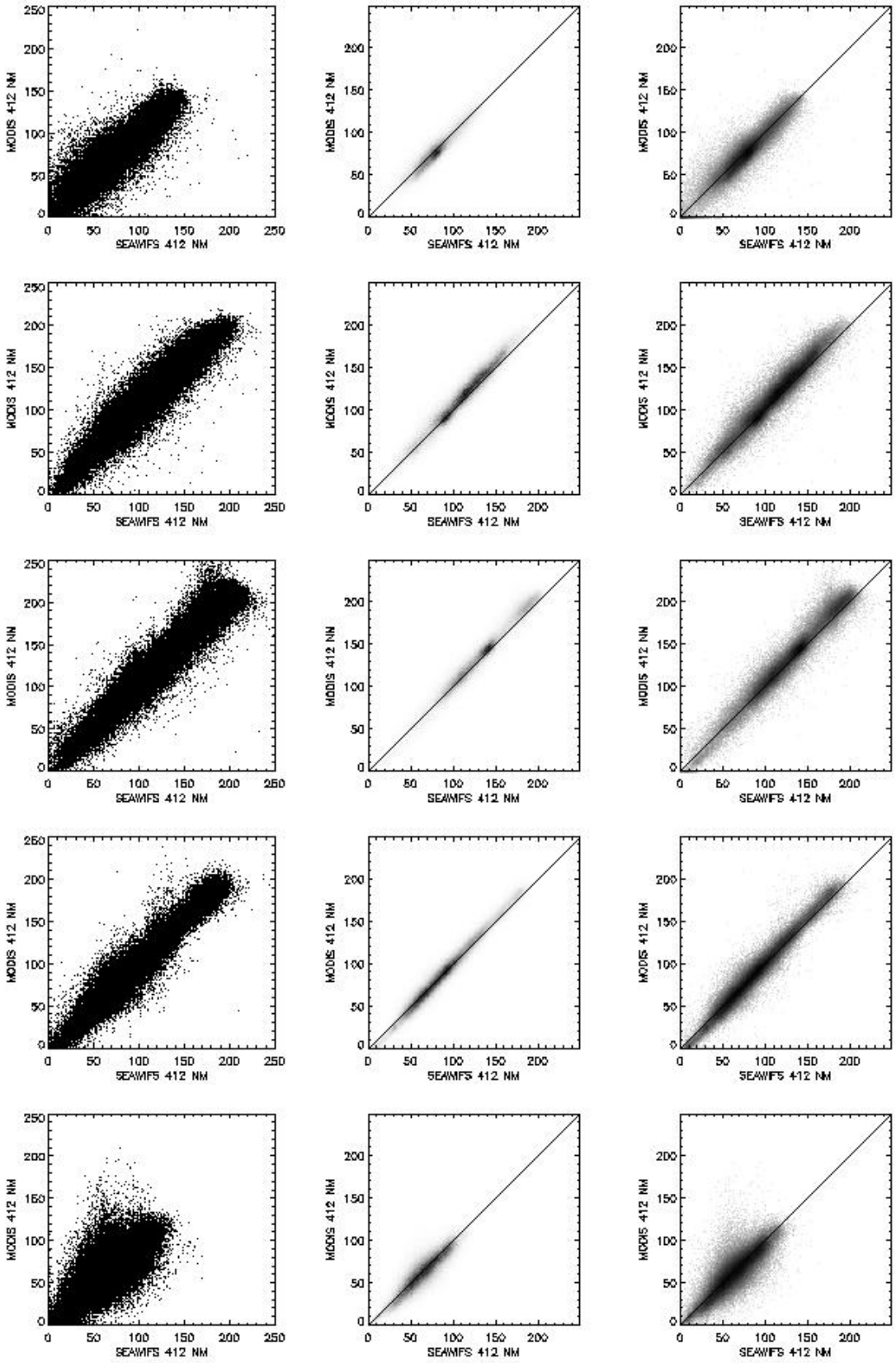
December 2003 – Northern Hemisphere – 443nm



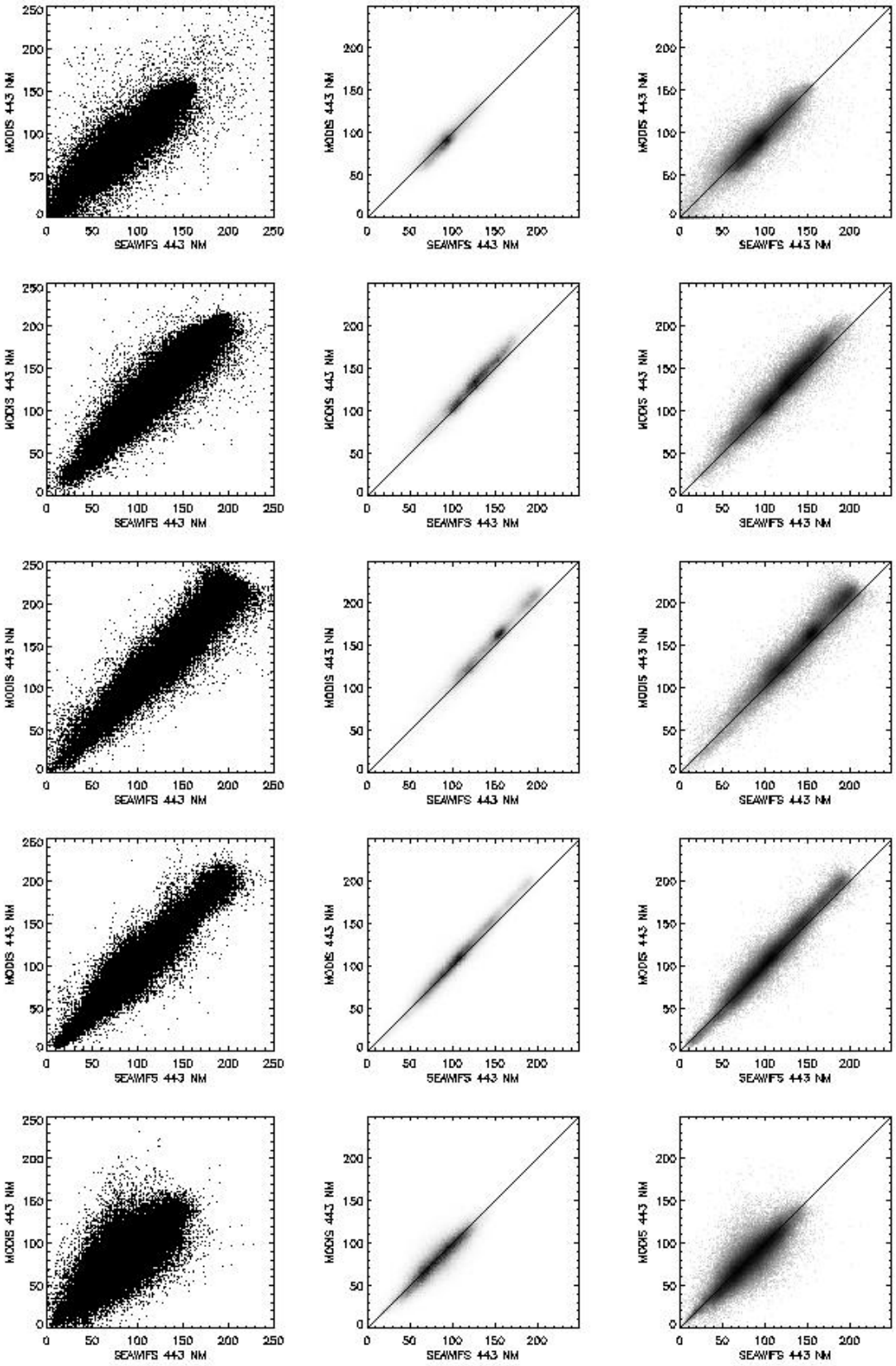
December 2003 – Northern Hemisphere – 488nm



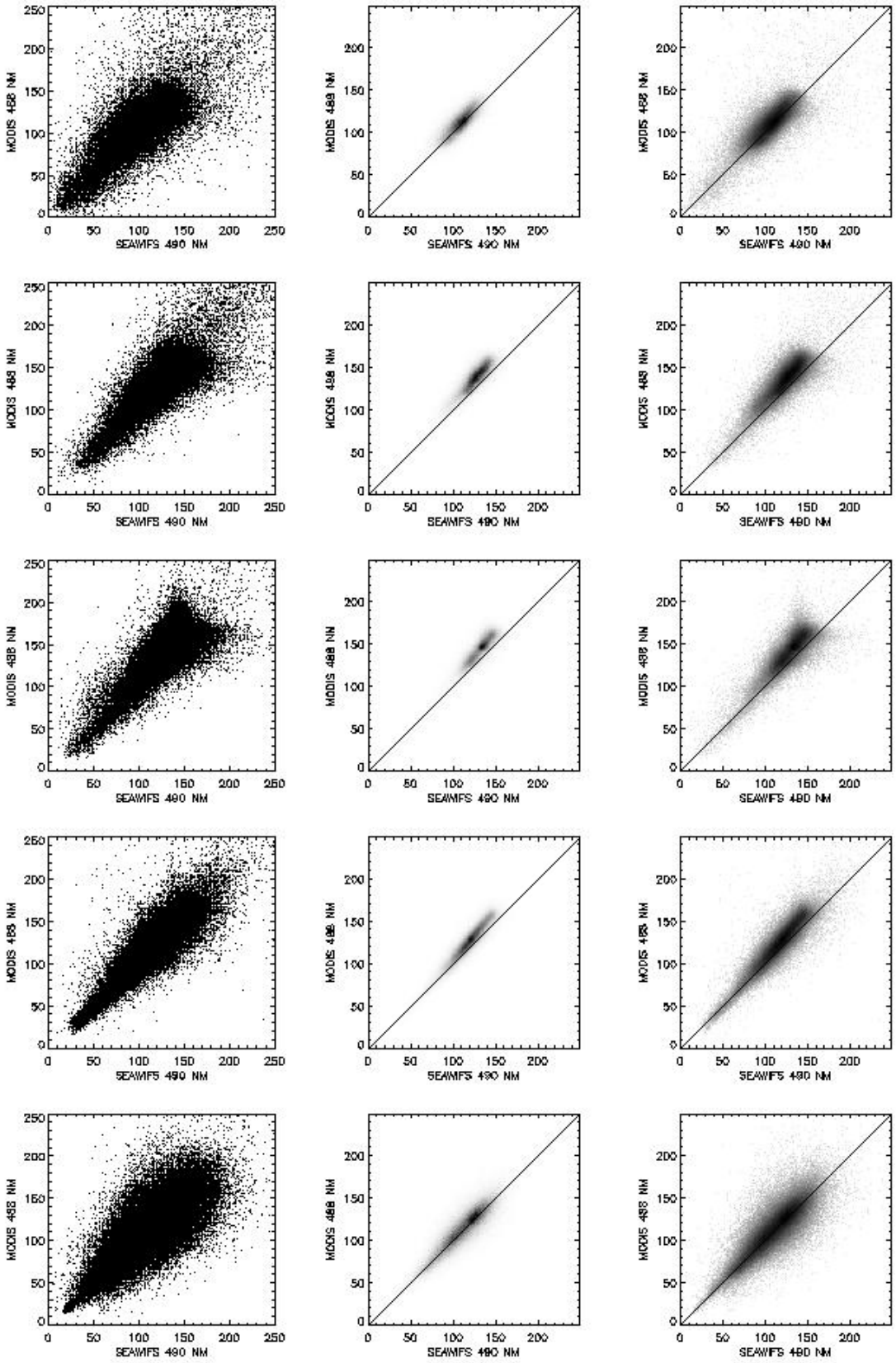
December 2003 – Southern Hemisphere – 412nm



December 2003 – Southern Hemisphere – 443nm



December 2003 – Southern Hemisphere – 488nm



Zonal Ratios vs Latitude (Median Values)