Sampling of fire regimes with satellite active fire data: scan pattern, land cover data, and diurnal cycle effects

Rationale: Land cover and available fuel

Diurnal cycle effects on sampling of fire regimes

Pixel ground footprint and sampling of fire regimes

Using MTSAT diurnal cycle to diagnose MODIS sampling of fire regimes and regions

Comparison of the fire locations to a new map of SE Asia land cover produced at the National University of Singapore (Mettheen et al., Remote Sensing Letters 2011) shows important differences between the different sensors. The Terra and Aqua MODIS sample relatively more burning in open areas, while MTSAT observations show relatively more fire in forested areas. Diurnal cycles of fires in each land cover type based on MODIS data (Figure 4, below) agree generally with earlier work (Giglio, RSIE 2007; Mu et al. JGR in review) showing forest burning, especially peat swamp, occurring later in the day. These diurnal effects are consistent with the observed fire distributions, but diurnal cycles alone cannot explain all differences.

Both geostationary and MODIS sensors have variable pixel geometry across the scan. For MTSAT, pixel size varies across the scan (Figure 6, above). Because pixel size and geography covary for MTSAT, we cannot directly test the effect of varying pixel size, but we can for MODIS. Figure 8 (left) shows fraction of detected fires in forest and open areas as a function of MODIS pixel size.

MTSAT has demonstrated different sensitivity to fire regimes from MODIS, but we can use the MTSAT diurnal information to estimate the magnitude of biases in estimated distributions of fire based on MODIS data. For regional fire distributions (above left, Figure 9), we can do this by comparing the fire activity during the period sampled by MODIS with the overall fire activity, and then normalizing to the regional totals. For this regional comparison, we can use a metric of “fires detected per usable (cloud-free + cloudy) look.” For vegetation types (Figure 10, below) we cannot accurately estimate the number of looks, so the results are less accurate, because they are based on total fire counts only.

We can see that regional estimates of fire activity based solely on MODIS MOD14 may overestimate fires in southern Indonesia while underestimating activity in Malaysia. We can also see that fires in peat swamp forest will be underestimated in MODIS-based inventories, relative to fires in non-forest areas.

FLAMBE and NAAPS: Global forecasting of aerosol in real time

Relevant Papers and Resources

FLAMBE and NAAPS are developed by NRL with support from NASA and the Office of Naval Research.