MODIS surface reflectance status (MOD09)

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The surface reflectance algorithm uses internal 1km aerosol optical depth since collection 3 processing.

MODIS Granule over South Africa (Sept,13,2001, 8:45 to 8:50 GMT)

RGB no correction for aerosol effect

RGB surface reflectance (corrected for aerosol)

Corresponding aerosol optical thickness at 670nm (0 black, 1.0 and above red) linear rainbow scale. Clouds are in magenta, water bodies are outlined in white.

The uses of the 4.0μm reflectance (post-launch product) and the 1km aerosol are extremely useful for QA of MOD09 and possible subsequent science studies

Example: Fire/Scars/Smoke monitoring (1/3)

August,31,2000

Example: Fire/Scars/Smoke monitoring (2/3)

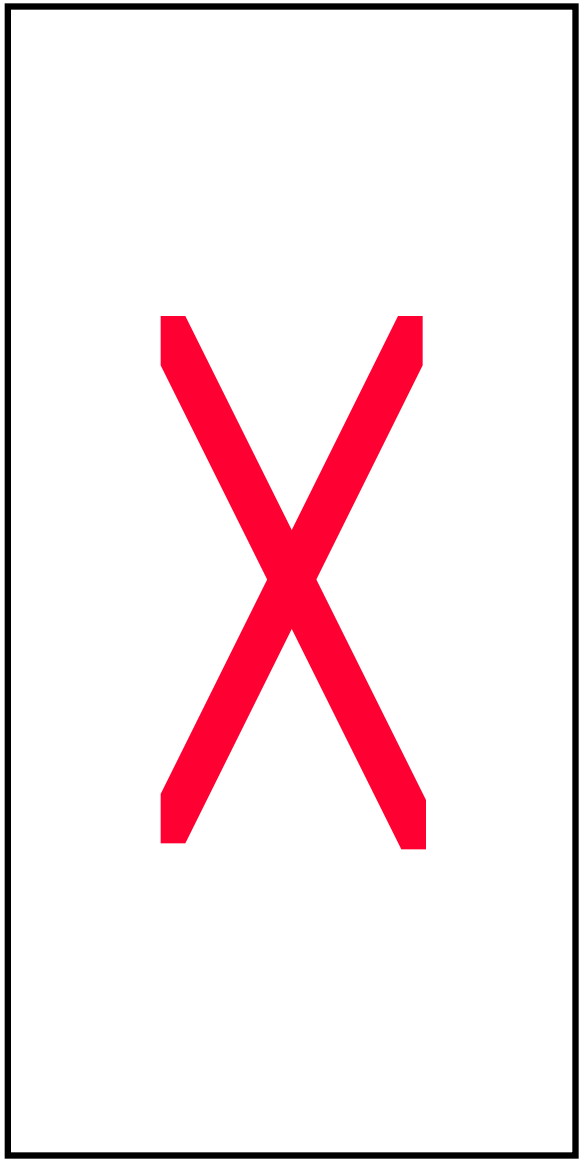
Sept,3,2000

Example: Fire/Scars/Smoke monitoring (3/3)

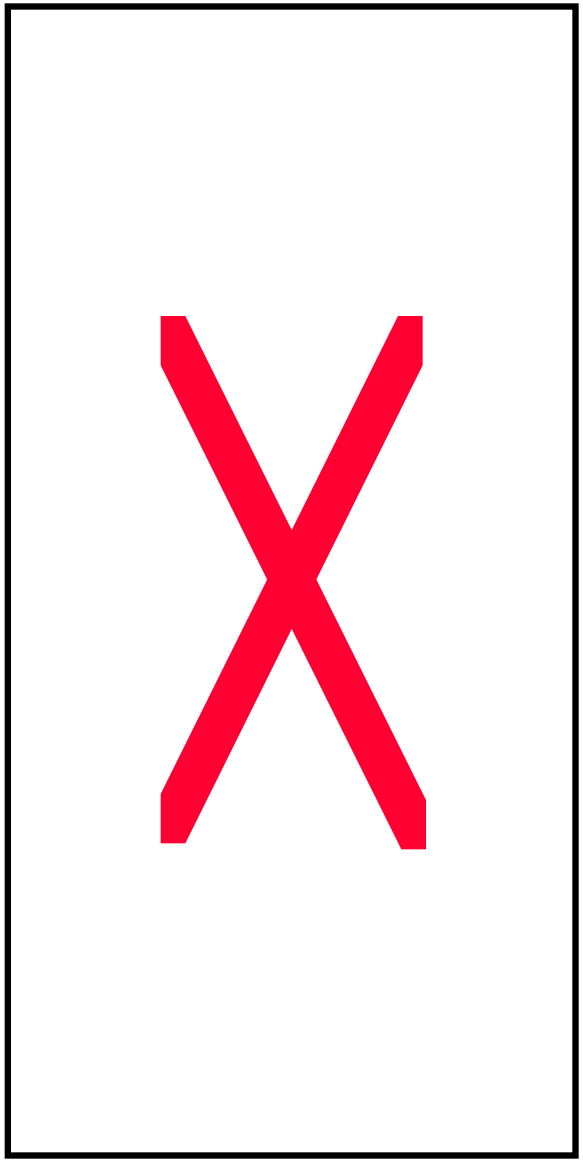
Sept,7,2000

Some internal processing mask have been developed specifically for aerosol inversion and correction: ***(a) Cloud mask***

RGB not corrected for aerosols

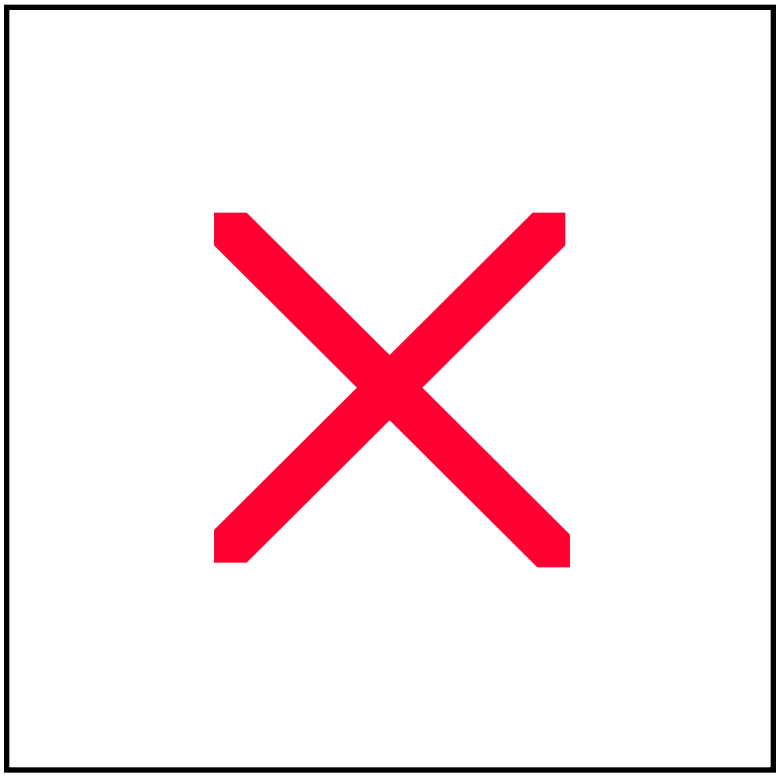


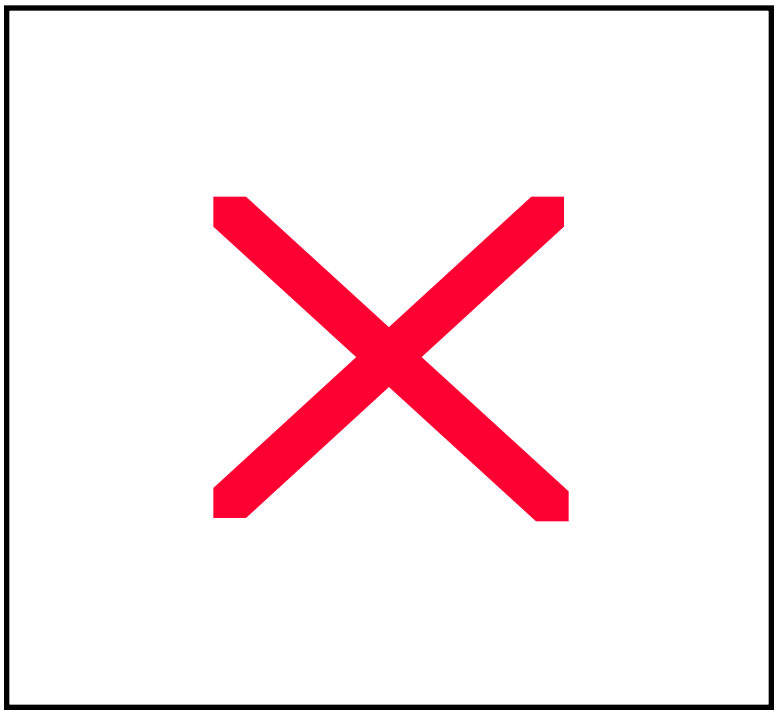
Internal cloud and sunglint mask (red) on top of corresponding RGB of surface reflectance



Fires can cause increase of reflectance at 2.1mic that is used in the aerosol algorithm (estimation of visible surface reflectance) and therefore need to be detected and filtered out:

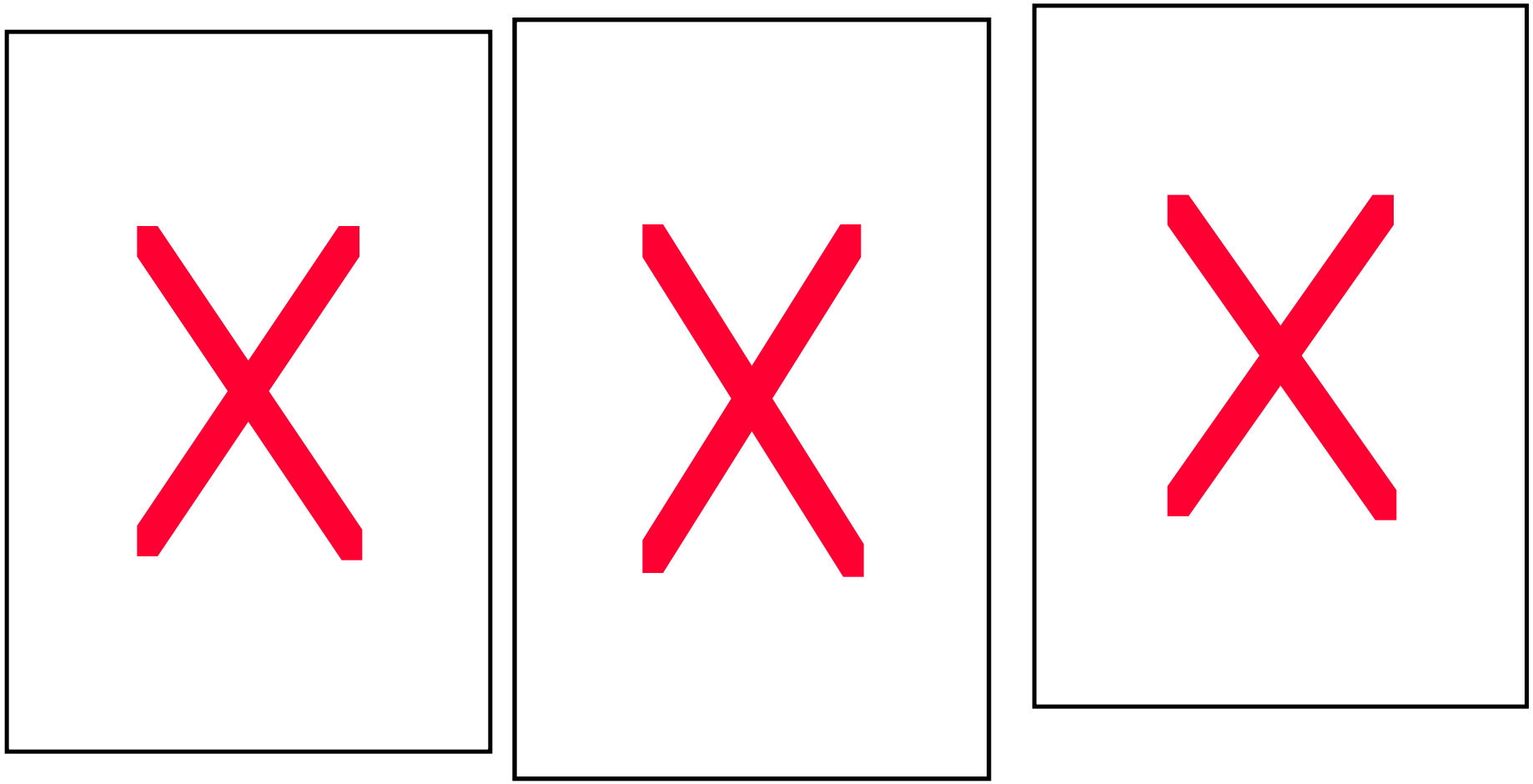
(b) Internal fire mask



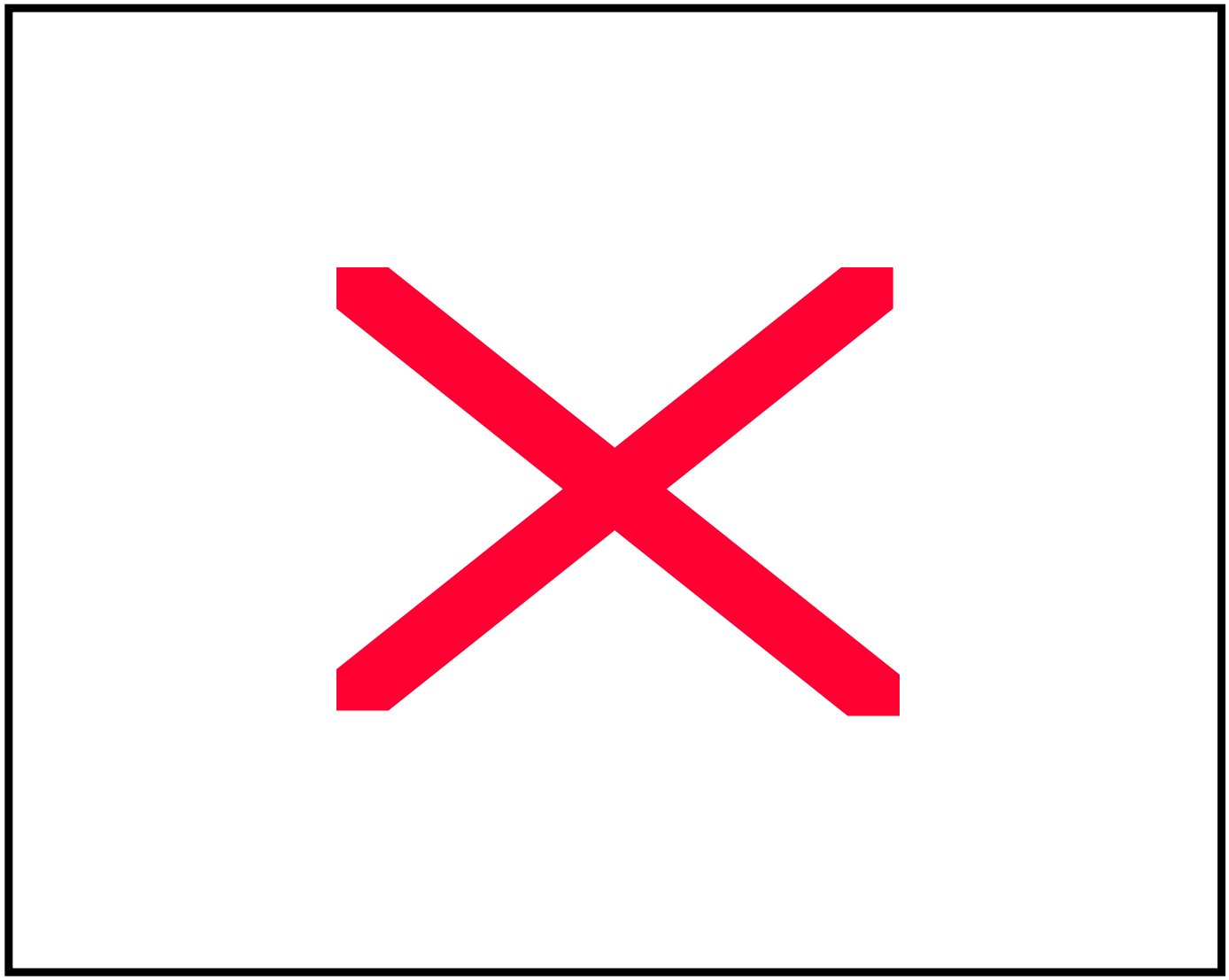


Snow will decrease the reflectance at 2.1mic that is used in the aerosol algorithm (estimation of visible surface reflectance) and lead to erroneous estimate of optical depth:

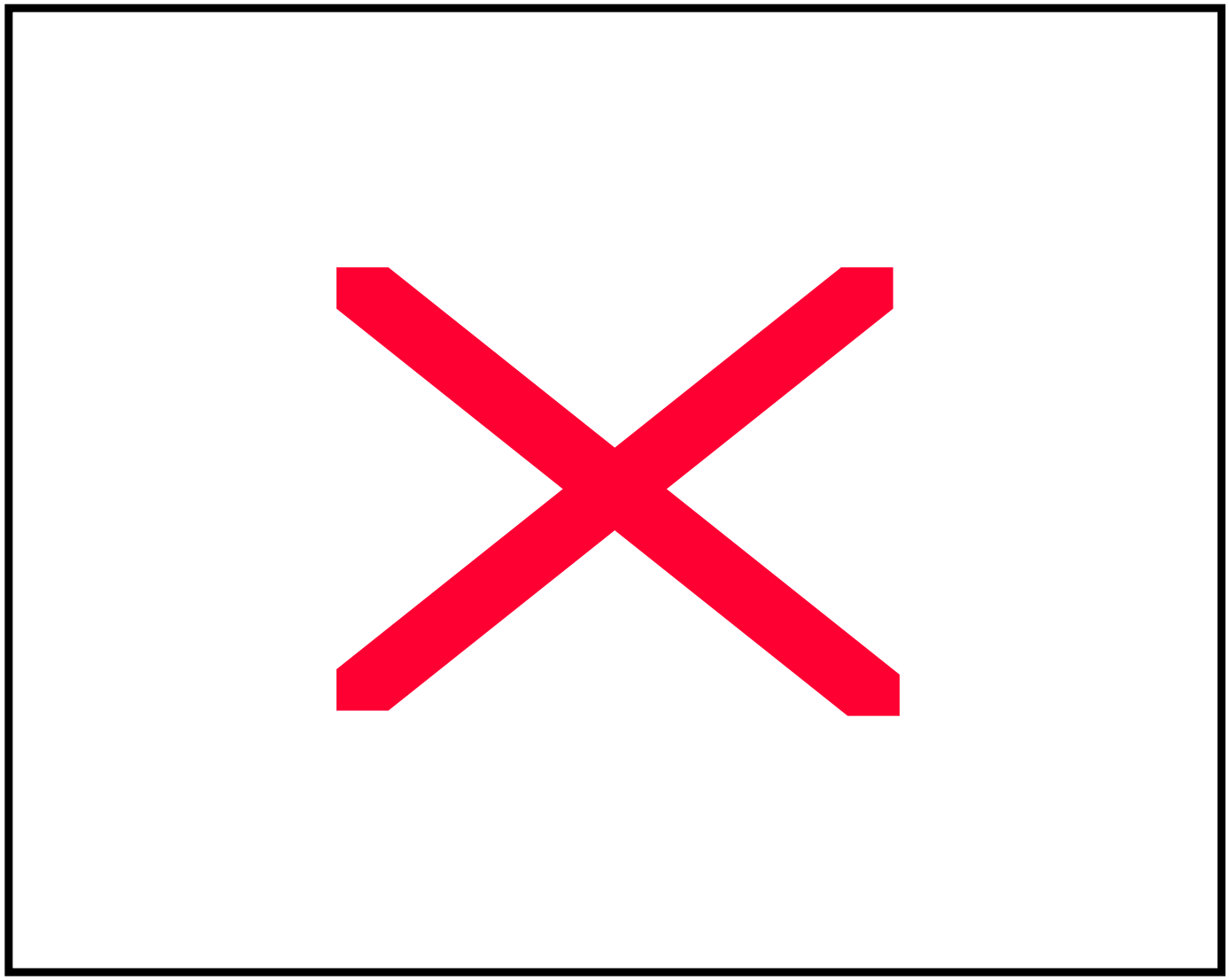
(c) Internal snow mask



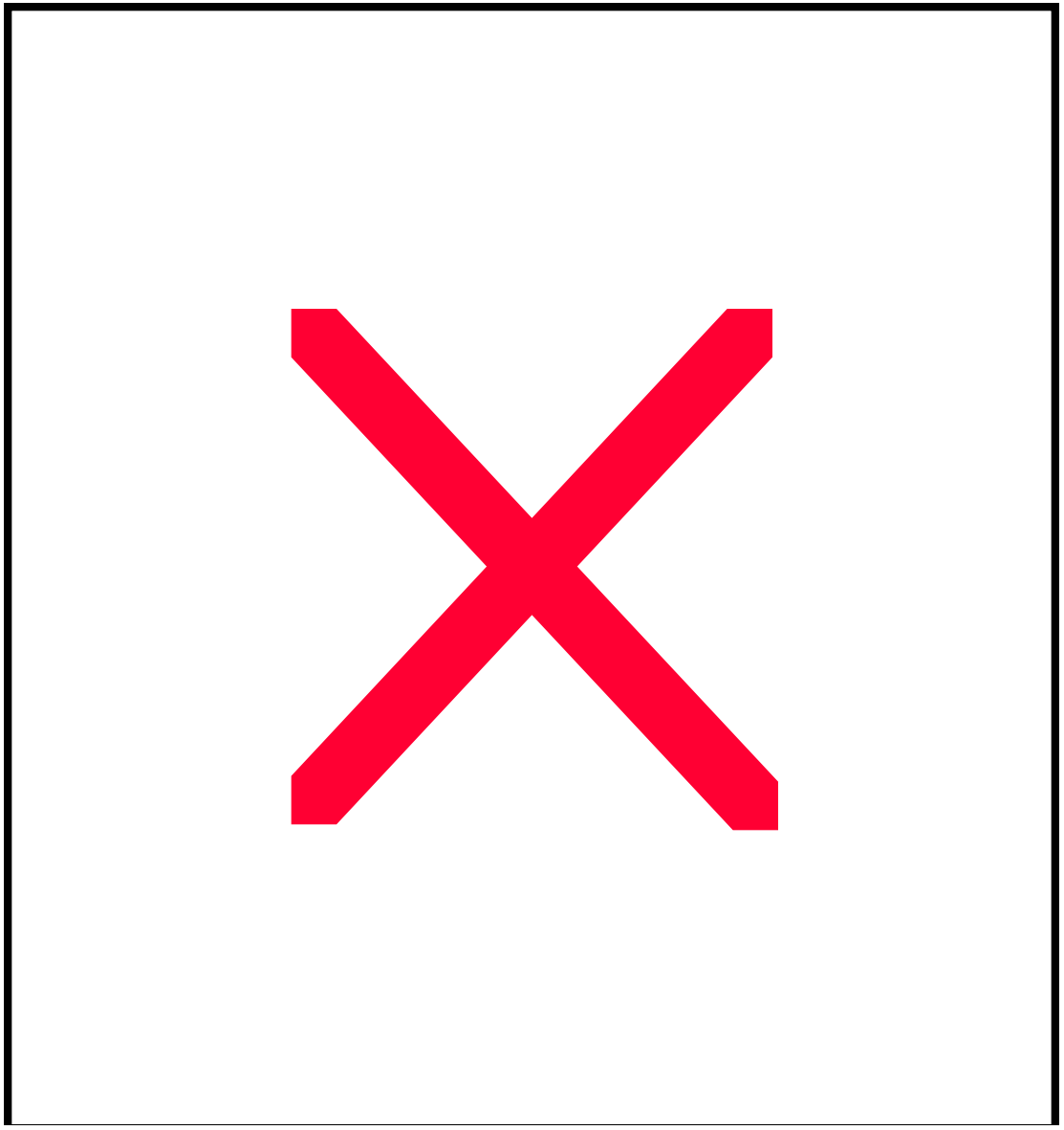
Validation of the aerosol optical depth used in the correction algorithm is on-going (1/2)



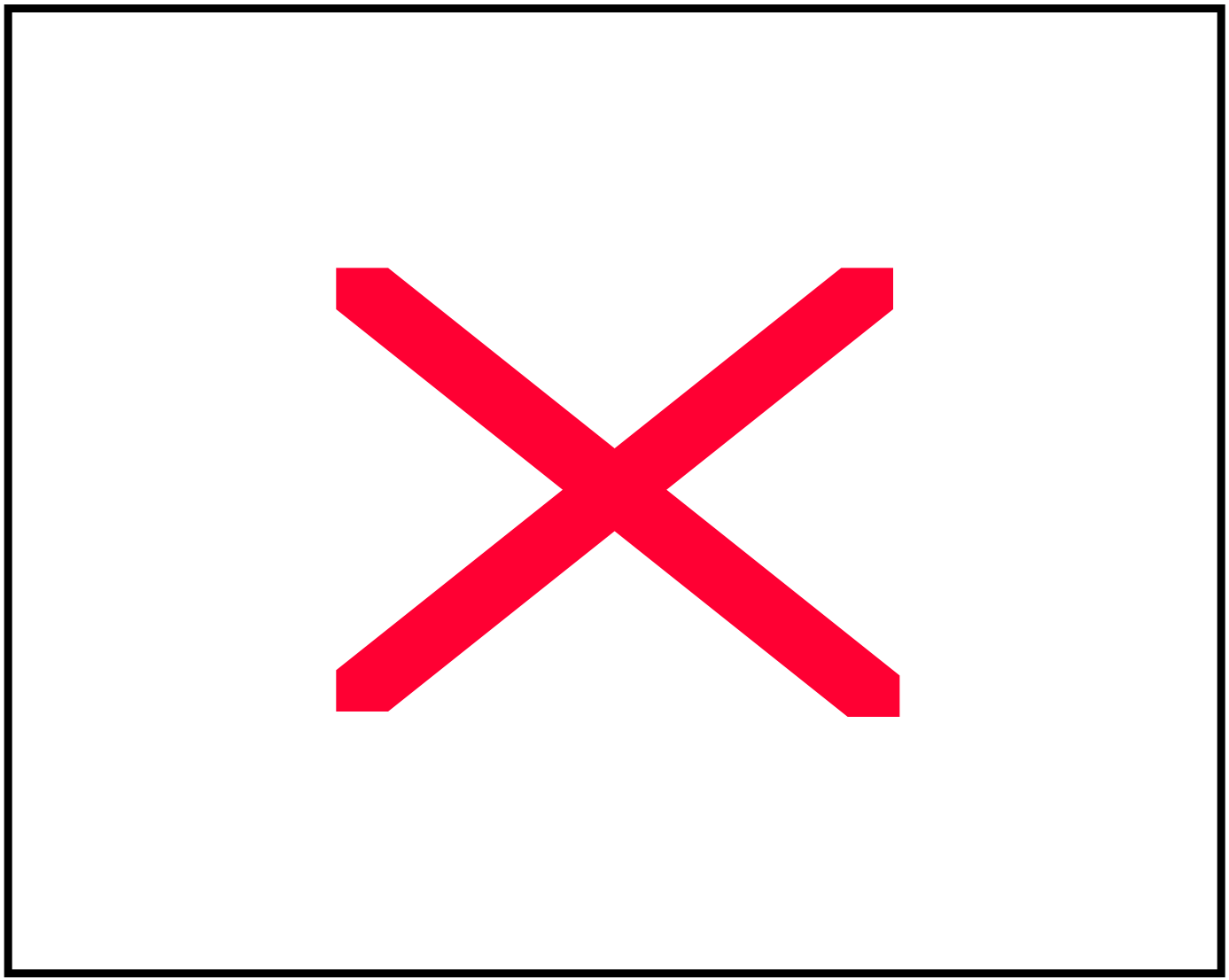
Validation of the aerosol optical depth used in the correction algorithm is on-going (2/2)



Validation of the surface reflectance itself is done by comparison to validated high spatial resolution surface reflectance (ETM+) agregated to the MODIS resolution over uniform areas. (Vermote et al., accepted in RSE).



ETM+ data are corrected for atmosphere accounting for adjacency effects and uses AERONET data as input (aerosol,water vapor). Results for selected sites are compared to ground measurements (J. Morisette) :



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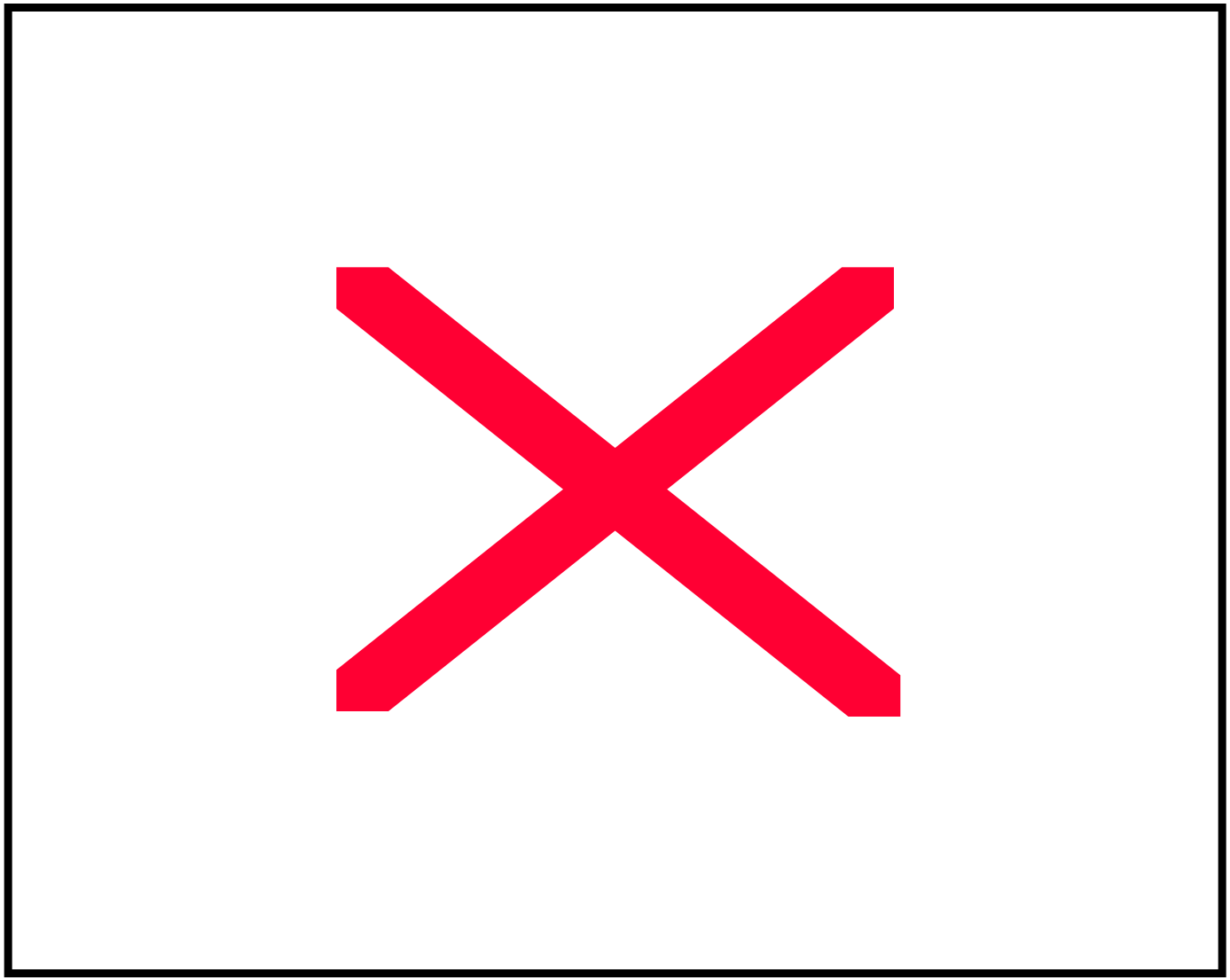
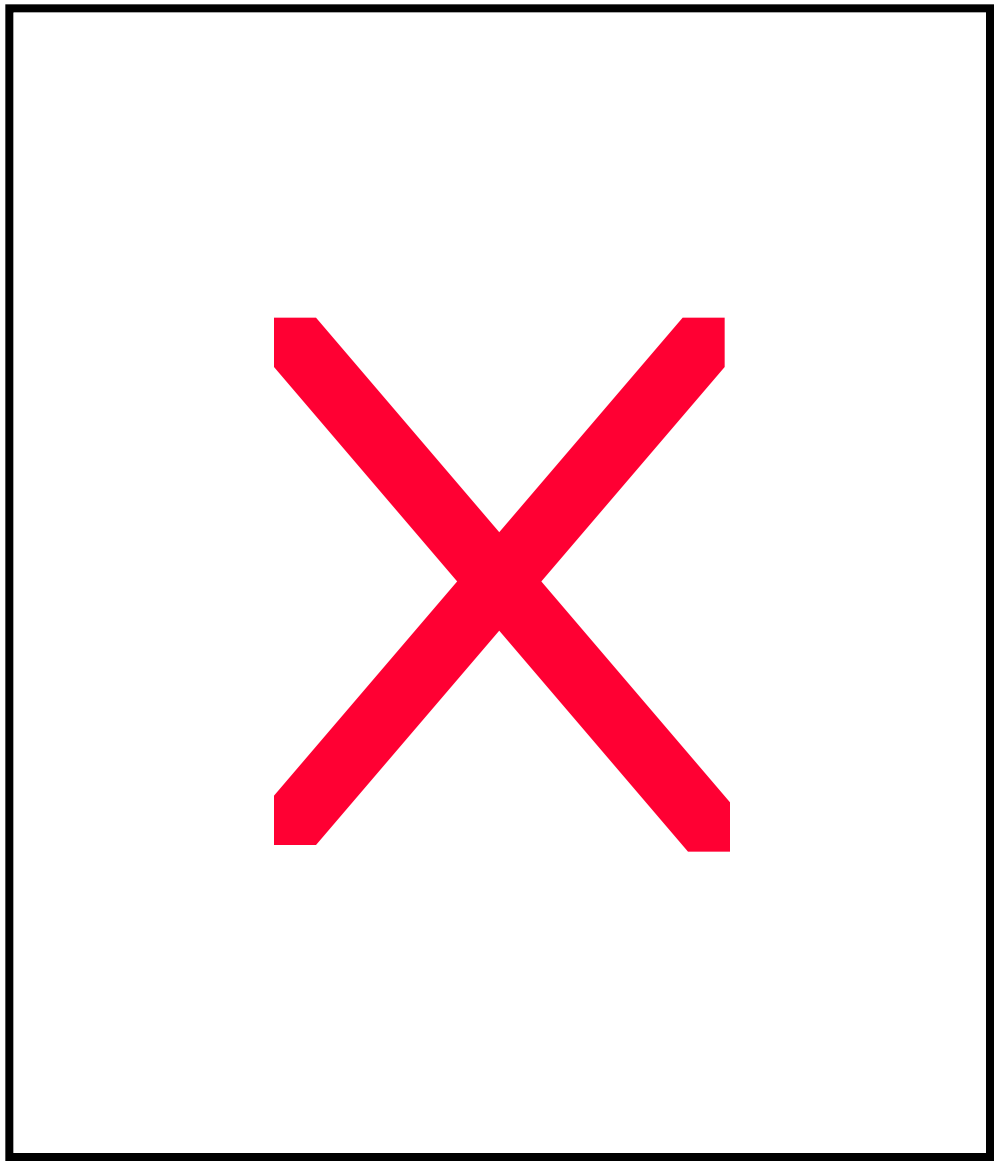


Directional effect sensitivity (atm-surf coupling) has started using MODIS Hot-Spot data

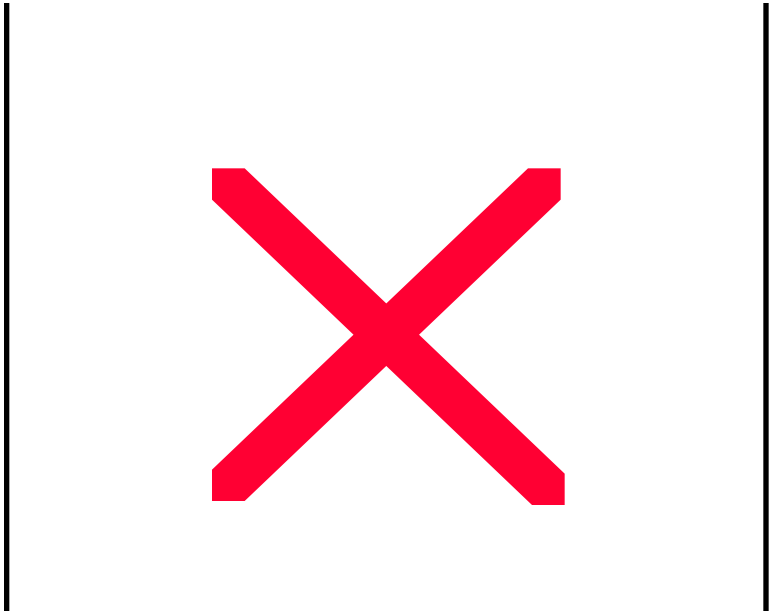


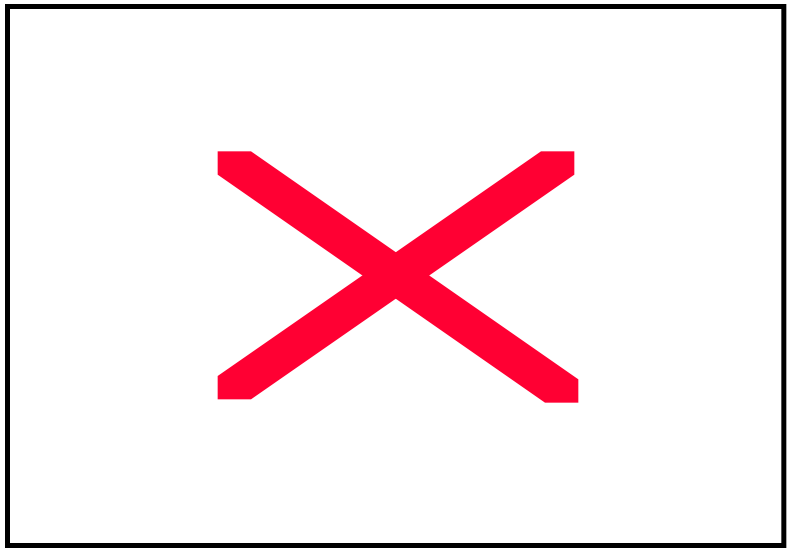
CONCLUSIONS

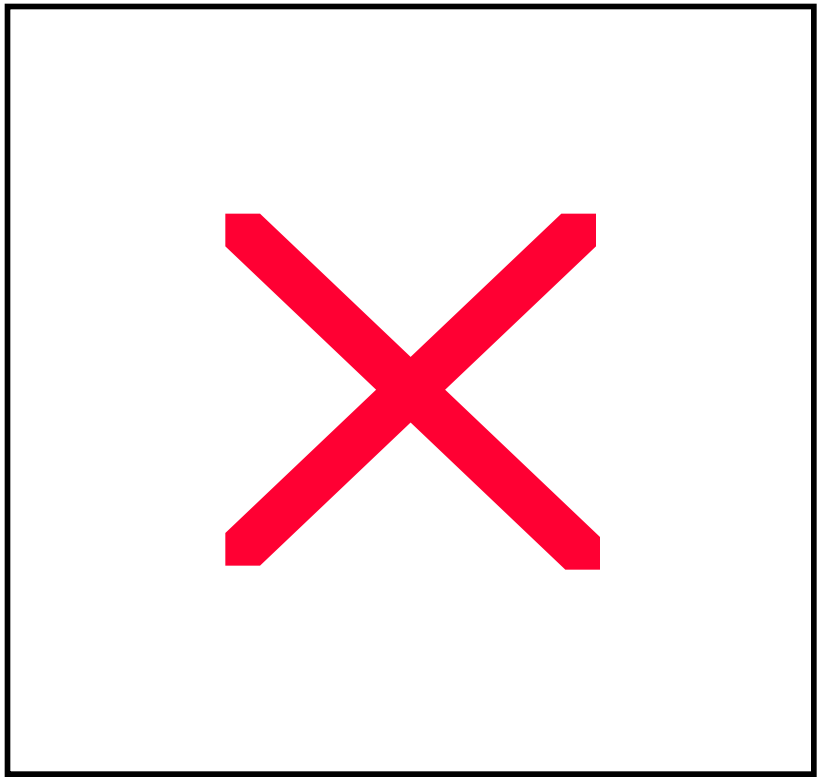
- MOD09 algorithm is working well, evaluation of internal masks is on-going.
- Validation protocol is clearly identified and need to be extended to more cases. Preliminary validation shows product is well within error bars
- Post Launch product (4.0μm reflectance) proves extremely useful (also in dust/volcanic ash/clouds discrimination)
- Atmosphere-BRDF coupling and adjacency effects needs to be addressed (1km aerosol will be extremely useful).
- More accurate dynamic aerosol model needs to be introduced to increase accuracy of surface reflectance and internal aerosol product (using Dubovik et al.).

Remaining issues (Level 1B)

- L1B Middle infrared (2.1micron) greatly improved but there are still issues on some detectors probably related to X talk that show in the aerosol product and surface reflectance.
- Fine calibration (below 1B error bars), mirror reflectance,mirror side and polarization are issues that need to be addressed.







Remaining issues (2/2)

- Ordering data for validation and algorithm improvements is a challenging task despite the help of Goddard DAAC (working on 200 cases - 600 files for 3 months period).

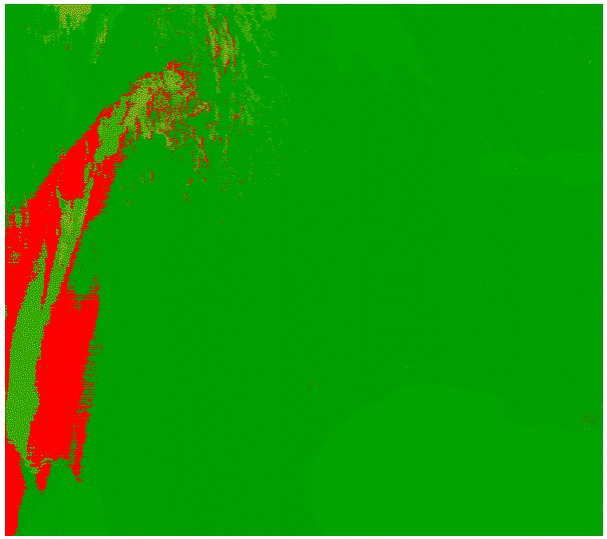
- Limited processing capability make it impossible to run through large volume of data and release highest quality data set (like SeaWiFS) to the public. The core data set, recommended by MODAPS processing review panel may address part of this issue.

- Issues in cloud mask (shadow) still remain and will need to be addressed internally in the surface reflectance algorithm.

- *AQUA will require modification of the surface reflectance algorithm (non-functioning detectors).*

Heavy aerosol typing/detection

Dust could be easily confused with clouds at high optical thickness: middle/shortwave infrared reflectances show different signature for dust versus clouds which enable to recover those situations and detect strong dust events.



RGB image (no aerosol correction) showing a dust storm (yellow-white) over the Mediterranean sea

False RGB image (2.1mic Blue, 1.6mic Green, 3.75mic Red), the low clouds appear whiter than the dust in this false RGB

Experimental dust storm mask, the area detected as strong dust concentration are colored in red-orange.

Heavy/Peculiar aerosol typing

Mt Etna eruption data acquired by MODIS offers unique opportunity to develop volcanic ash detection technique: middle/shortwave infrared reflectances show a very specific signature of the volcanic ash plume.

RGB image of the Mt Etna volcanic ash plume. The plume appears gray.

False RGB image of the Mt Etna volcanic ash plume this time using 2.1mic (Blue) ,1.6mic (Green) and 3.75mic reflectance (red)