Issues in the implementation of the spectral matching algorithm: Atlantic examples

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What is SMA?

The spectral matching algorithm (Gordon et al., 1997) is a technique that aims to compensate for the effects of dust aerosols by computing simultaneously in-water and aerosol properties, using information from all the ocean color bands (rather than first estimating the atmospheric correction from the NIR bands, and subsequently applying that to the visible bands). While SMA can improve data retrievals, it is more computationally intensive than standard processing.

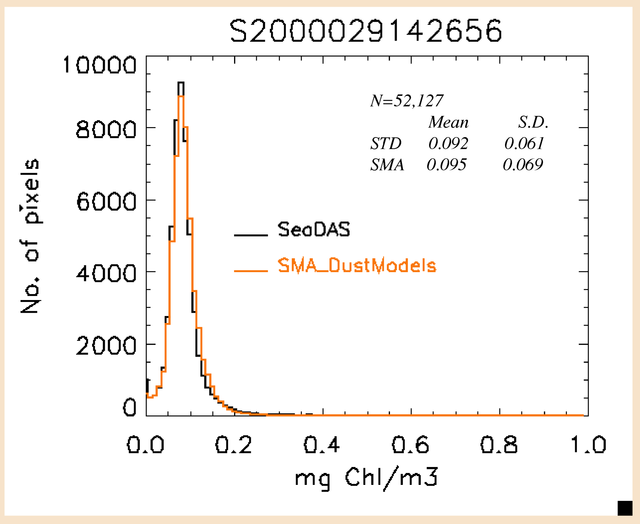
SMA was developed in a non-SeaDAS environment and is typically run using 18 African dust models (3 sizes X 3 vertical heights X 2 absoprtion indices). Although it can also be run using scattering models only, mixing both scattering and dust models does not produce good results. SMA was applied previously to a limited number of passes off the coasts of Africa, Arabia and the Mediterranean.

The next step

To transition to a more basin scale application of SMA, tests are being made spanning the Atlantic Ocean. This represents the simplest case, where 1) dust optical properties are presumably well- represented in the SMA model suite and 2) dust is over mostly Case 1 waters. The example given here shows 3 days: Jan 29-31,2000.

Chl retrieval in non-dusty conditions

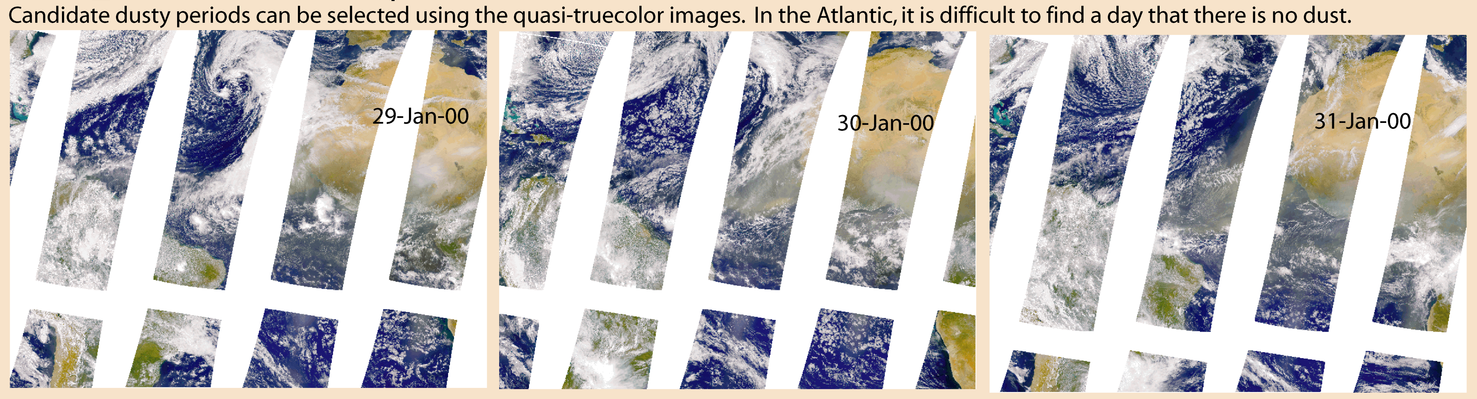
Comparison of the distribution of chlorophyll (common pixels only) in an oligotrophic region (red box) in the absence of dust aerosols shows that SMA yields statistically comparable values to the standard method, albeit requiring a longer computation time



In the future, it would be more efficient if dust-affected pixels could be identified and only those would be subjected to SMA processing. We examined several dust identification criteria, none of which is perfect. Selecting criteria that were certain to include all dust-affected pixels meant flagging some non-dusty areas (e. g., high chlorophyll pixels) as well. But since SMA results are comparable to the standard results, this may not be an important issue.

Quasi_truecolor RGB composites

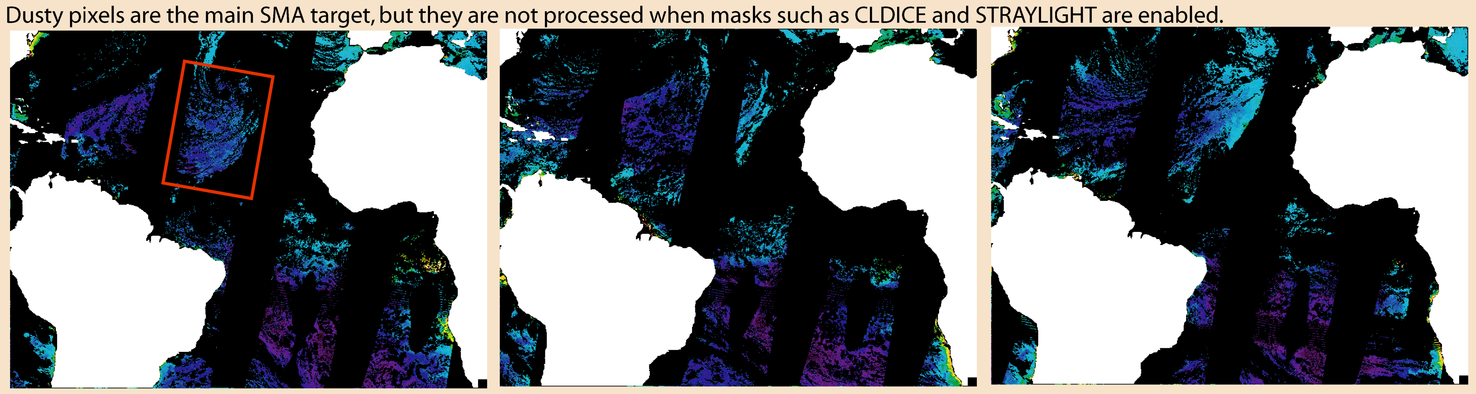
Candidate dusty periods can be selected using the quasi-truecolor images. In the Atlantic, it is difficult to find a day that there is no dust.



Standard processing

std mask: 1=ATMFAIL, 2=LAND, 4=HIGLINT, 5=HILT, 9=STRAYLIGHT, 10=CLDICE, 16=CHLFAIL

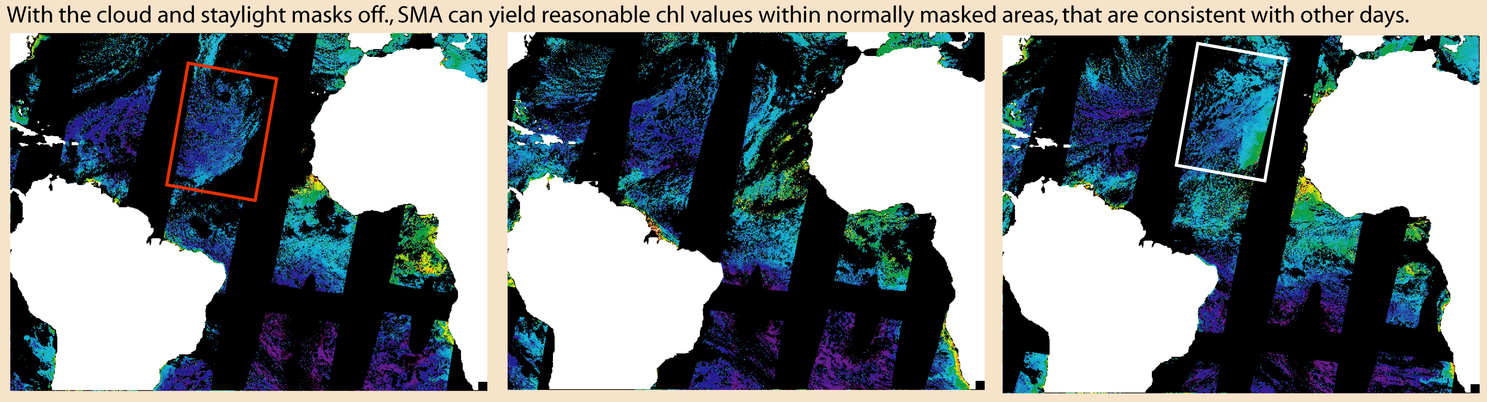
Dusty pixels are the main SMA target, but they are not processed when masks such as CLDICE and STRAYLIGHT are enabled.



SMA processing

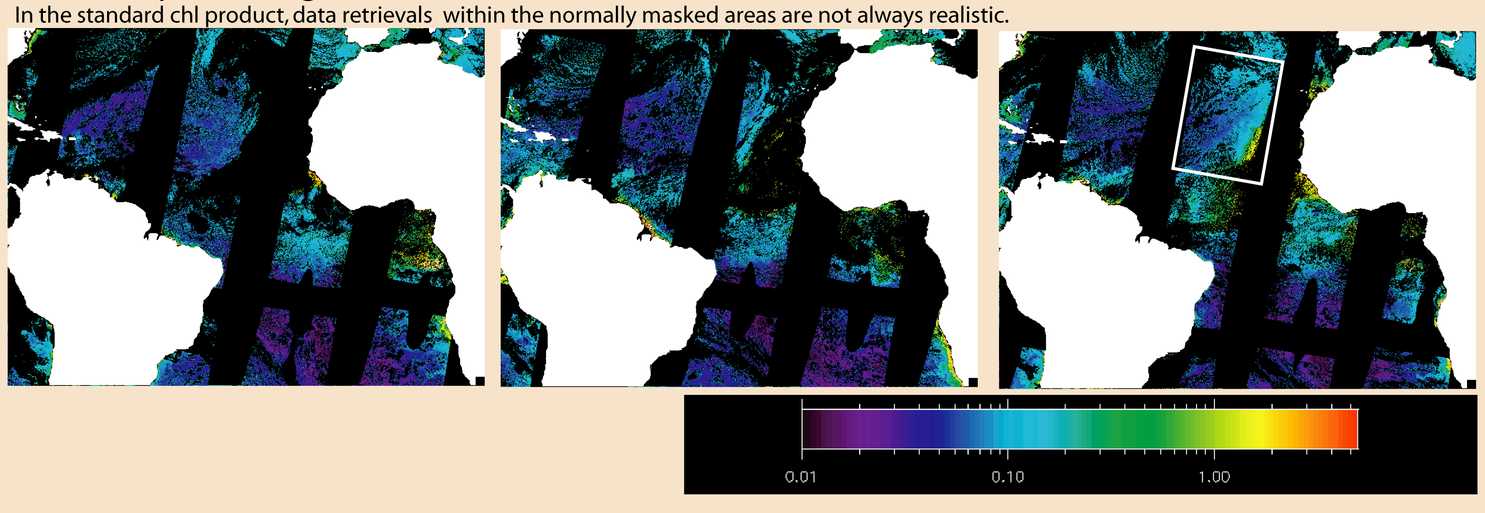
SMA mask: 1=EPSILON, 2=LAND, 4=HIGLINT, 16=CHLFAIL

With the cloud and staylight masks off., SMA can yield reasonable chl values within normally masked areas, that are consistent with other days.



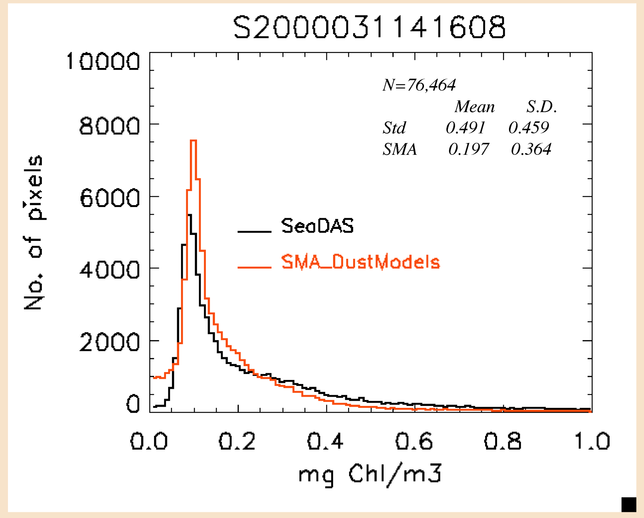
Standard processing (SMA mask)

In the standard chl product, data retrievals within the normally masked areas are not always realistic.



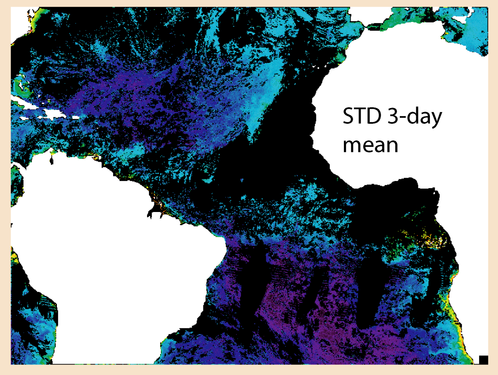
Chl retrieval in dusty conditions

During the passage of a dust plume, chlorophyll retrievals by the two methods tend to be quite different especially if normally masked areas are included (white boxes). The histogram of commom pixels shows that SMA yields lower values compared to the standard method. On the average, the standard method tends to give higher chlorophyll values (which are normally flagged as suspect). The SMA mode was slightly higher since more retreivals were made in the range : 0.01 to 0.20.

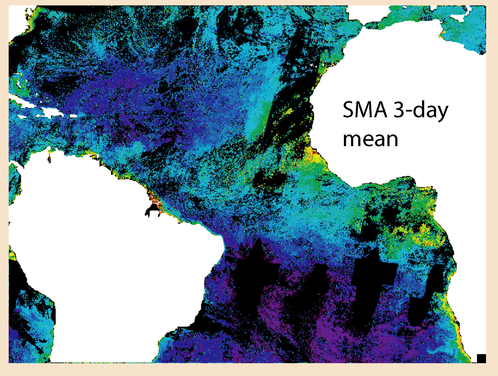


Better coverage but ....

A 3-day mean shows the increased coverage that may be gained using SMA. There are, however, slight differences that stem from the fact that SMA is run under an older processing code. These differences need to be reconciled, most preferably by inclusion of SMA in the SeaDAS code.



Moreover, to distinguish which SMA retrievals are bad, comparisons to in situ values have to be made. The masks and flag criteria, especially for clouds, need to be revisited since as mentioned, SMA is run with the cloud mask off. The modifications that may be required need to be considered carefully since they may require a departure from the established processing.



Acknowledgements

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