Combining Data Assimilation with an Algorithm to Improve the Consistency of VIIRS Chlorophyll: Toward a Multidecadal, Multisensor Global Record

NASA ROSES 2013 NNH13ZDA001N-SNPP
2.1.3 Other New NASA Data Products from Suomi NPP Measurements

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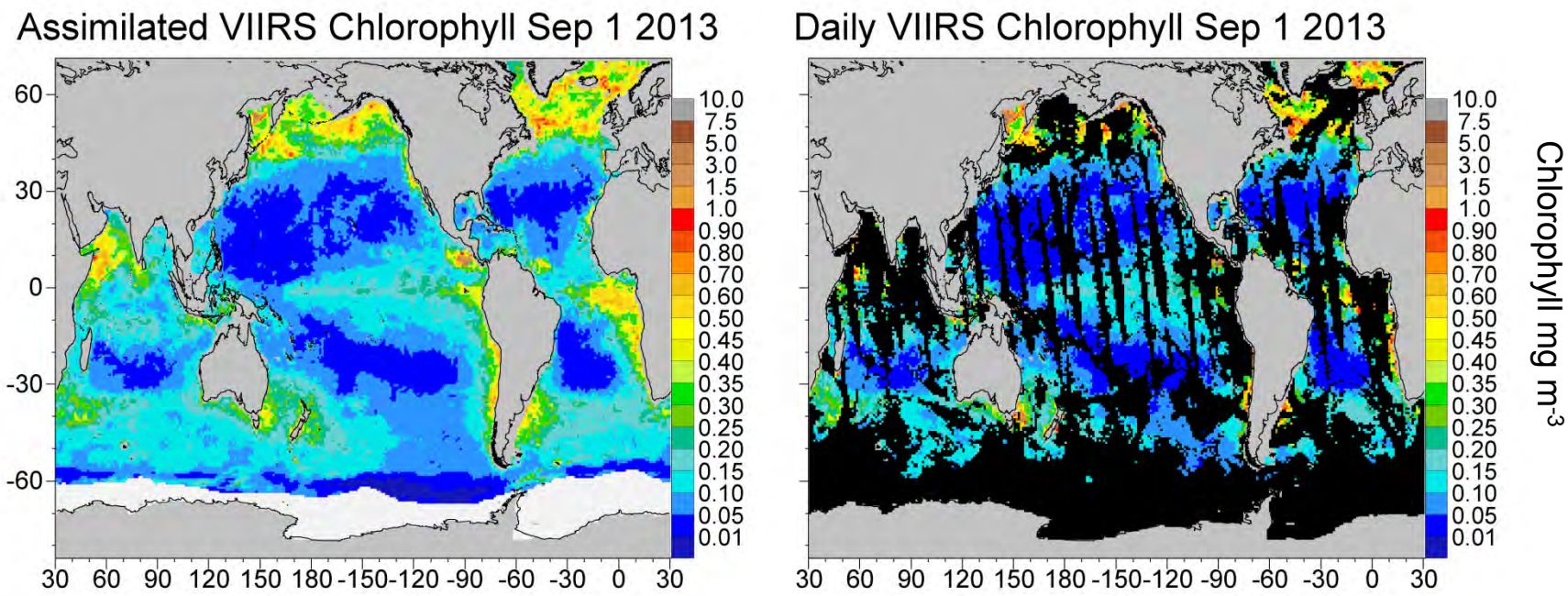
Objective:

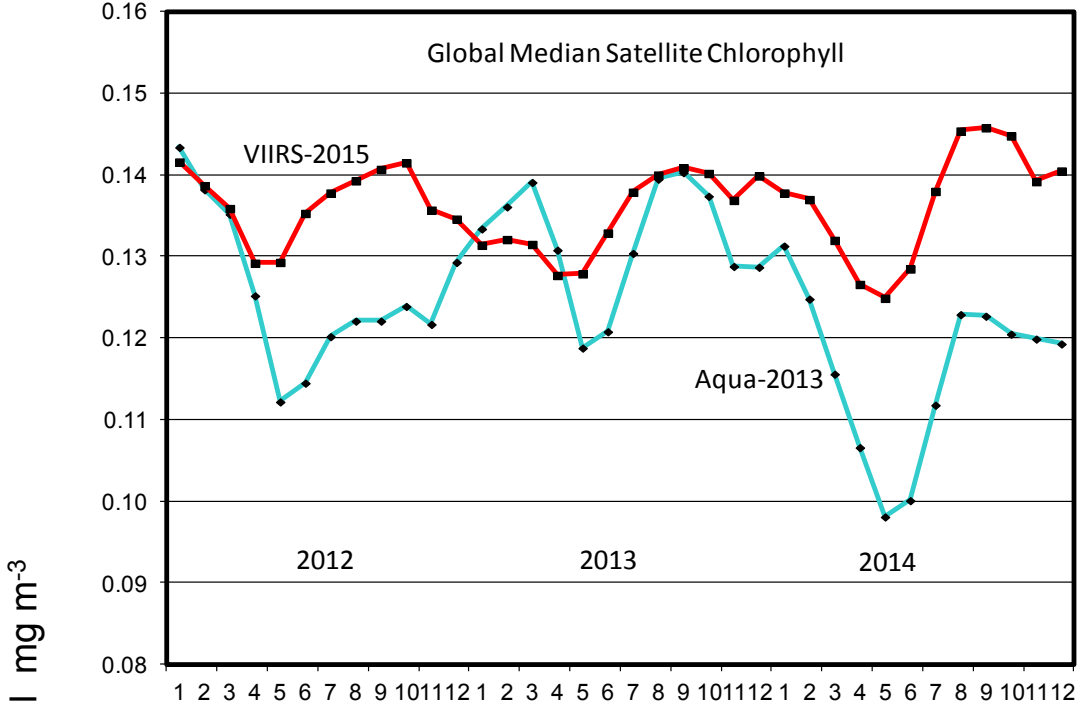
Use data assimilation and bias correction to produce enhanced representations of VIIRS global ocean chlorophyll

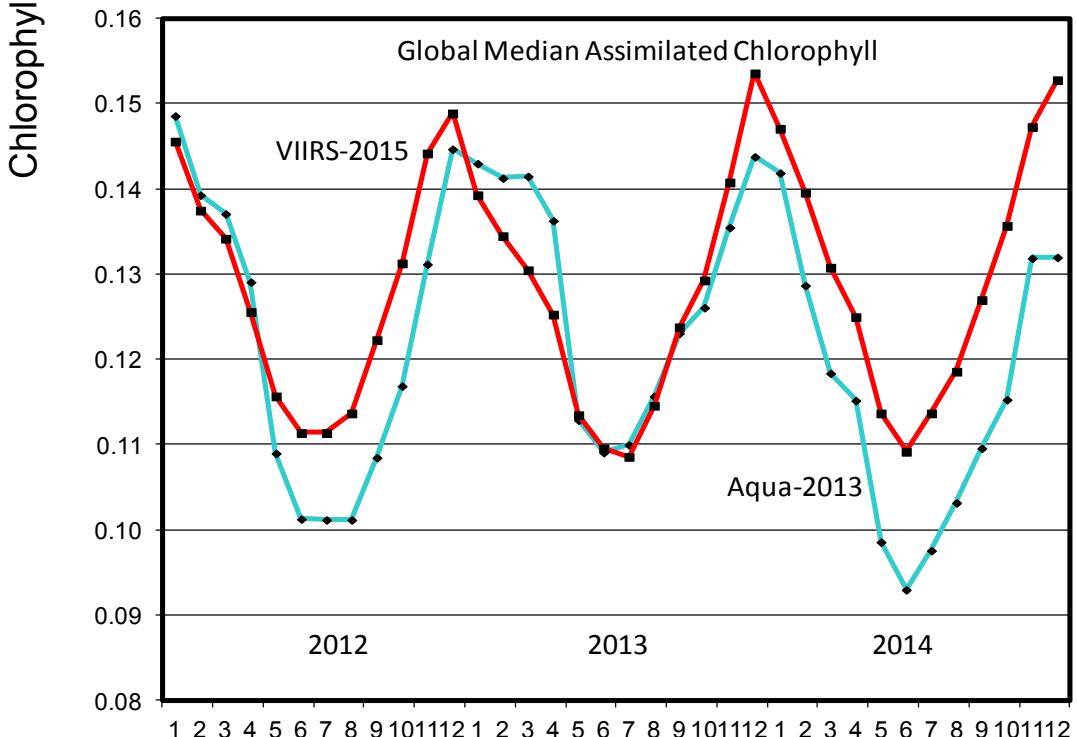
A proposed Level 4 product

Daily Chlorophyll



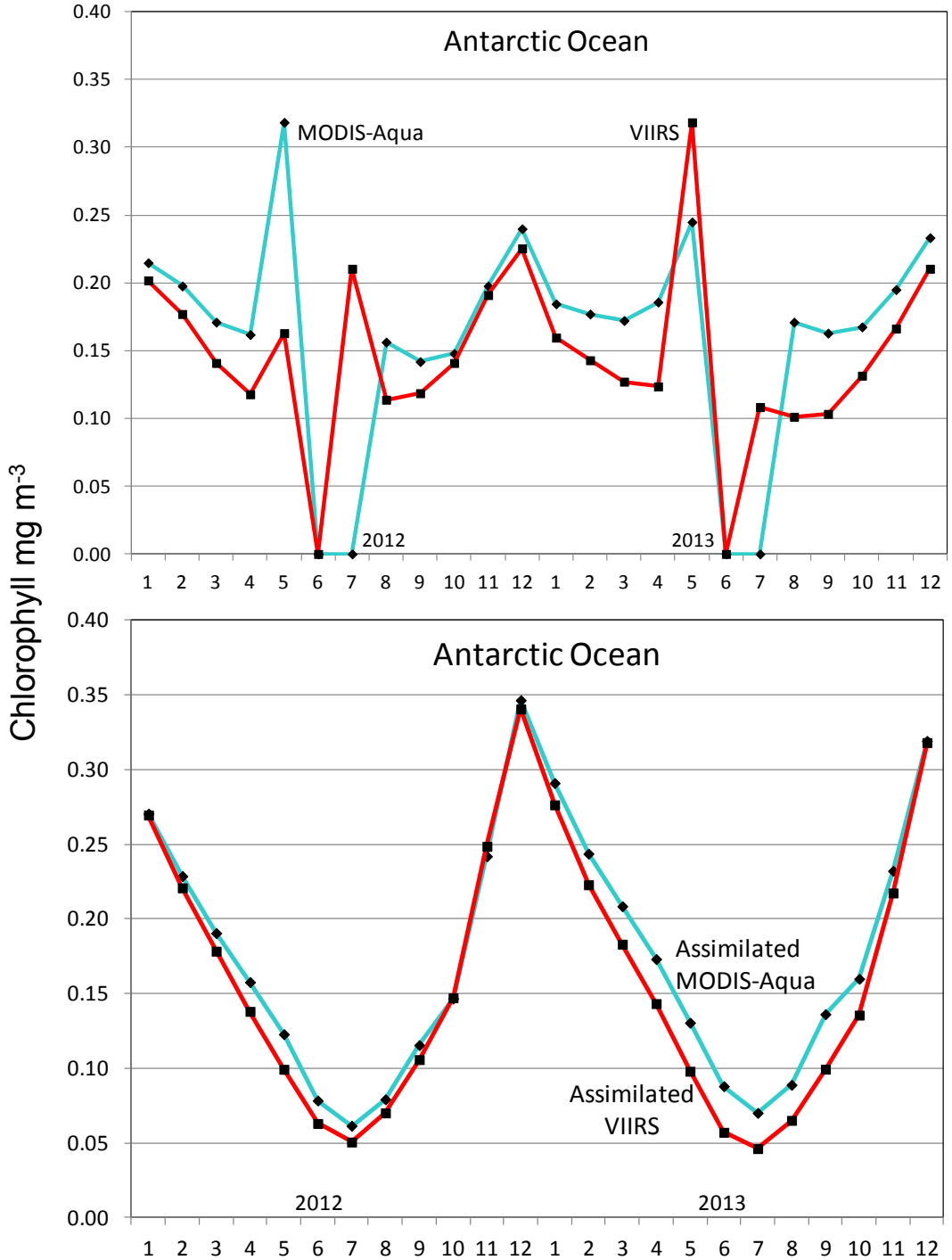
Ice fields are shown in white.
Missing data in black.

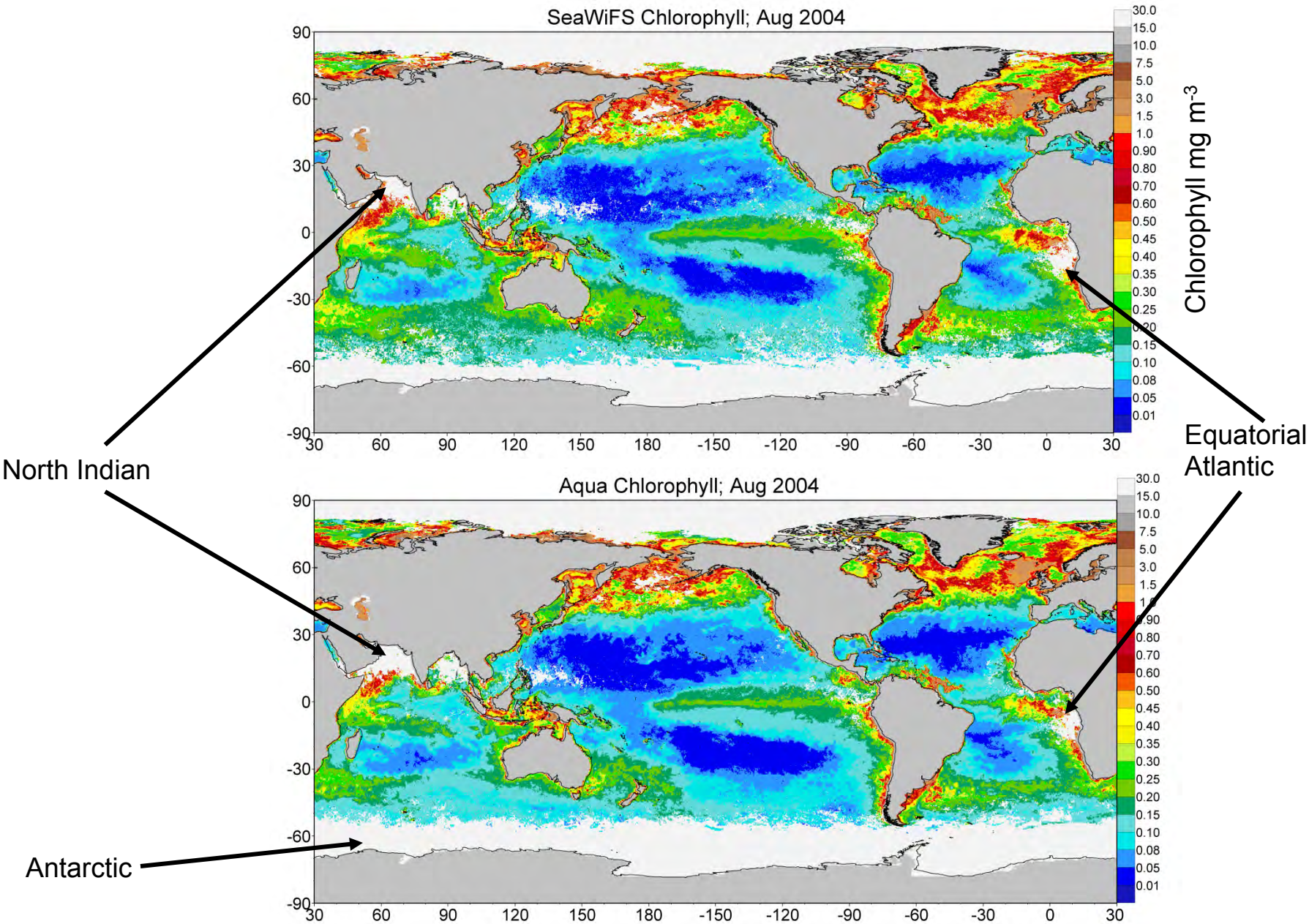




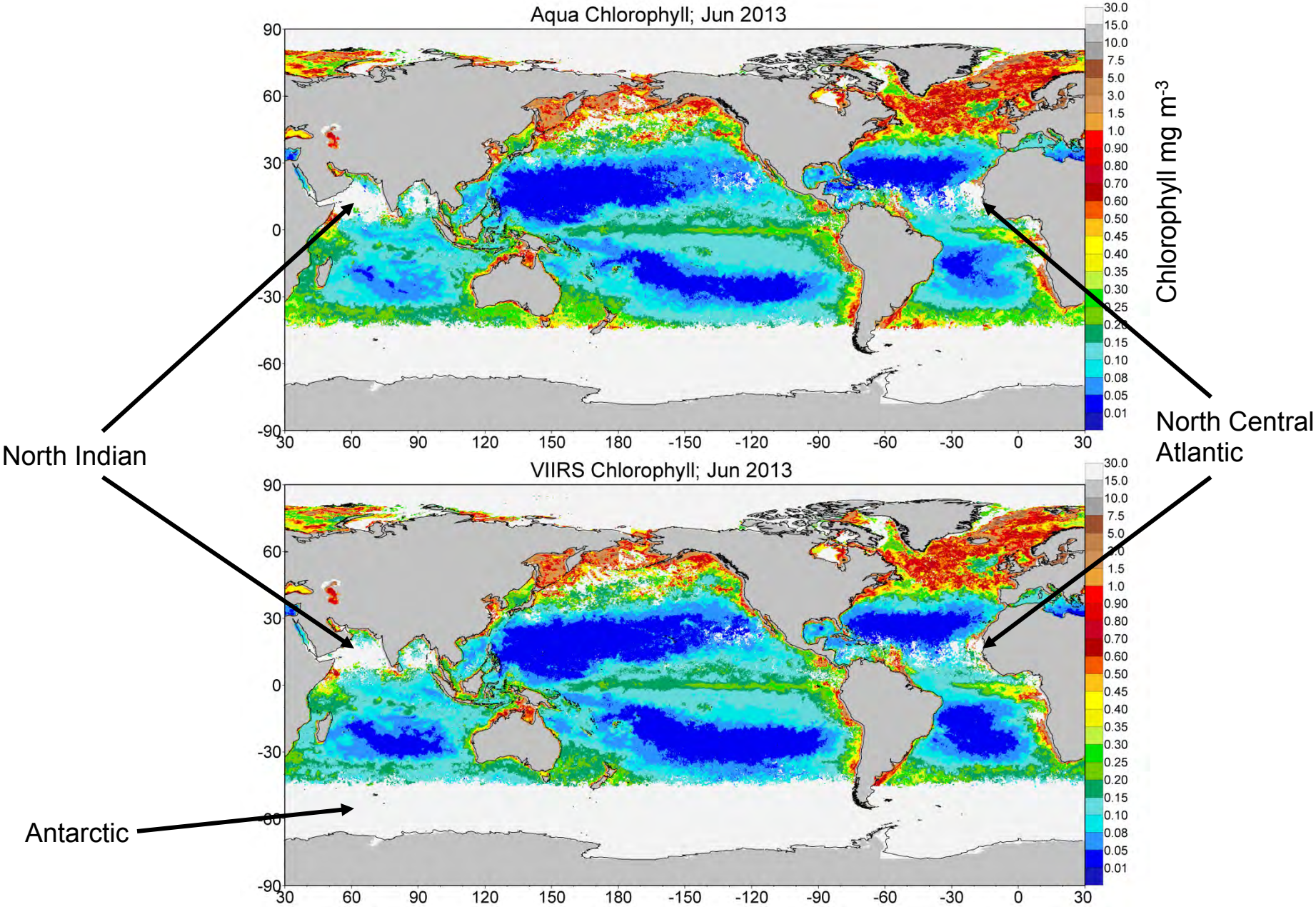
VIIRS: v2015

Aqua: v2013


Antarctic Ocean
MODIS-Aqua
VIIRS
2012
2013
Antarctic Ocean
Assimilated
MODIS-Aqua
Assimilated
VIIRS
2012
2013
Chlorophyll mg m-3
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12

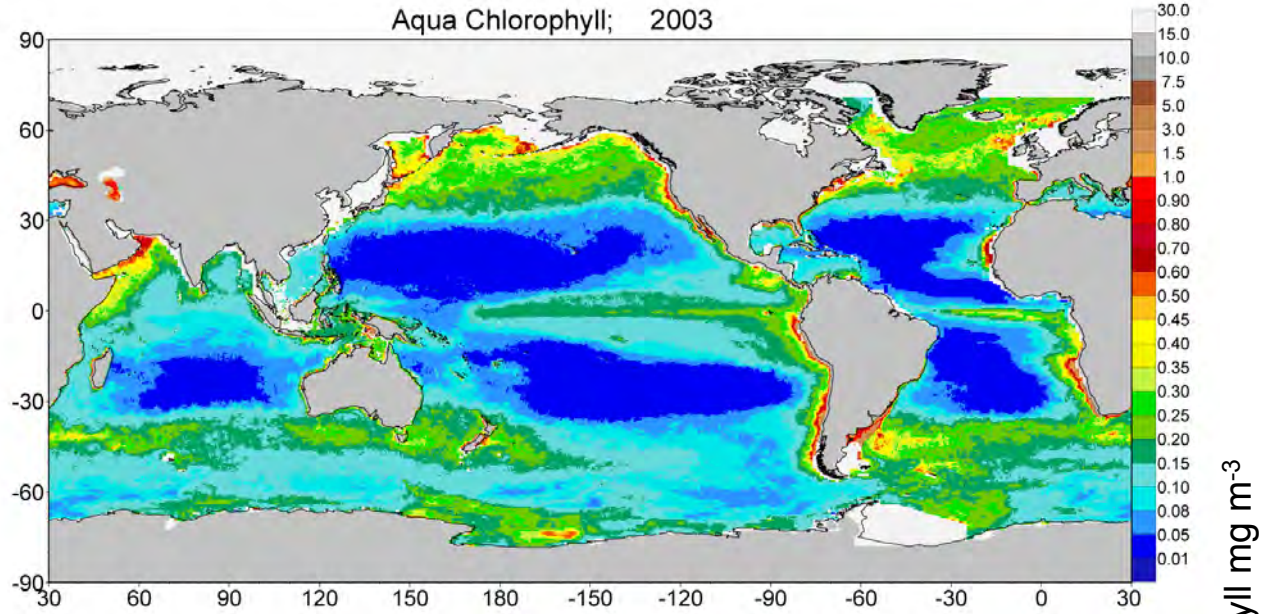


Differences in sampling between SeaWiFS (top) and MODIS (bottom) due to 1) aerosol masking in the North Indian and Equatorial Atlantic and 2) the Antarctic.

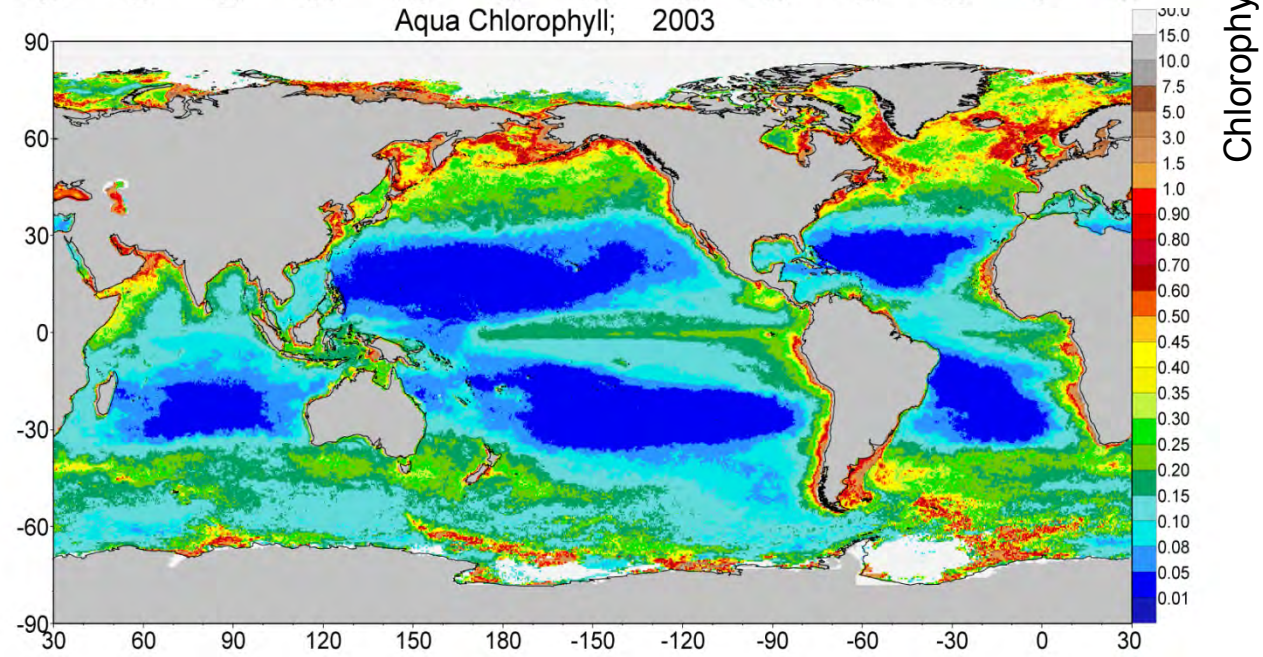


Differences in sampling between MODIS-Aqua (top) and VIIRS (bottom). The differences are smaller than between MODIS and SeaWiFS. Notice increased coverage by VIIRS in Southern Ocean.

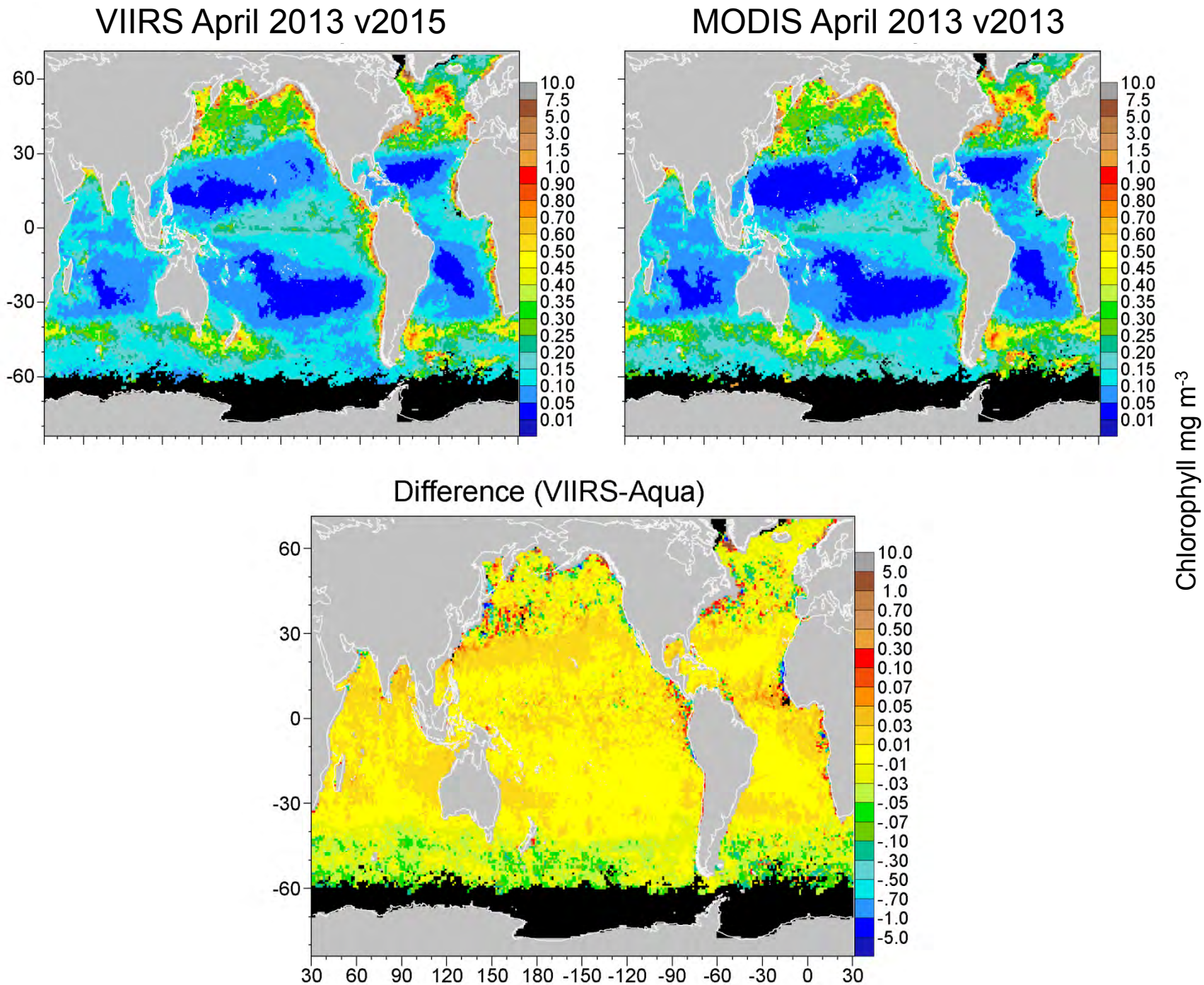
Assimilated
Global Annual
Median Chlorophyll
for MODIS-Aqua

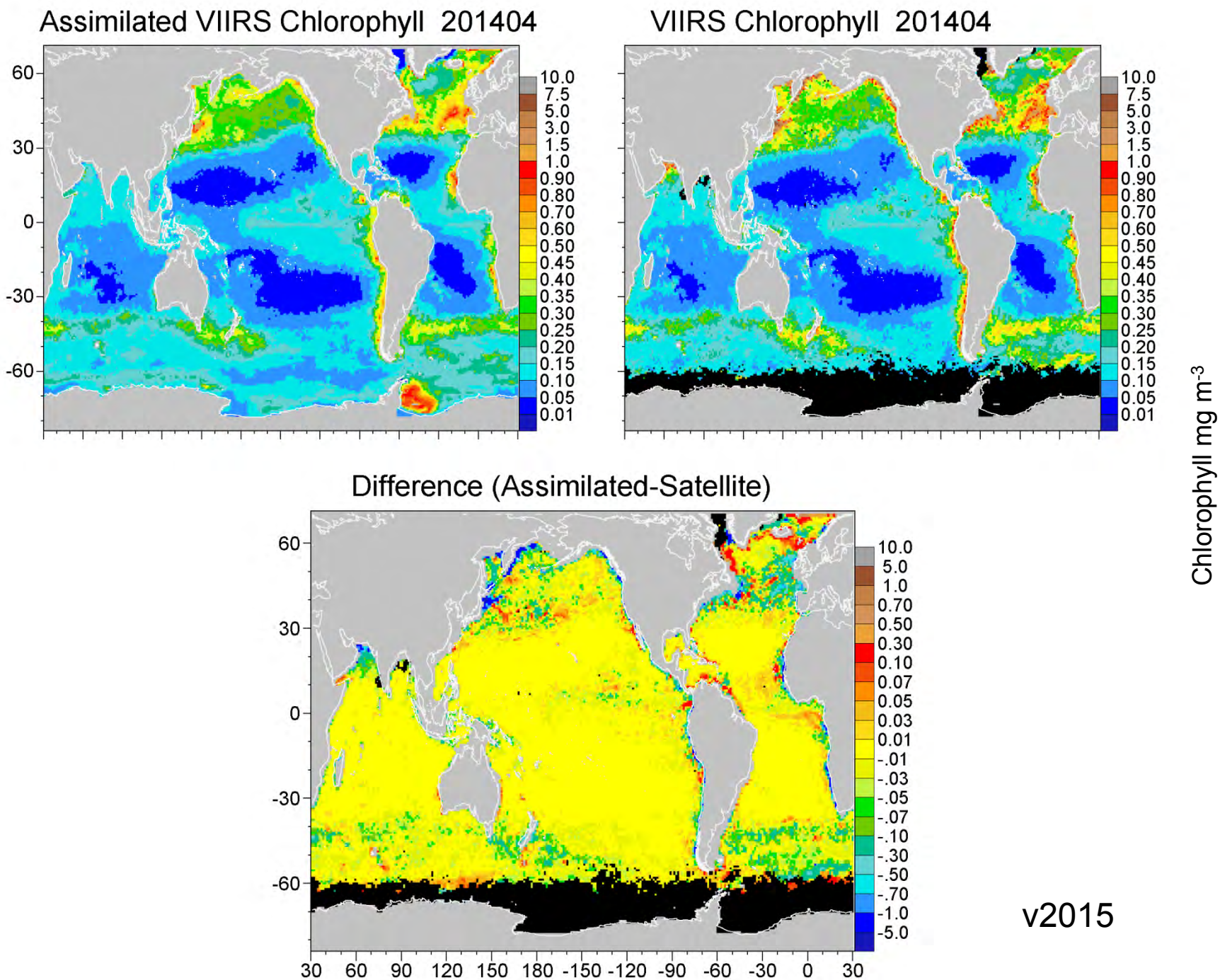


Global Annual
Median Chlorophyll
for MODIS-Aqua



Note the plumes of high chlorophyll in the Southern Ocean that are artifacts of sampling. Missing data along some continental shelves, which is due to the underlying model domain.


VIIRS April 2013 v2015
MODIS April 2013 v2013
Difference (VIIRS-Aqua)
60
30
0
-30
-60
10.0
7.5
5.0
3.0
1.5
1.0
0.90
0.80
0.70
0.60
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.01
10.0
5.0
1.0
0.70
0.50
0.30
0.10
0.07
0.05
0.03
0.01
-.01
-.03
-.05
-.07
-.10
-.30
-.50
-.70
-1.0
-5.0
30 60 90 120 150 180 -150 -120 -90 -60 -30 0 30
Chlorophyll mg m-3

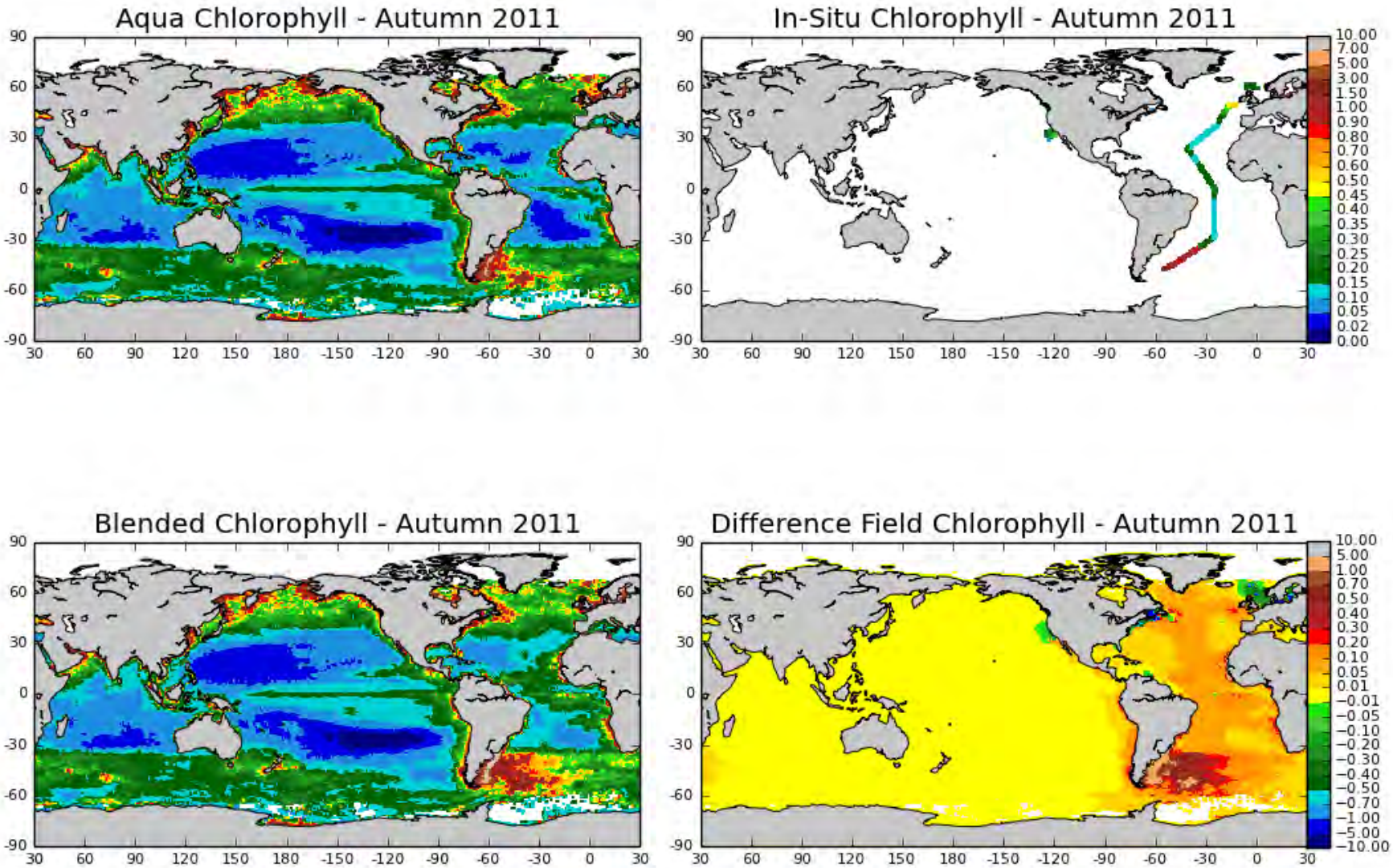

Assimilated VIIRS Chlorophyll 201404
VIIRS Chlorophyll 201404
Difference (Assimilated-Satellite)
60
30
0
-30
-60
10.0
7.5
5.0
3.0
1.5
1.0
0.90
0.80
0.70
0.60
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.01
10.0
5.0
1.0
0.70
0.50
0.30
0.10
0.07
0.05
0.03
0.01
-.01
-.03
-.05
-.07
-.10
-.30
-.50
-.70
-1.0
-5.0
30 60 90 120 150 180 -150 -120 -90 -60 -30 0 30
Chlorophyll mg m-3
v2015

Bias-Correction Using In Situ Chlorophyll Data

We use 3 archives:

NODC
SeaBASS
AMT

Quality checked using blended analysis (used for bias correction of SST by the Reynolds methodology) for the period 2012-2014

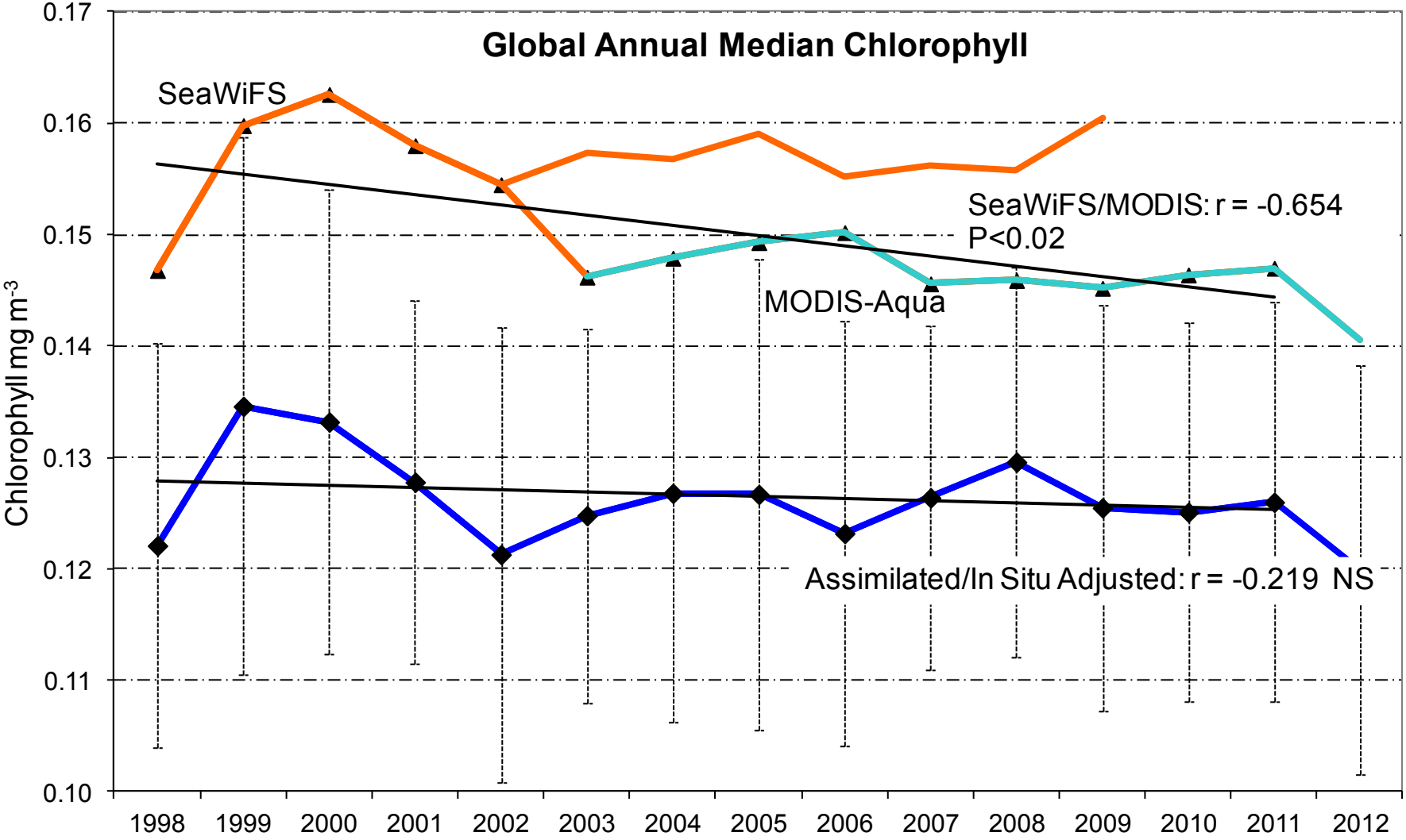


After QC, we have 611 data points of chlorophyll for 2012-2014

Statistics for 2012-2014
Comparison with In situ Data
(Satellite-weighted; open ocean only)

	Bias (Median% diff)	Uncertainty (SIQR)	N
MODIS-Aqua v2013:	5.0%	23.3%	140
VIIRS v2015:	23.8%	27.6%	158

(for 2002-2009 we had 1757 data points matchups for MODIS)



Gregg and Rousseaux, JGR-Oceans 2014

Plans

Obtain more in situ data

Obtain new MODIS-Aqua 2015 re-processing

Develop statistics; assess the need for bias correction

Begin discussions on how to implement Level-4
assimilated data products