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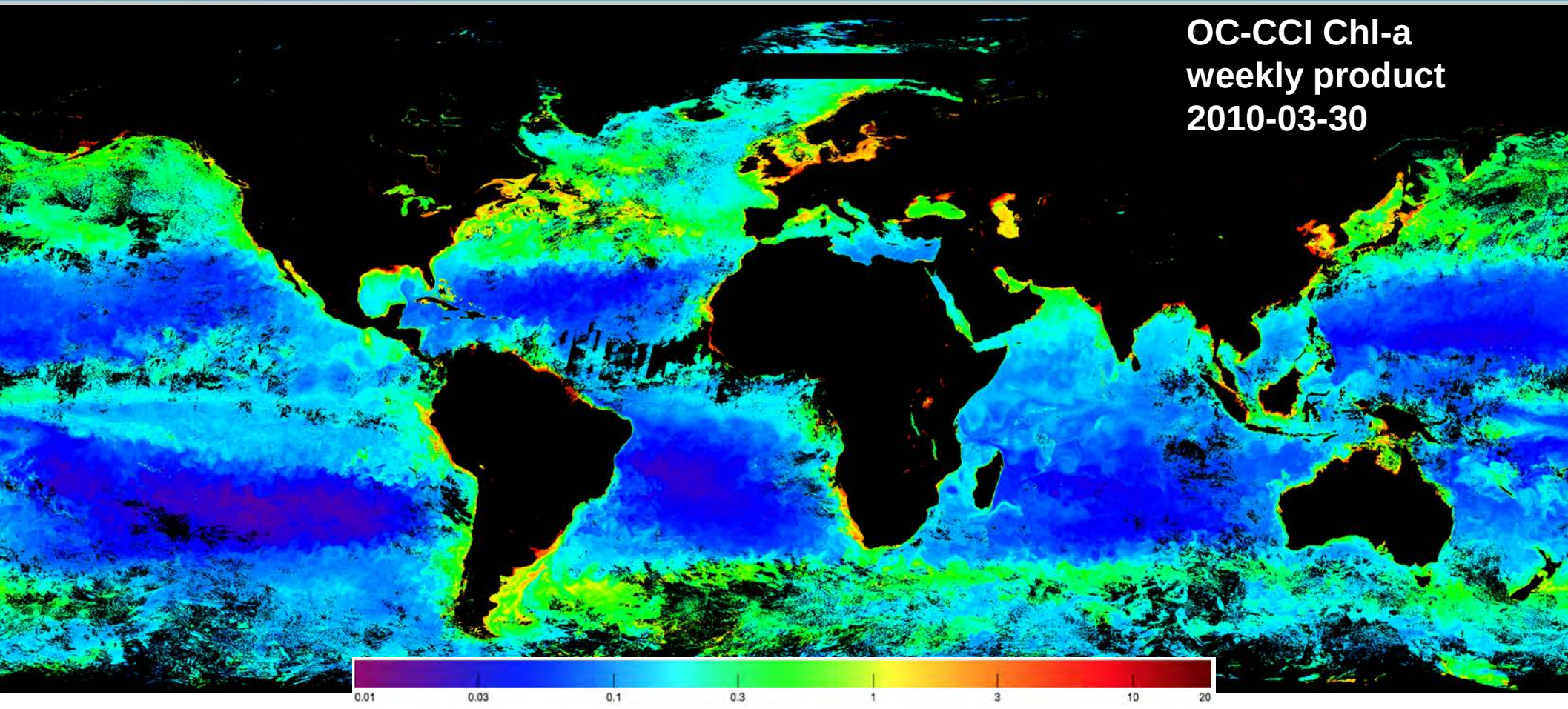

IOCS 2017 Breakout session 7

Thomas Jackson

gorithm performance and blending in the context of optical w

With thanks to the (large) OC-CCI team, R.Brewin, H.Evers-King and POCO team, S.Simis, A.Tyler and Globolakes Team, T.Moore, NASA

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Talk outline

Diversity of algorithm approaches

In situ data

Performance metrics

Per-waterclass assessment

Algorithm Blending

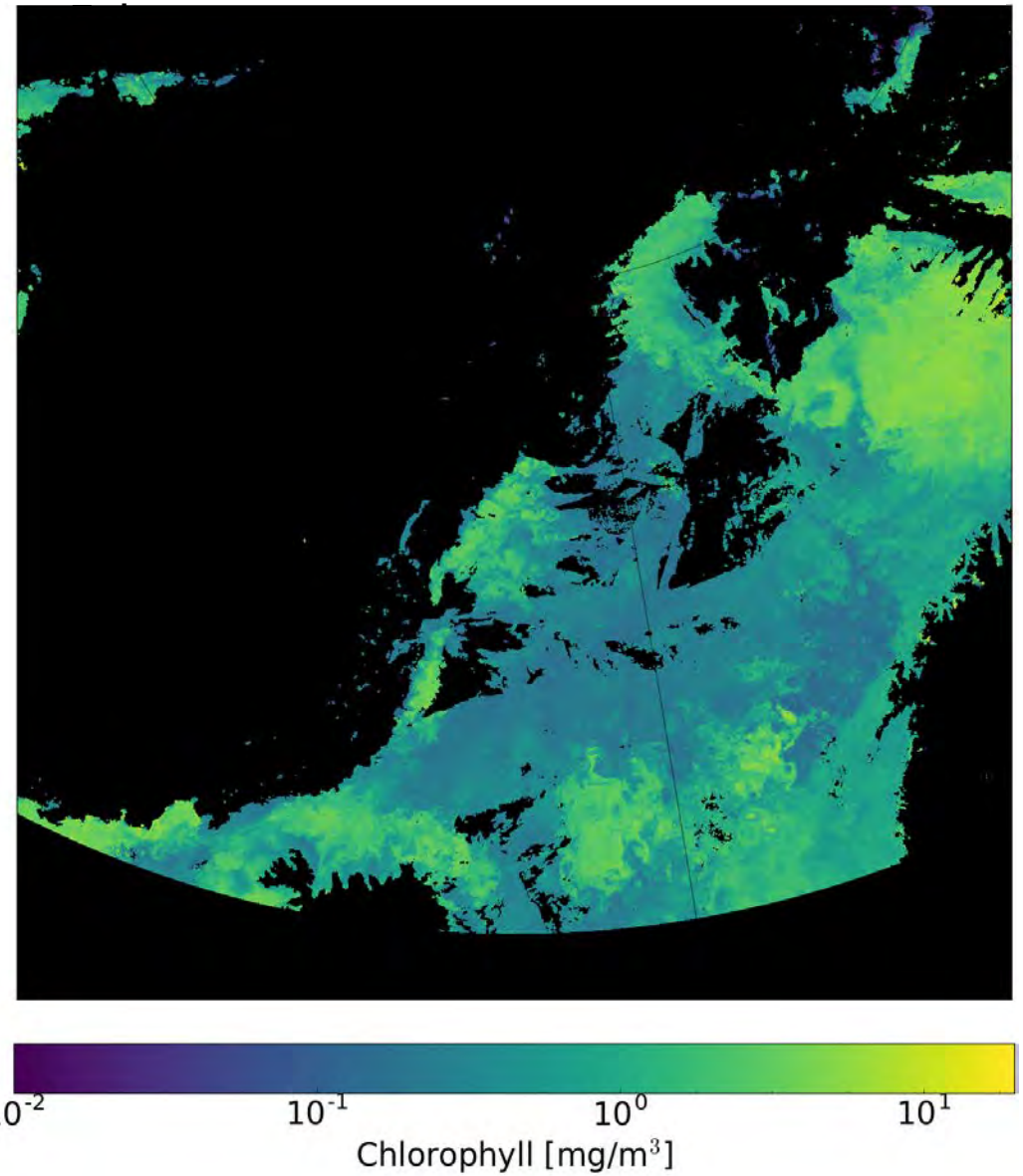
Questions

Algorithm approaches

Bricaud et al. (1995)
Garver and Siegel (1997)
Lee et al. (1998, 1999, 2002, 2009)
O'Reilly et al. (2000)
Maritorena et al (2002)
Gohin et al. (2002, 2005)
Smyth et al. (2006)
Morel et al. (2007)
Franz and Werdell (2010)
Morel and Antoine (2011)
Hu et al. (2012)
Werdell et al. (2013)

- Case-I and Case-II.
- Band ratio (e.g OC2-4) vs IOPs (e.g QAA, GSM).
- Regional or global algorithms?

CMEMS Arctic region Chl 2010-05-17 8d

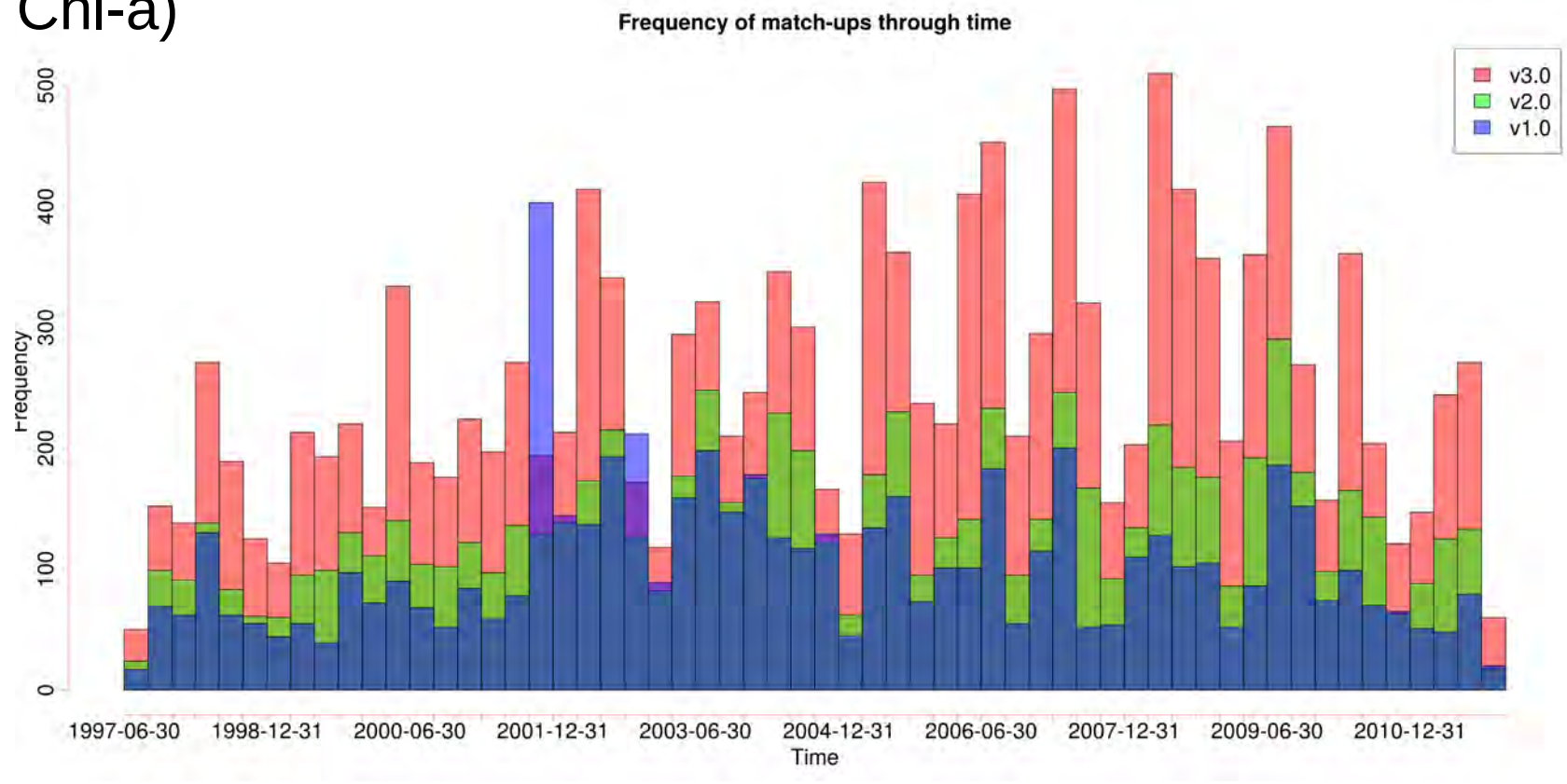


Assessing performance: In situ data

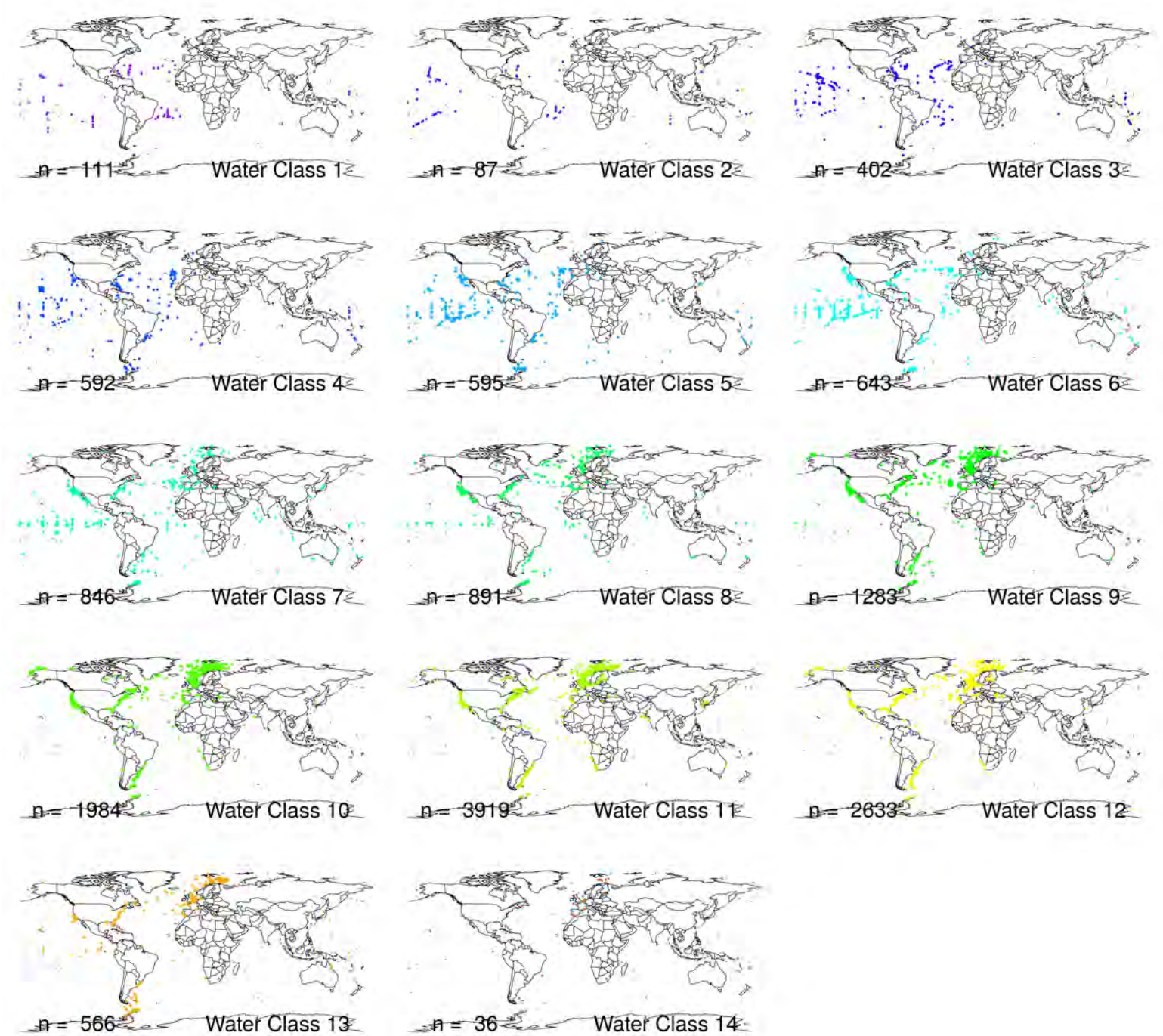
Assessment of algorithm performance relies upon collection of masses of high quality in situ data.

When using in situ data the spatio-temporal distribution of observations needs to be considered.

Some variables (e.g. b_{bp}) are under-sampled compared to others (e.g. Chl-a)



Heavy sampling bias still exists



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Metric can determine 'best' algorithm

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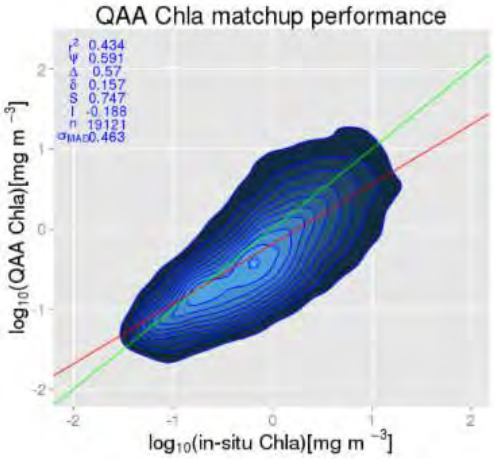
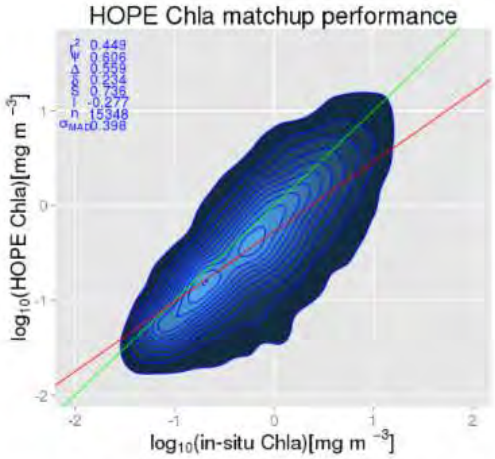
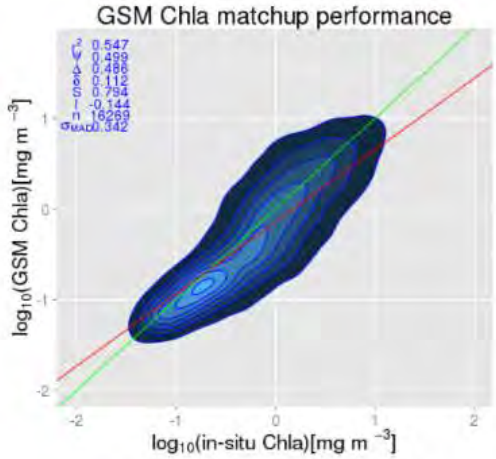
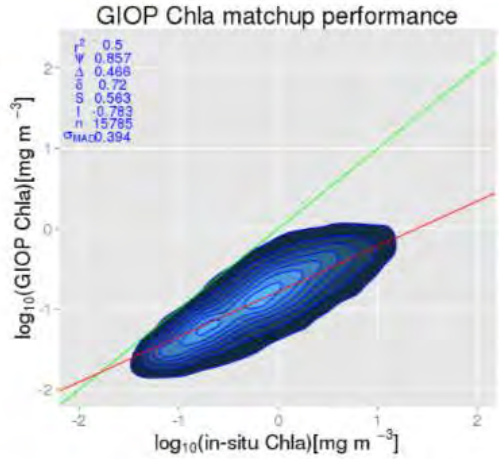
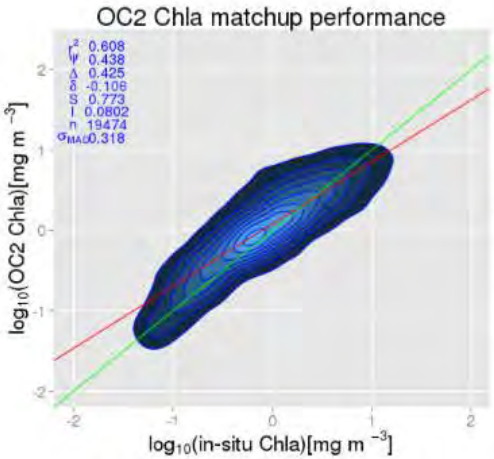
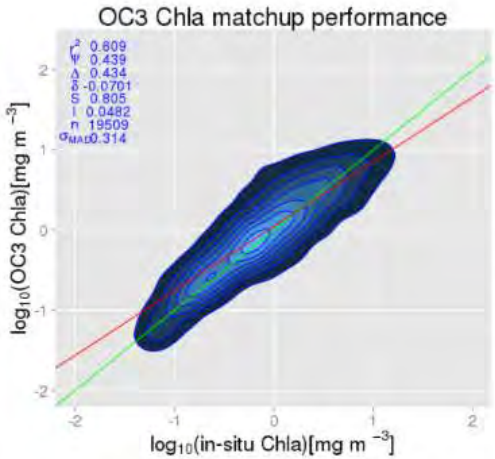


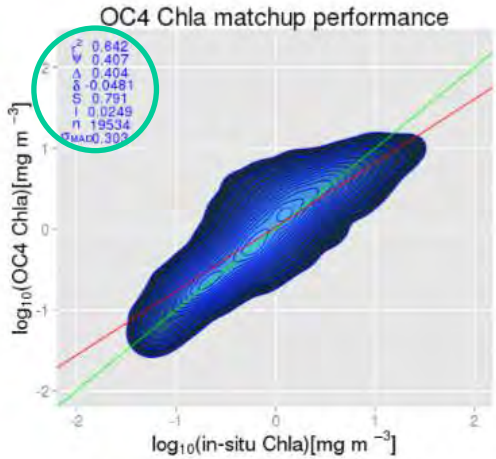


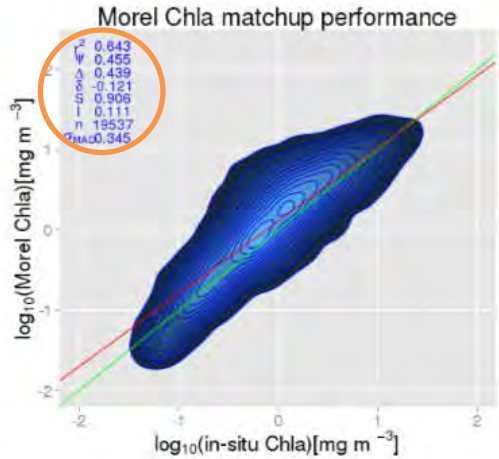


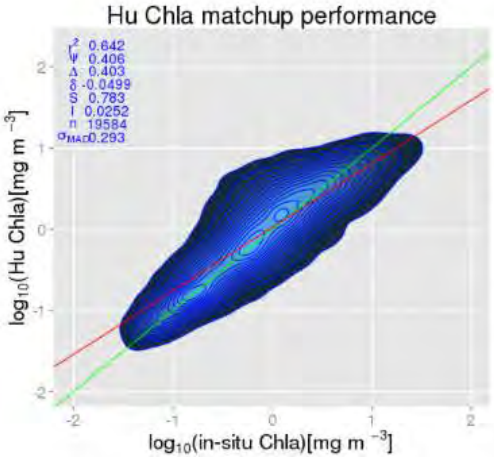


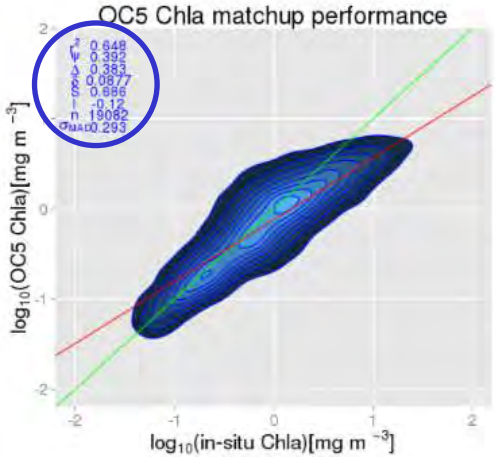


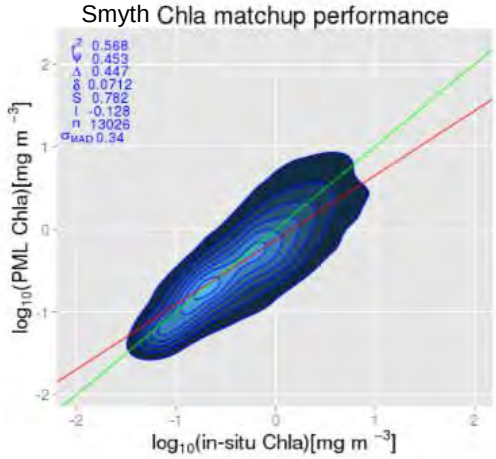












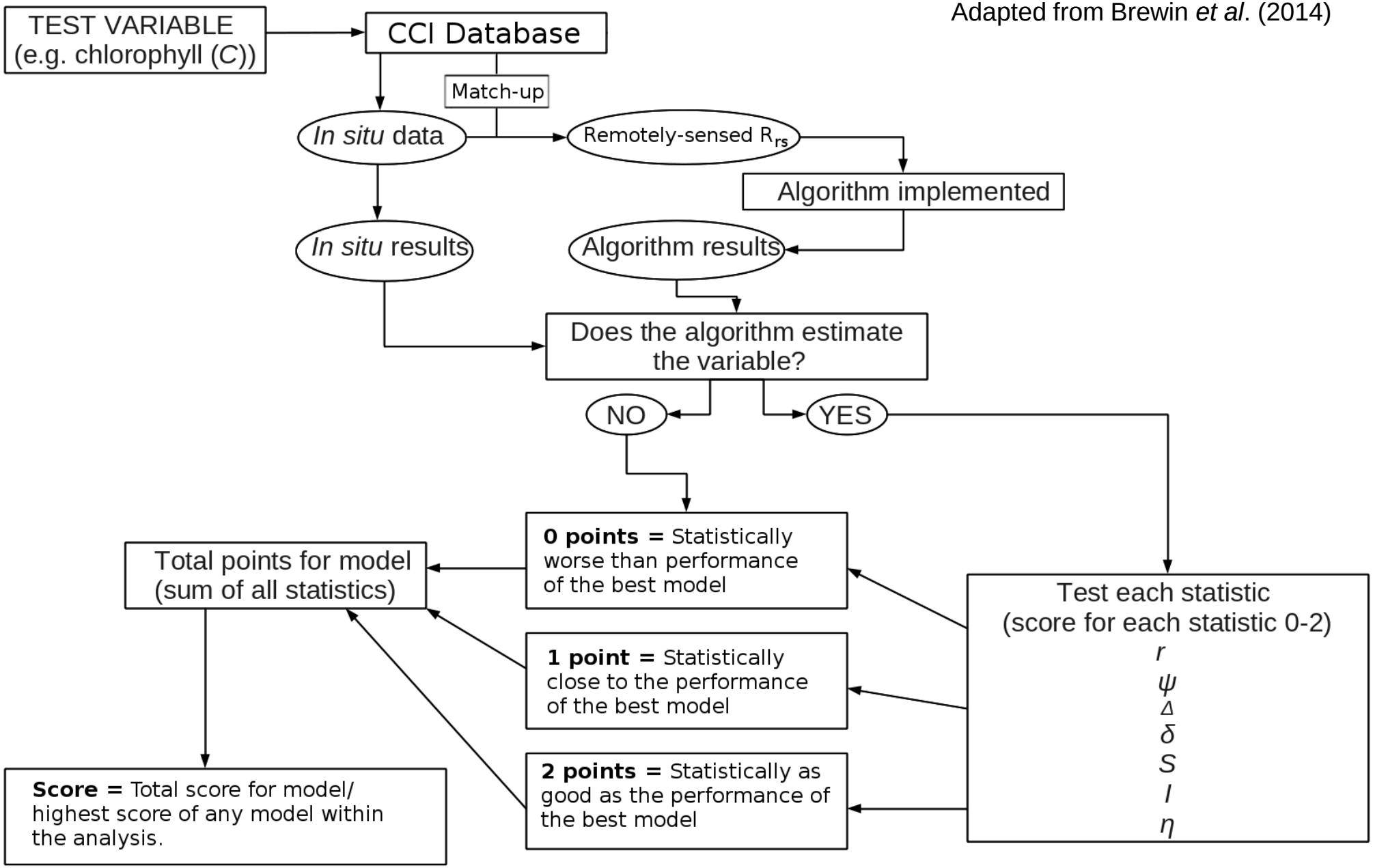
Best Slope

Best r^2

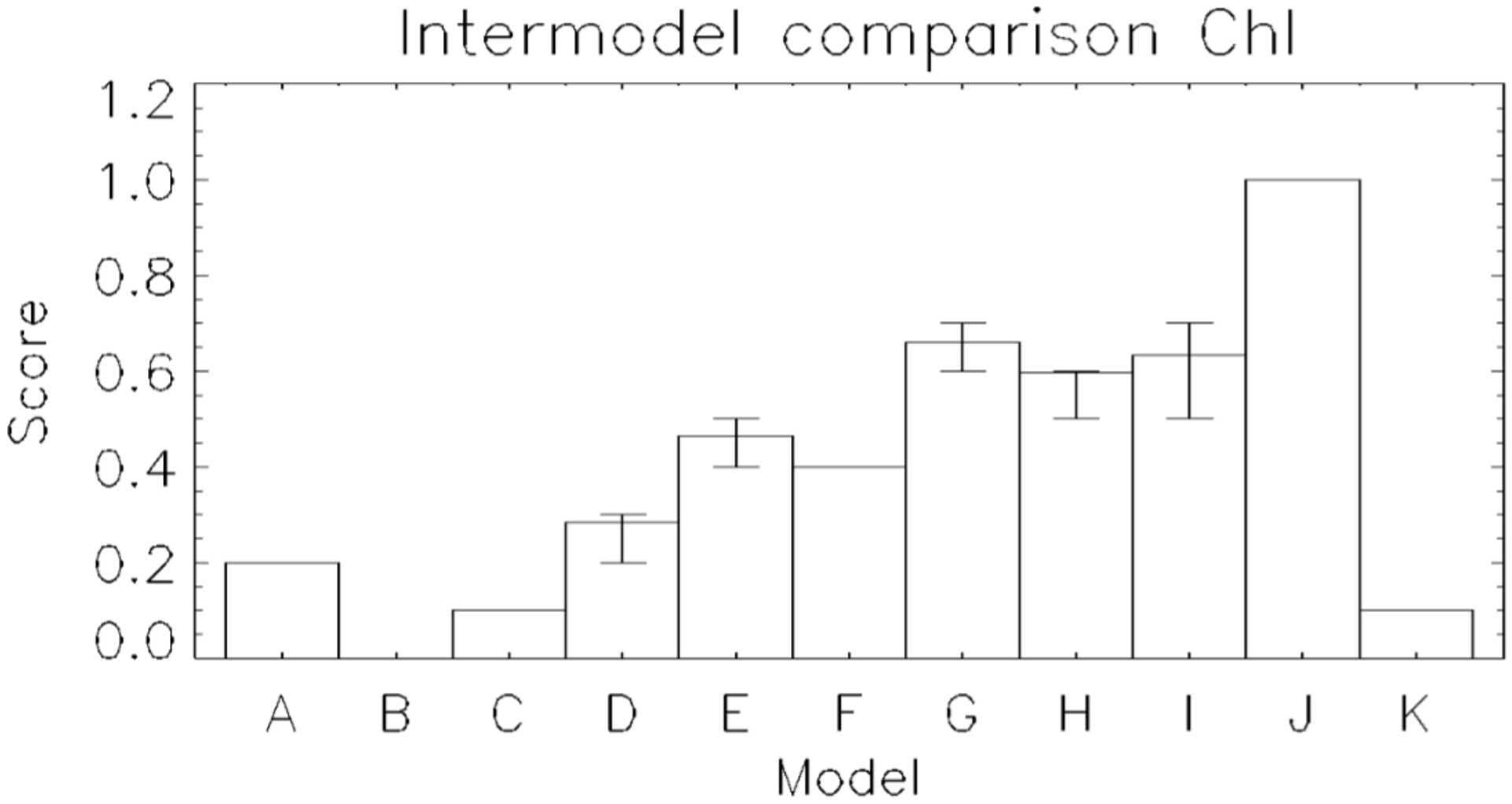
Best bias

OC-CCI In Water algorithm Round Robin

Adapted from Brewin *et al*. (2014)



V3 In Water RR results (multi-metric)

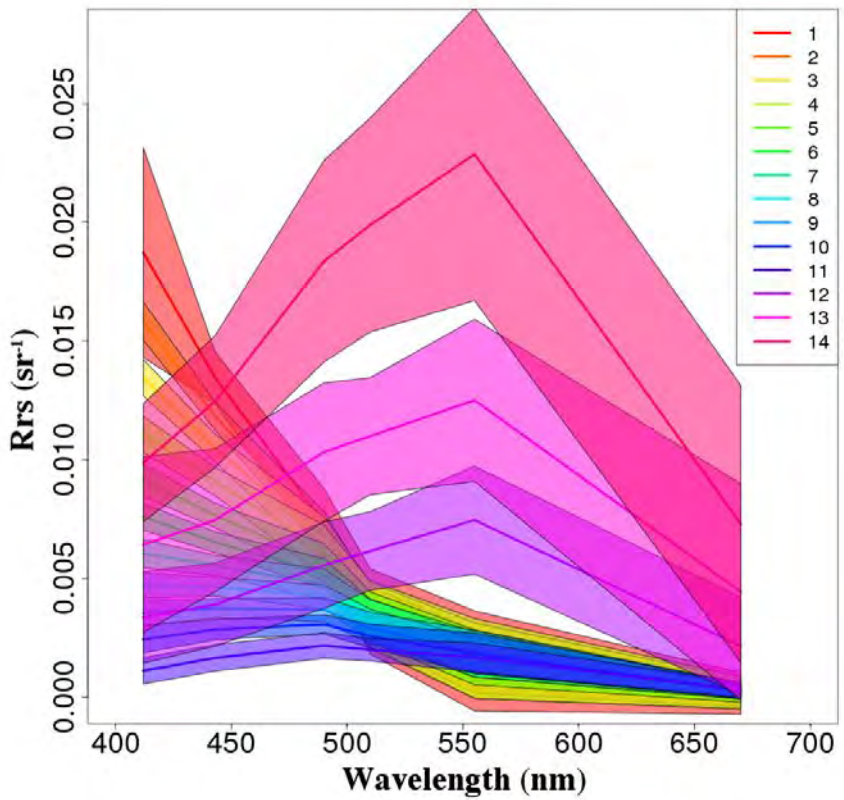


Assess performance by water class

Optical water classes as introduced by Tim Moore (2009, 2014).

Optical water classes were already used in OC-CCI for the assignment of per product uncertainty. These agree with estimates for other methods (Melin, 2016).

Where there are sufficient data, you can assess the algorithm performance in each optical water type.



OC-CCI water classes as updated within the project to better cover the global variability in R_{rs} (Jackson et al 2017).

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Assess performance by water class

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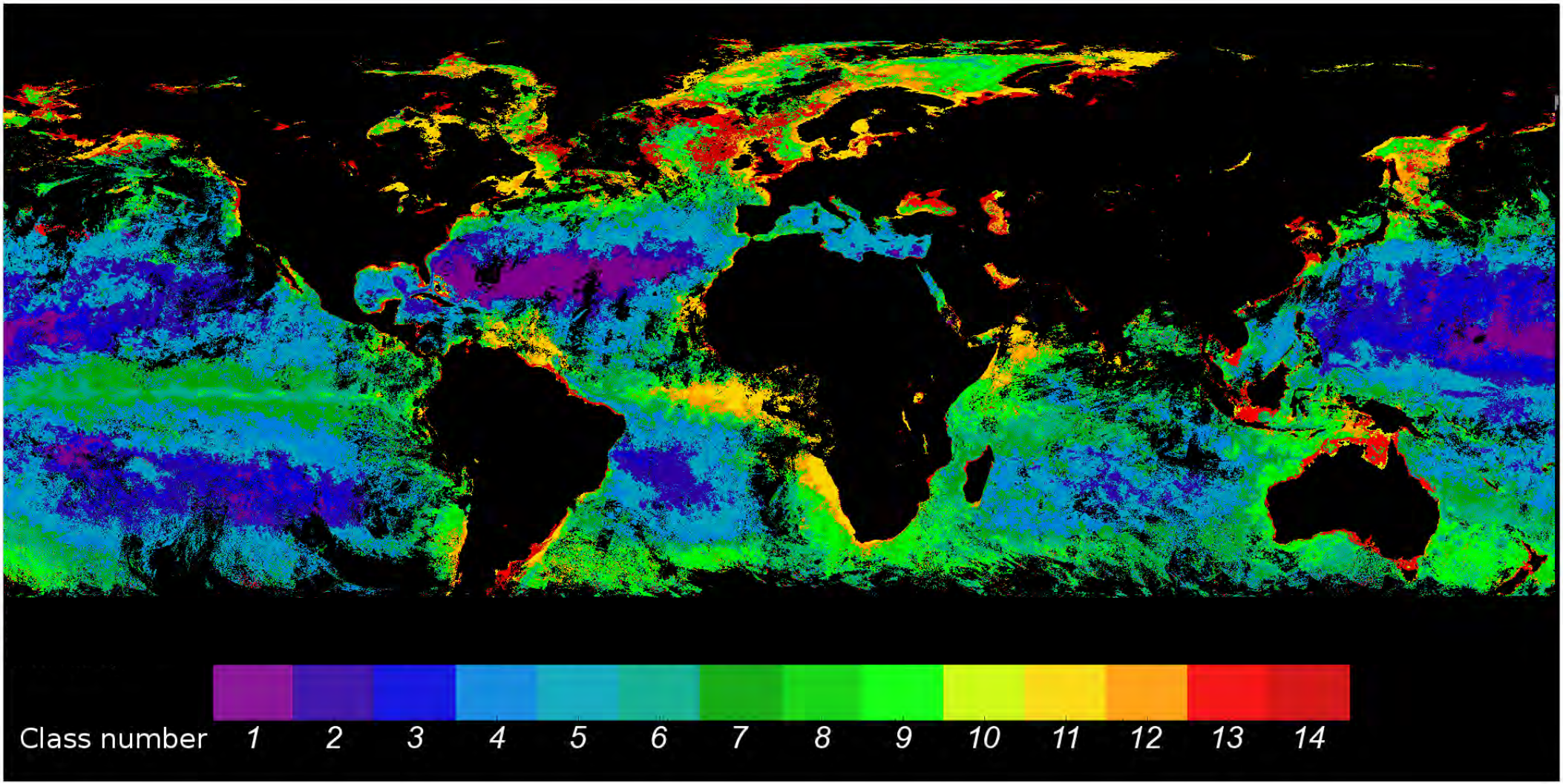
Dominant Optical Water Class, July 04-08 2004



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Assess performance by water class

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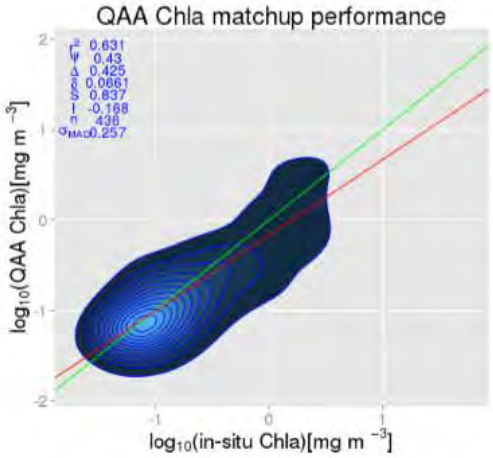
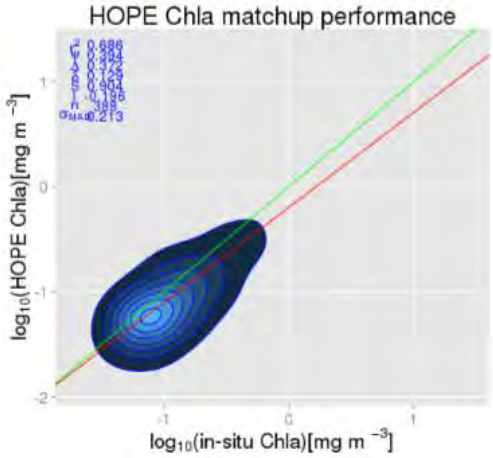
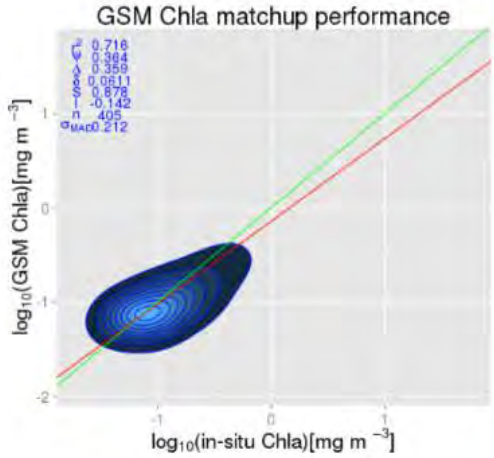
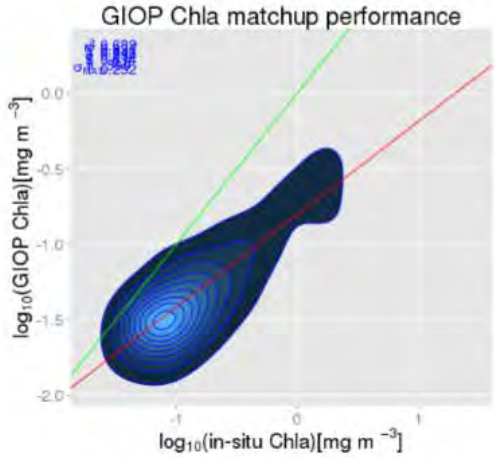
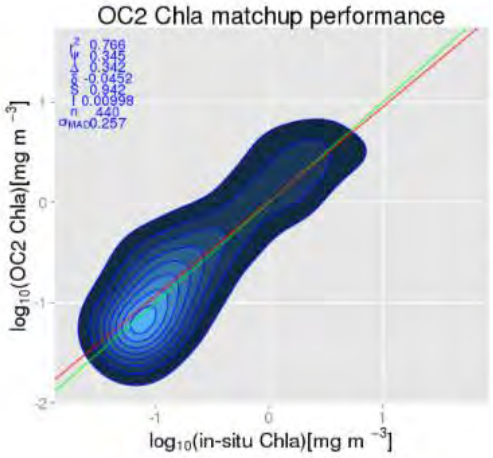
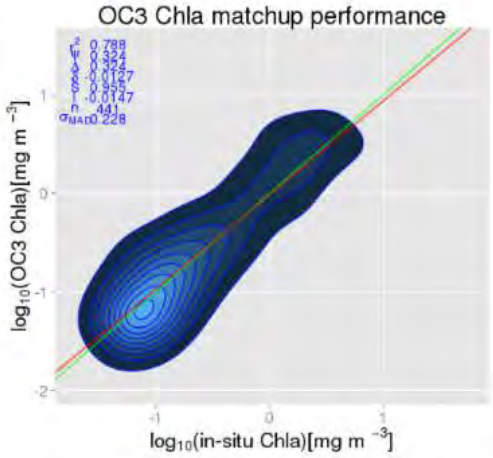


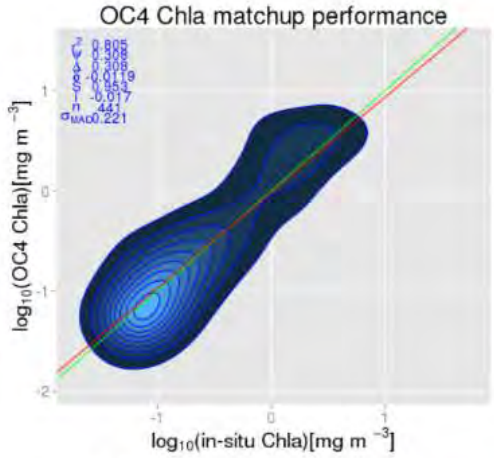


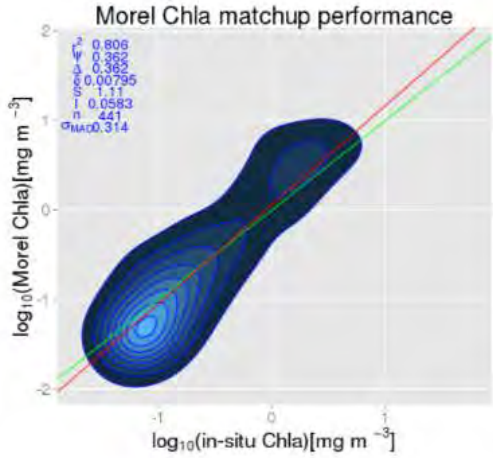


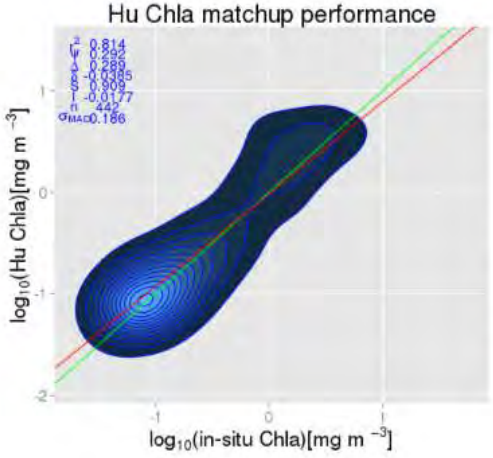


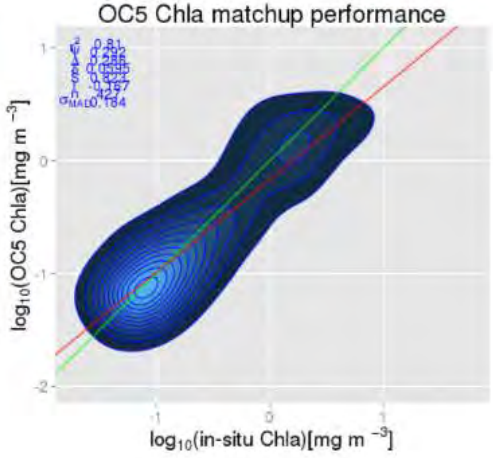


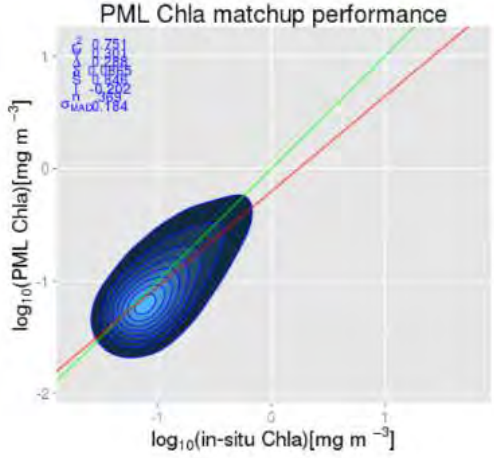












MerSensors_All_Chl_water_class_4

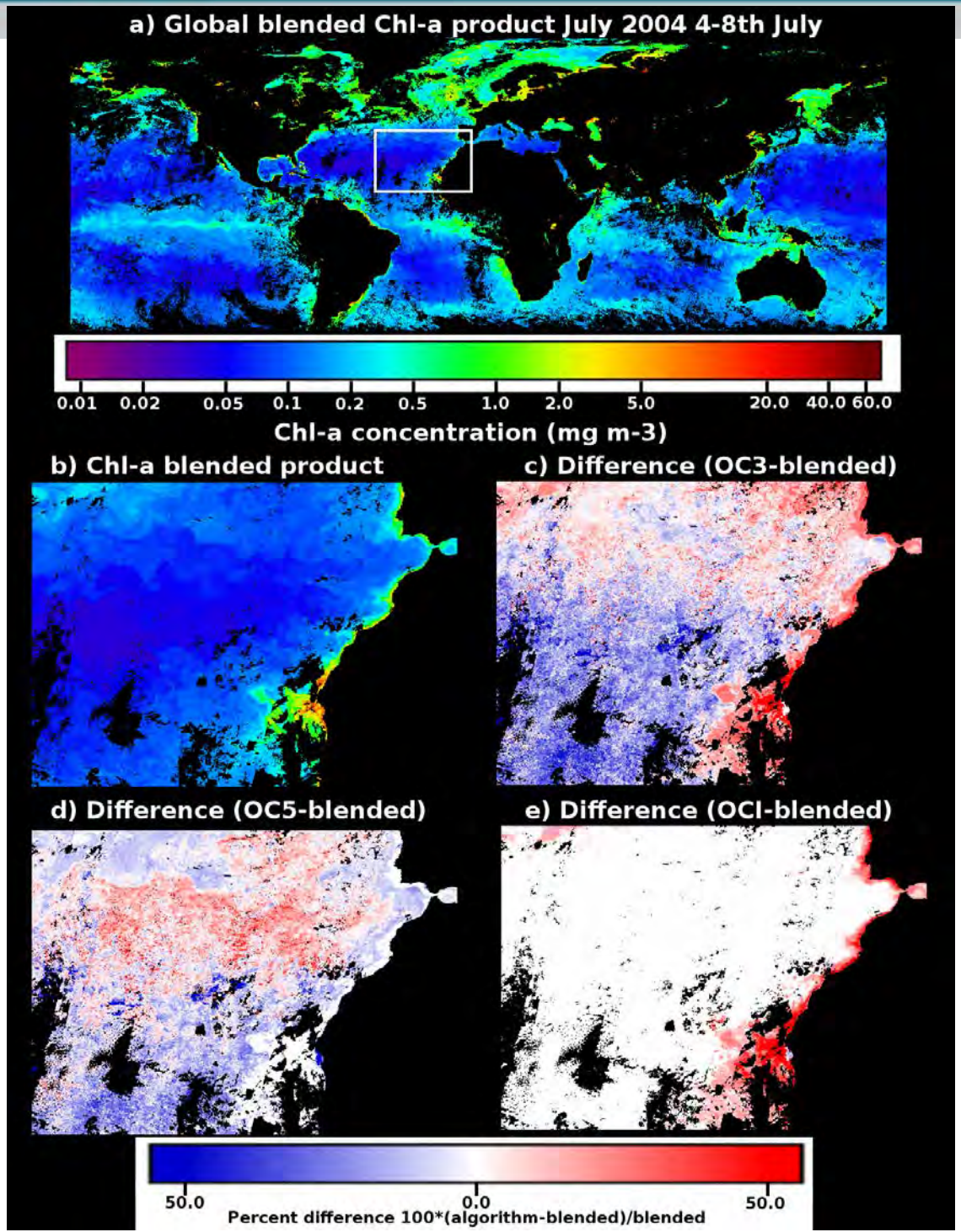
Apply algorithms by water class

Simply switching from one algorithm to another according to dominant optical class may introduce artificial boundaries in the derived products. The OCI algorithm is an example of a blended algorithm that avoids this problem.

Within the OC-CCI processing chain, water class memberships are used to weight the blending, respecting which algorithm(s) are expected to perform best given the optical characteristics of the observed water.

Relatively simple to add new optical water types and algorithms to such a comparison and processing chain with sufficient justification.

Apply algorithms by water class



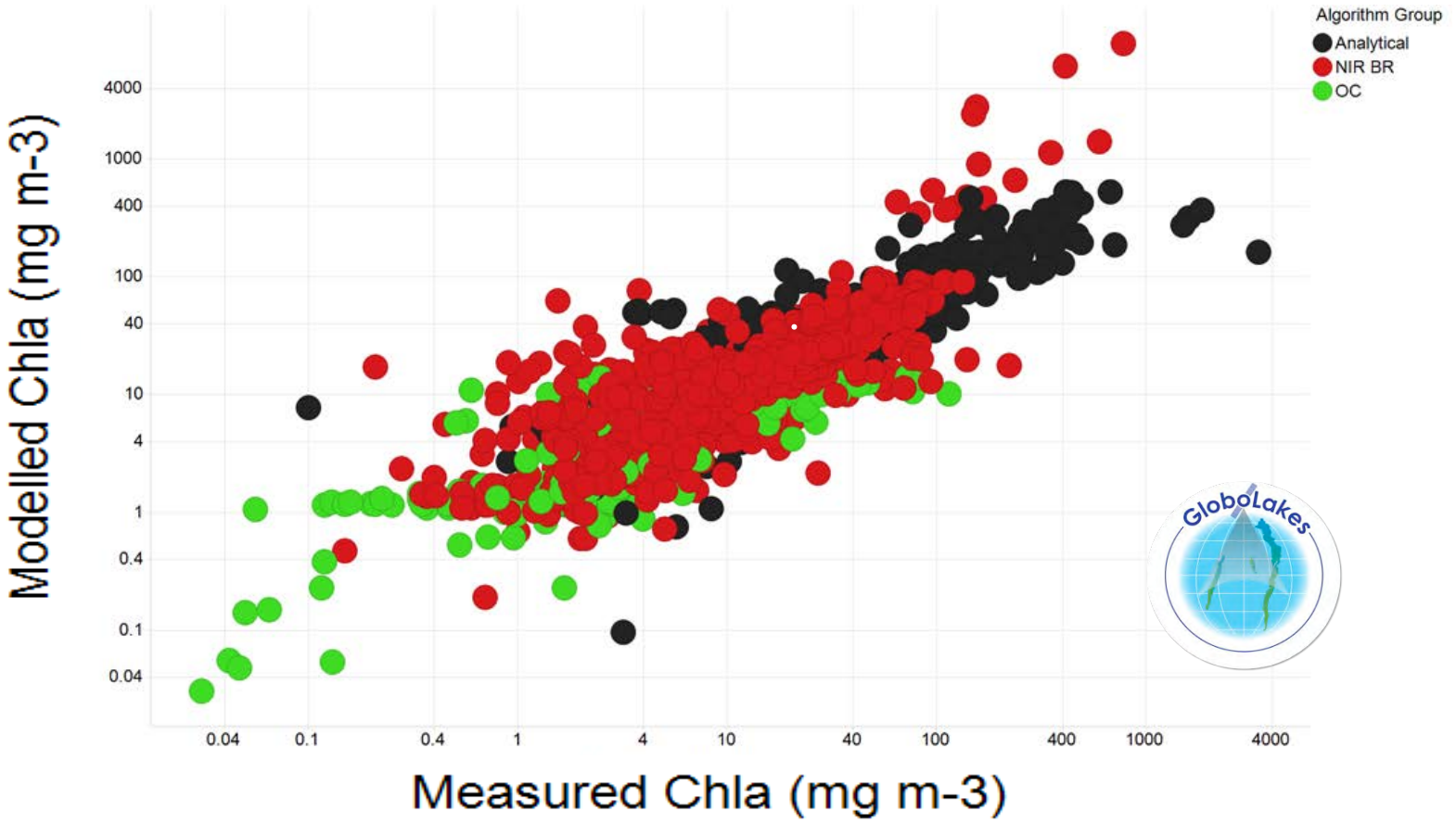
Blending by water class can include algorithms that are themselves blended algorithms (e.g OCI).

We can observe the dominance of algorithms in particular conditions without introducing artificial boundaries.

Jackson *et al*. (2017)

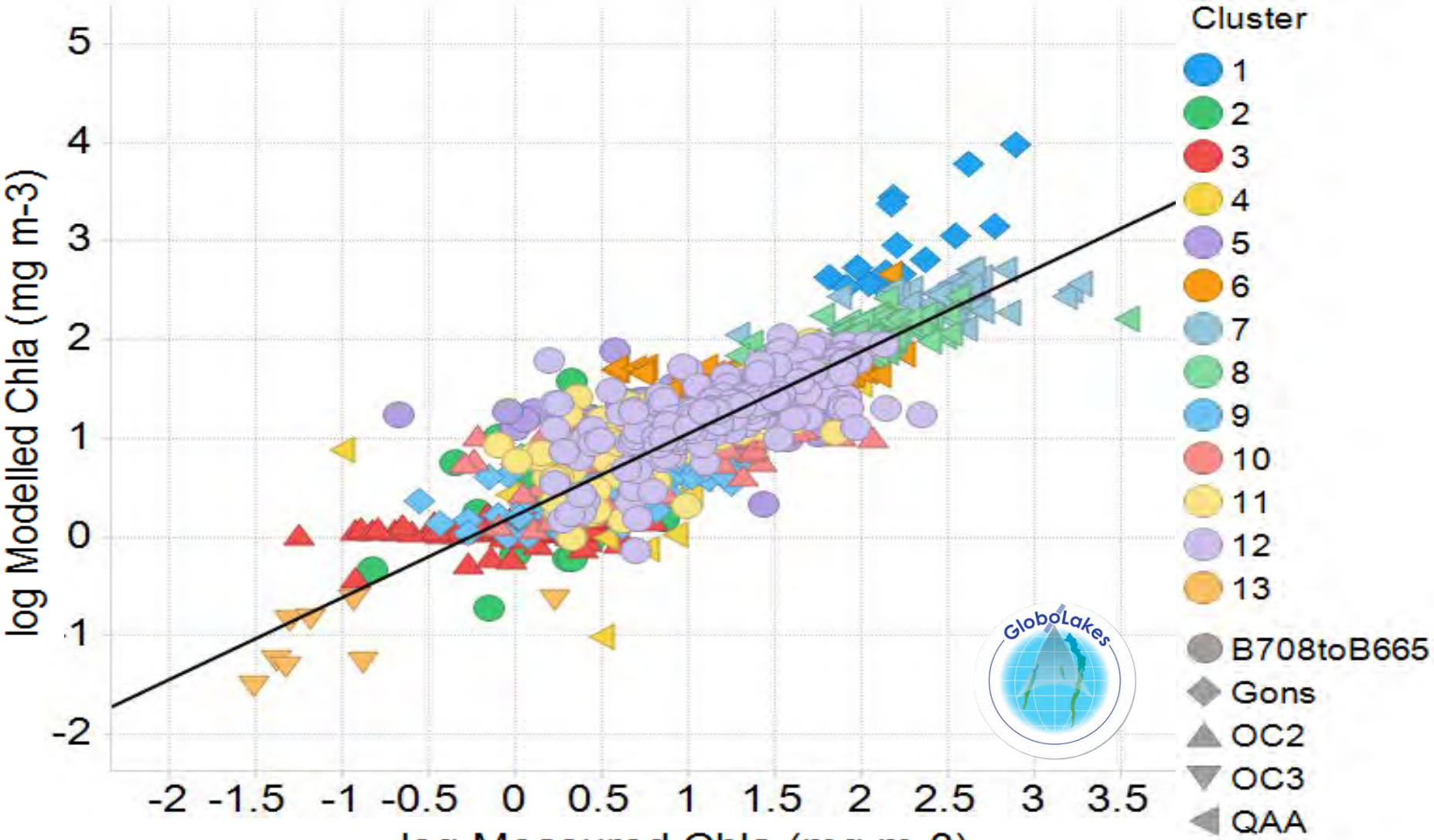
Apply algorithms by water class

Water class based algorithm assessment and blending approaches are now being trialled for new applications e.g smaller water bodies such as lakes.



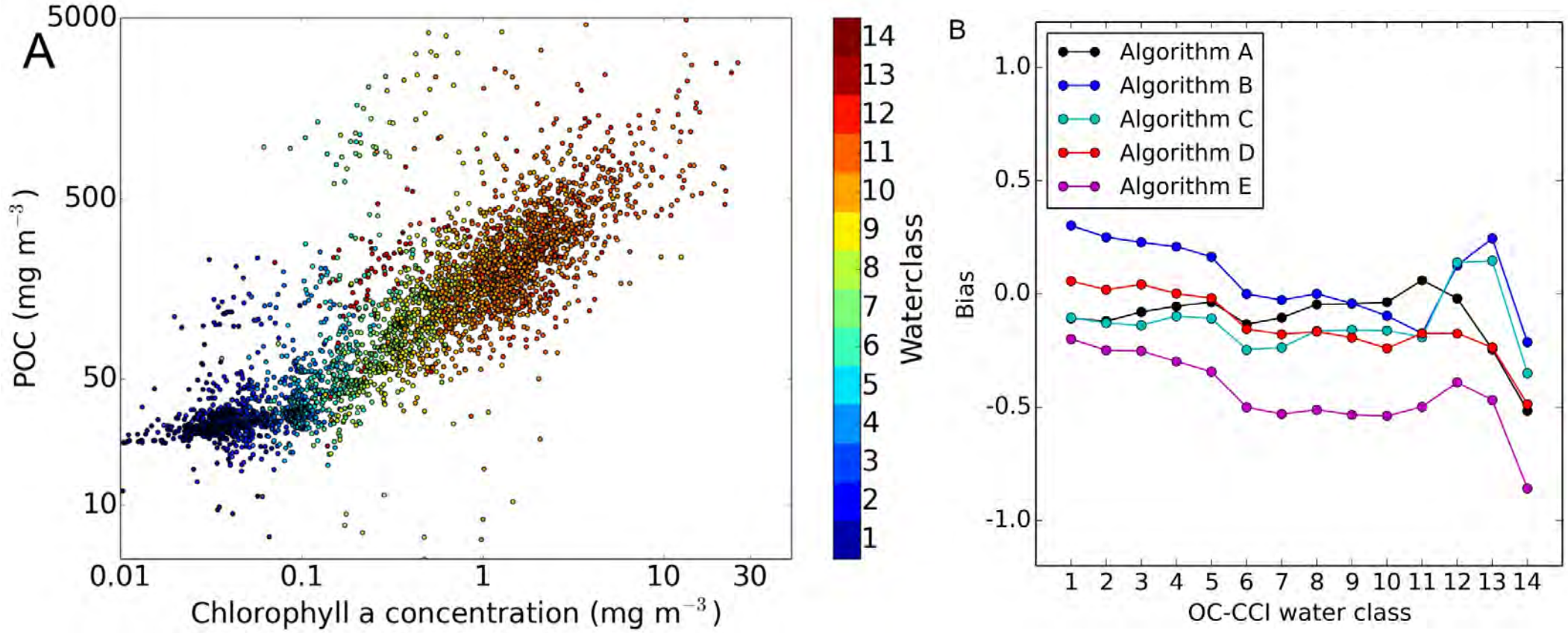
Apply algorithms by water class

Water class based algorithm assessment and blending approaches are now being trialled for new applications e.g smaller water bodies such as lakes.



Apply algorithms by water class

Water class based algorithm assessment and blending approaches are now being trialled for new applications e.g Phytoplankton Carbon algorithms (Martinez-Vicente *et al*. 2017 in review, Evers-King *et al*. 2017 in review).



Summary:

Assess algorithm performance through multi-metric approach rather than relying on a single measure of performance.

Consider what is important for the end users (number of retrievals, unbiased results, minimal error, IOPs?).

Techniques such as bootstrapping can allow insight into the robustness of results and the sensitivity to sample selection.

The multi-metric assessment is applicable (and required) for both atmospheric correction and in-water algorithms.

Questions? docs/news : http://www.esa-oceancolour-cci.org

data : https://www.oceancolour.org