Dissolved organic and inorganic carbon from space

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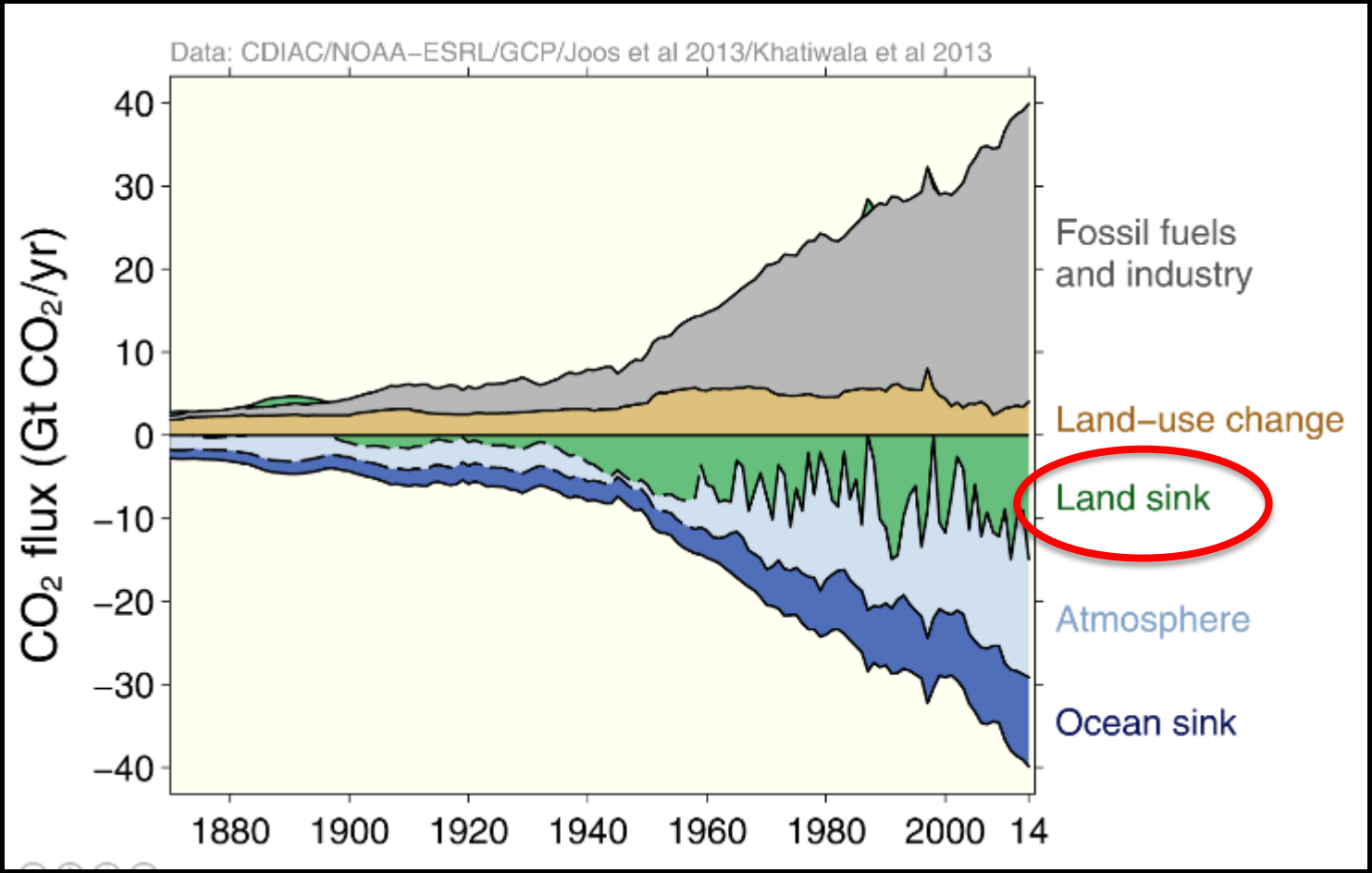
1. The importance of the oceans

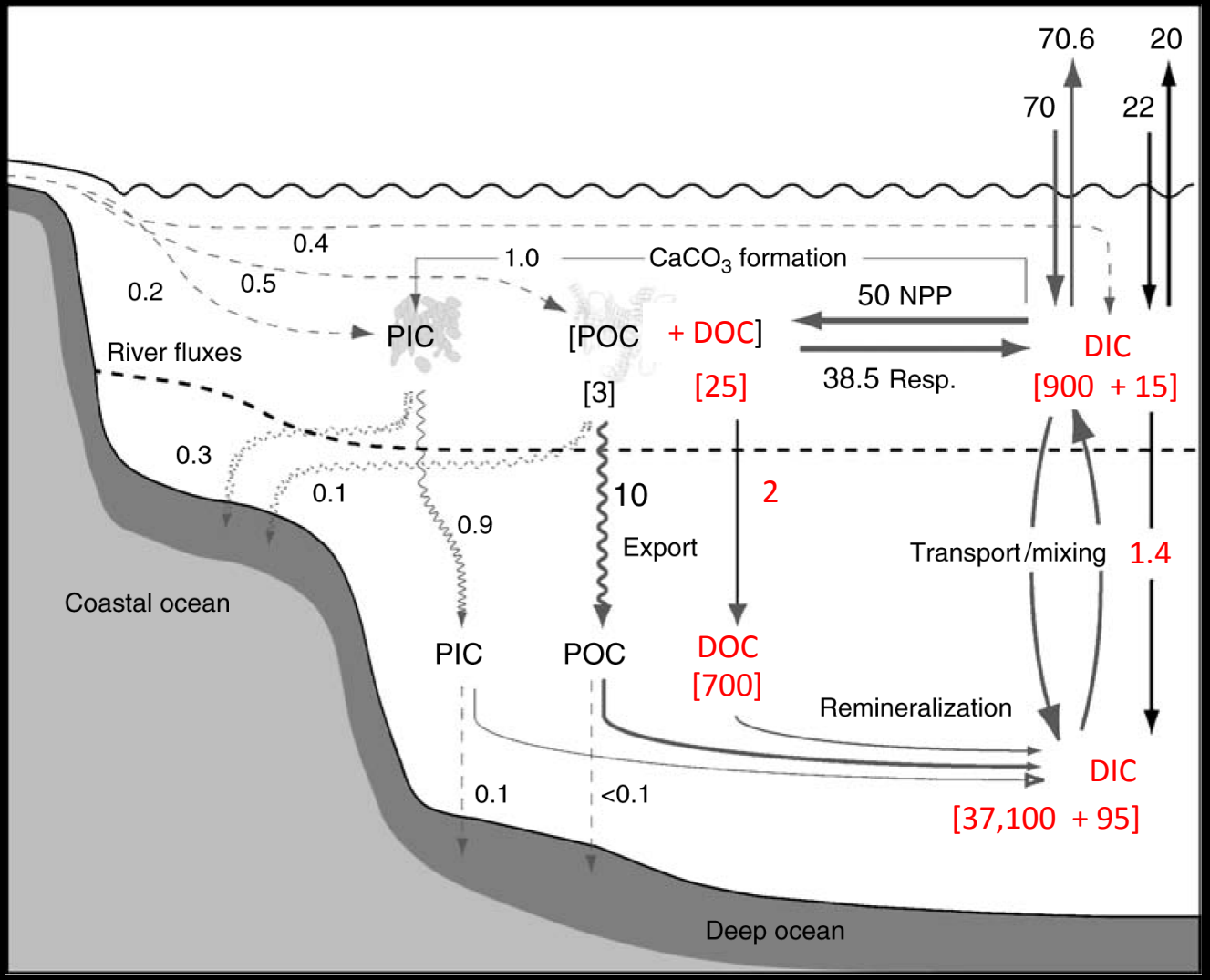
2. The importance of the oceans



Source: CDIAC; NOAA-ESRL; Houghton et al 2012; Giglio et al 2013; Joos et al 2013; Khatiwala et al 2013; Le Quéré et al 2015; Global Carbon Budget 2015

GLOBAL CARBON PROJECT

Dissolved organic and inorganic carbon (DOC, DIC)

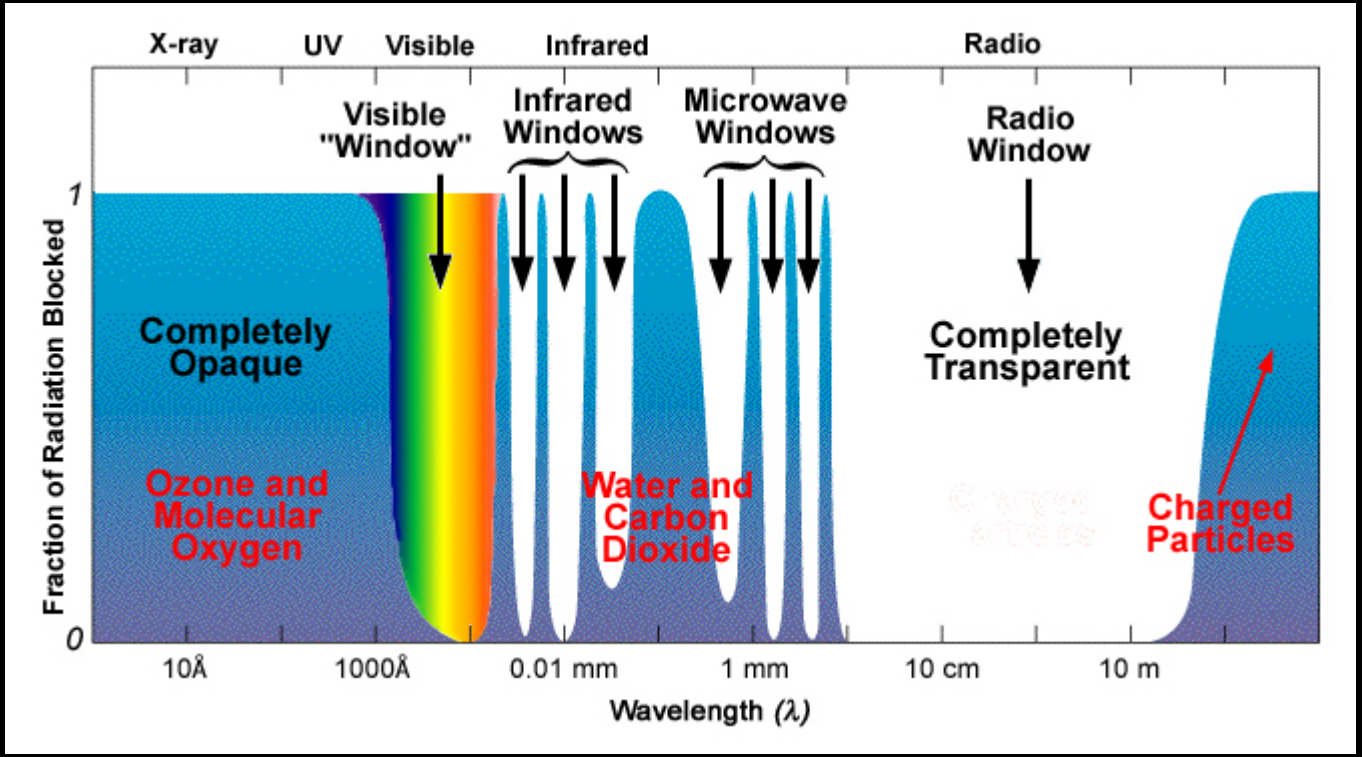


Need for carbon focused efforts – synergy approaches

CEOS recommendation – product focused (Carbon), rather than discipline focused.

Need to exploit multiple parts of the electromagnetic spectrum.

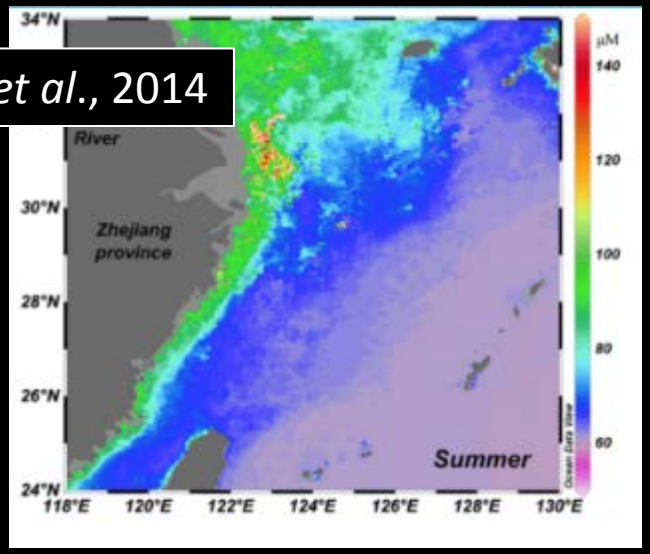
Synergy approaches



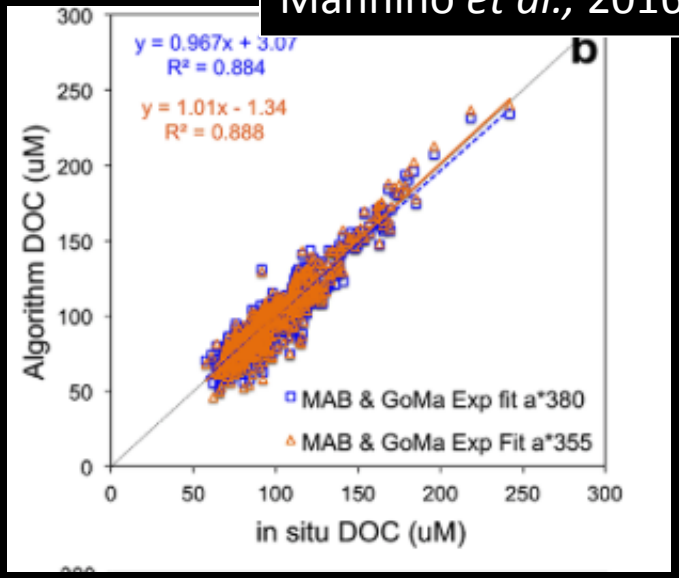
Dissolved organic carbon

DOC is made up of many components – one is CDOM.
DOC correlates with a_{CDOM} in coastal, estuarine and shelf seas.
Regional DOC approaches, exploit DOC-a_{CDOM}-salinity linkages.
Published methods use SeaWiFS and/or MODIS-Aqua

Liu et al., 2014



Mannino *et al.*, 2016

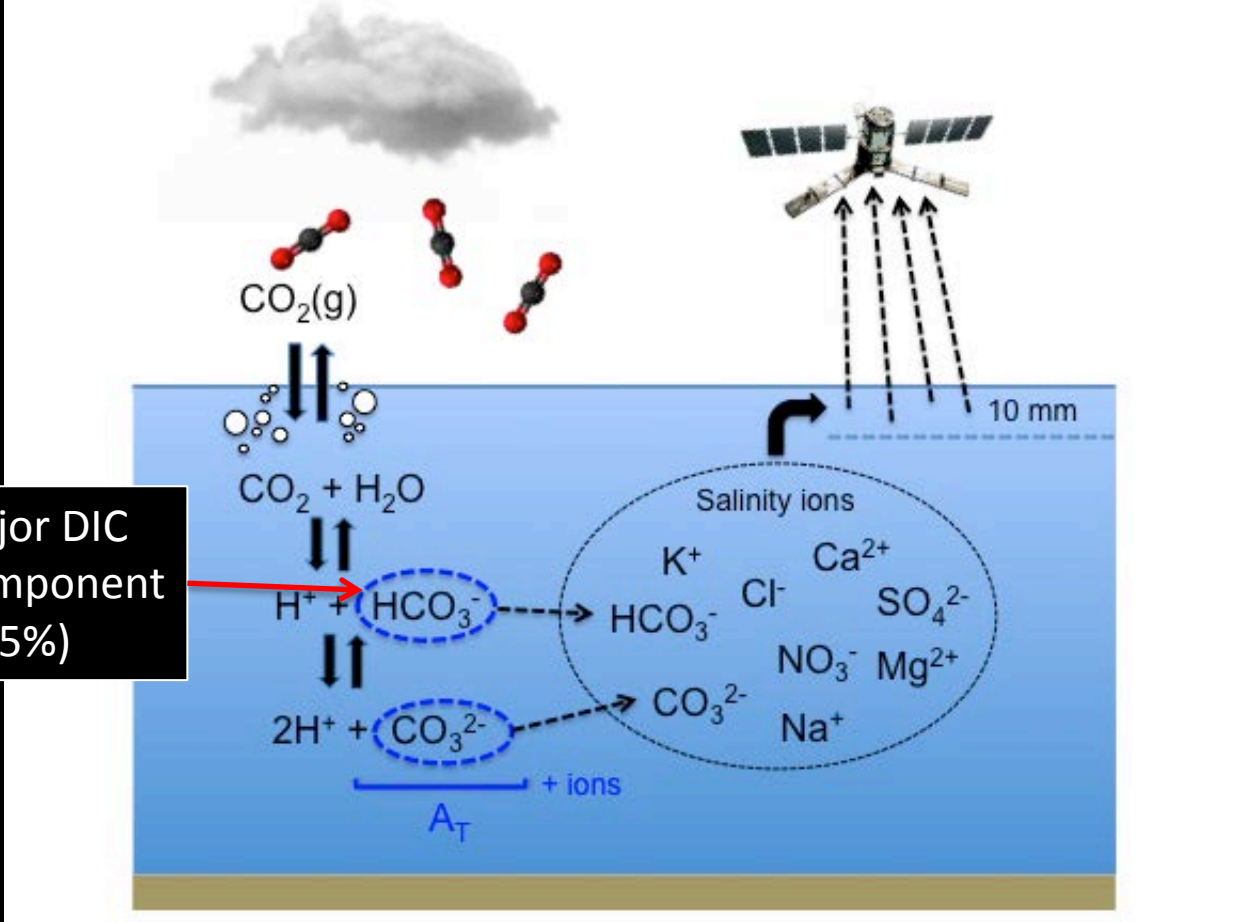


Stocks:
Del Castillo and Miller, 2008; *Mannino et al.*, 2008; *Griffin et al.*, 2011; *López et al.*, 2012; *Liu et al.*, 2014; Mannino *et al.*, 2016.

Fluxes:
Del Castillo and Miller, 2008; *López et al.*, 2012; Mannino *et al.*, 2016

Dissolved inorganic carbon

No direct optical signature
Salinity from space now allows DIC to be observed
Exploit salinity-alkalinity relationships via regional algorithms

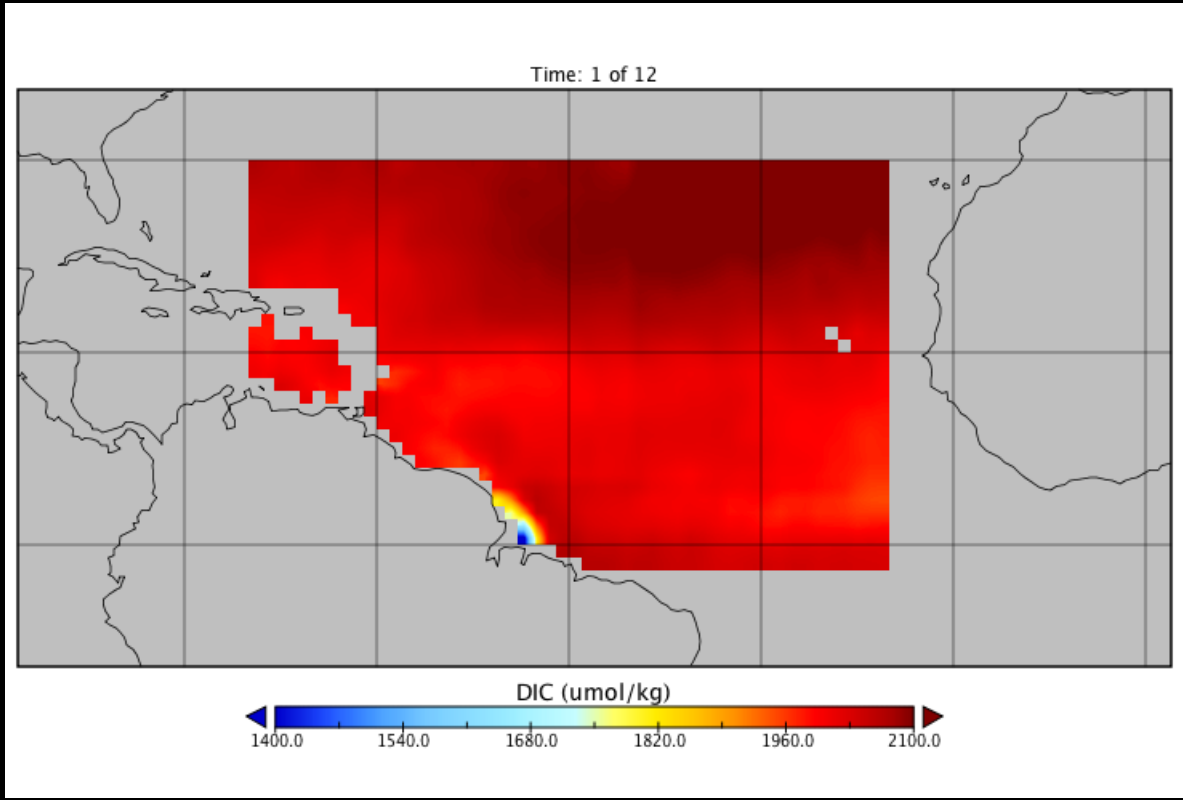


major DIC Component (~85%)

Capability identified by:
Land et al., 2015
Salisbury et al., 2015

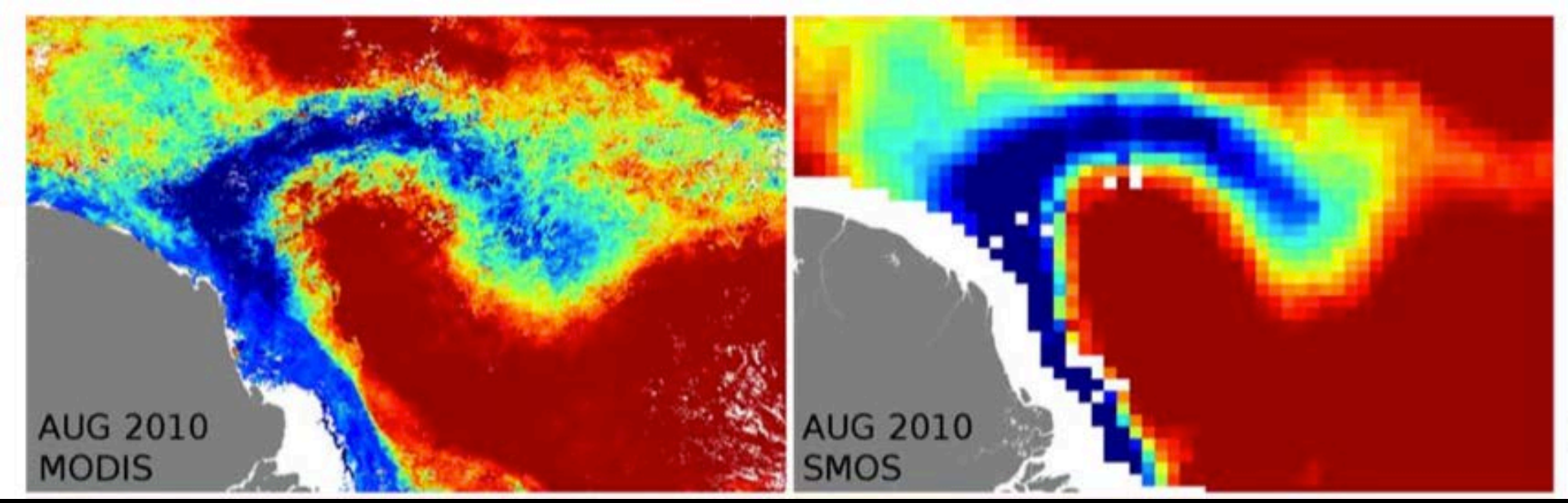
A survey in 2015 found one suitable algorithm:
Lee et al., 2000
Uses salinity and nitrate

Dissolved inorganic carbon



river dominated DIC flux and mixing as seen by Aquarius (salinity) using Lee et al., 2000

Dissolved inorganic carbon



Ocean colour – salinity – alkalinity could be exploited.

Note: Error of 1-3 PSU, results in a small (<5%) error in DIC and A_T

Suggested community effort and opportunities

Community effort:

- Continue to highlight the importance of observing ocean carbon at an international level e.g. greater participation at Carbon from Space, routine carbon assessments..
- Carbon focused products (CEOS recommendation) in units of carbon.
- Land-ocean fluxes of carbon needs to be explicitly included in annual assessments (CEOS/ESA/GCP recommendation).

Opportunities for ocean colour community to lead:

- UV methods for DOC (via CDOM)? Low Earth orbit?
- Salinity from ocean colour in coastal zone?, even if RMSE is 1-3 PSU.
- More regional DIC algorithm development and evaluation and/or retraining of existing regional algorithms using new datasets? e.g. GLODAPv2 dataset.
- Routine monitoring of land-sea DOC and DIC fluxes for large rivers? A good start would be to quantify variability for major rivers e.g. Amazon, Mississippi, Ganges.

The importance of the oceans