The Coastcolour Round Robin (CCRR) algorithm intercomparison

K. Ruddick, C. Brockmann, R. Doerffer, Z. Lee, V. Brotas, N. Fomferra, S. Groom, H. Krasemann, V Martinez-Vicente, C. Sa, R. Santer, S. Sathyendranath, K. Stelzer, S. Pinnock

MUMM/RBINS, Brockmann Consult, GKSS, MSU, U. Lisbon, PML, LISE, ESRIN

What is a Round Robin?

- Petition against authority signed in a non-hierarchical circle pattern so that none can be identified as ring leader [OED, C17th Fr *ruban*=ribbon]
- Correspondance from many to one address
- … or from one to many ("circular")
- Sport: everyone plays everyone else

Round Robin Objectives

- ESA Statement of Work:
  - Objective: "To develop, validate and demonstrate best-practice regional optimisations of MERIS Case 2 algorithms"
  - Task: "Organise open regional algorithm RR comparing results of regional algos for MERIS and other OC sensors"
  - Encourage external participants
- Exactly what do we want in CoastColour?
  - intercomparison => understanding of performance differences
  - progress to consensus algorithm?
  - ~~choose best algo for Coastcolour processor~~?
  - Help users find/assess best algo/product for their region

Coastcolour Round Robin (CCRR) – Key points

- CCRR protocol describes plan
  - PDF from www.**coastcolour**.org/**round_robin**.html
- 4 Datasets supplied as input:
  - a) Matchups
  - B) In situ reflectances
  - C) Simulated reflectances
  - D) Images
  - C and D ready and available from
    www.**coastcolour**.org/**round_robin**.html
- Participation:
  - Public
  - In situ data policy
- Algorithm Providers to deliver results for Apr 2010
- Mainly L2W (e.g. CHLa) algos, but L1 processing also possible

Algorithm Intercomparison - generic

Subsampling: time, space, radiometric, spectral

Correction for atmospheric effects

Inversion of Rrs spectra for water products

Nature
↓
SENSOR
↓
L1: Ltoa
↓
ATCOR
↓
L2R: Rrs
↓
WATER
↓
L2W
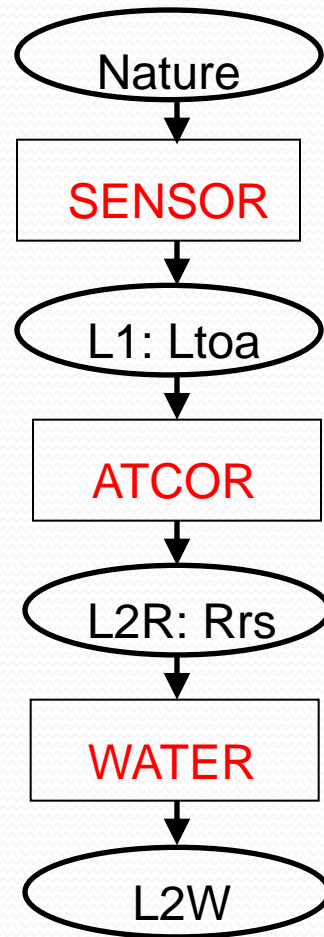
- Possible objectives:
  - Determine "optimal" SENSOR, ATCOR or WATER algorithm
  - Understand algorithm performance differences
  - Help users find the best (MERIS) algorithm/product for their region

Coastcolour products (case 2 water algorithms)

Surface reflectances
RLw   Directional water leaving radiance reflectance
RLwn   Fully normalized water leaving radiance reflectance

Inherent optical properties
a_total   Total absorption coefficient of all water constituents
b_total   Total scattering or backscattering coefficient
A_pig   Phytoplankton pigment absorption coefficient
A_ys   Yellow substance absorption coefficient
A_poc   Absorption by particulate organic matter

Water constituent concentrations
Chl.   Chlorophyll a concentration
TSM   Total suspended matter

Water transparency/turbidity information
kd   Spectral downwelling irradiance attenuation coefficient
Z90_max   Maximal signal depth
Z_eu   Depth of euphotic layer
Z_SD   Secchi disc depth
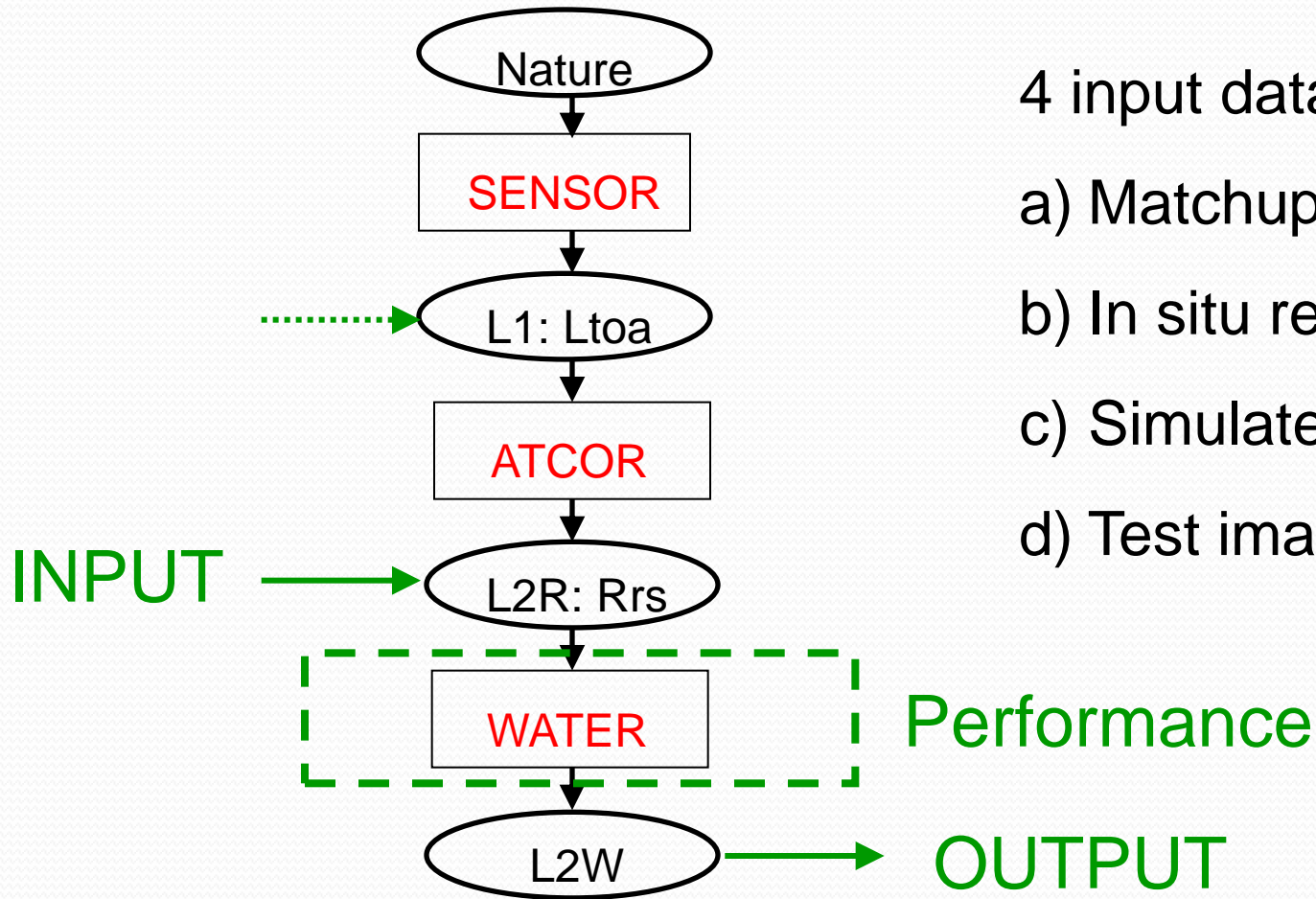TFU   Turbidity in Formazine Units

Chlorophyll Indices
FLH   Fluorescence line height
MCI   Maximum chlorophyll index

Available at:

- 300m

- Near real-time

- Historical

Algorithm Intercomparison - Coastcolour

```
        ┌──────────┐
        │  Nature  │
        └────┬─────┘
             ▼
        ┌──────────┐
        │  SENSOR  │
        └────┬─────┘
             ▼
   ·······►┌──────────┐
           │ L1: Ltoa │
           └────┬─────┘
                ▼
        ┌──────────┐
        │  ATCOR   │
        └────┬─────┘
             ▼
INPUT ──►┌──────────┐
         │ L2R: Rrs │
         └────┬─────┘
              ▼
        ┌──────────┐
        │  WATER   │
        └────┬─────┘
             ▼
        ┌──────────┐
        │   L2W    │──► OUTPUT
        └──────────┘
```

4 input datasets:

a) Matchups

b) In situ reflectance

c) Simulated

d) Test images

Performance

Dataset c) Simulated

- Input: HYDROLIGHT L2R (reflectance), 5000 spectra
- Output: L2W (CHL, IOPs, etc.) vs HYDROLIGHT input
- Compares: WATER algo *(+ spectral band choice)*

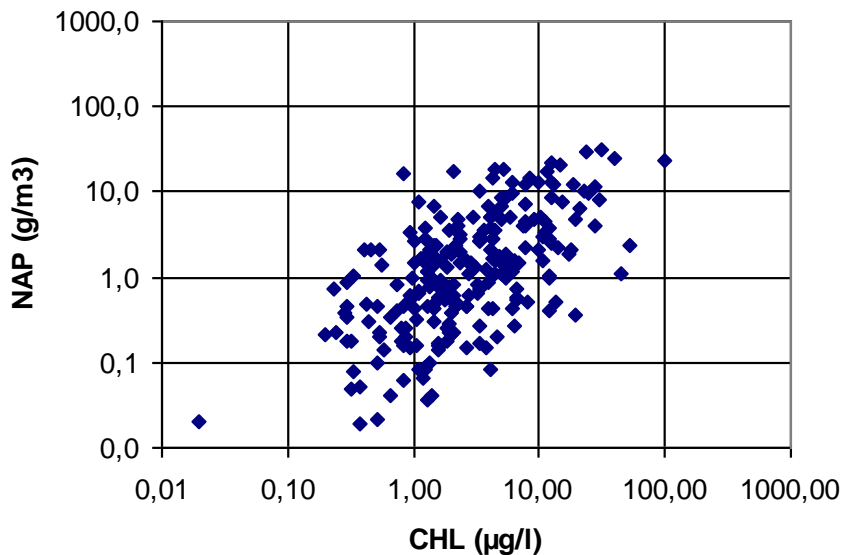HYDRO LIGHT → **L2Refl.** Spectra → **Algos** → **L2Water** Chl TSM a, etc.
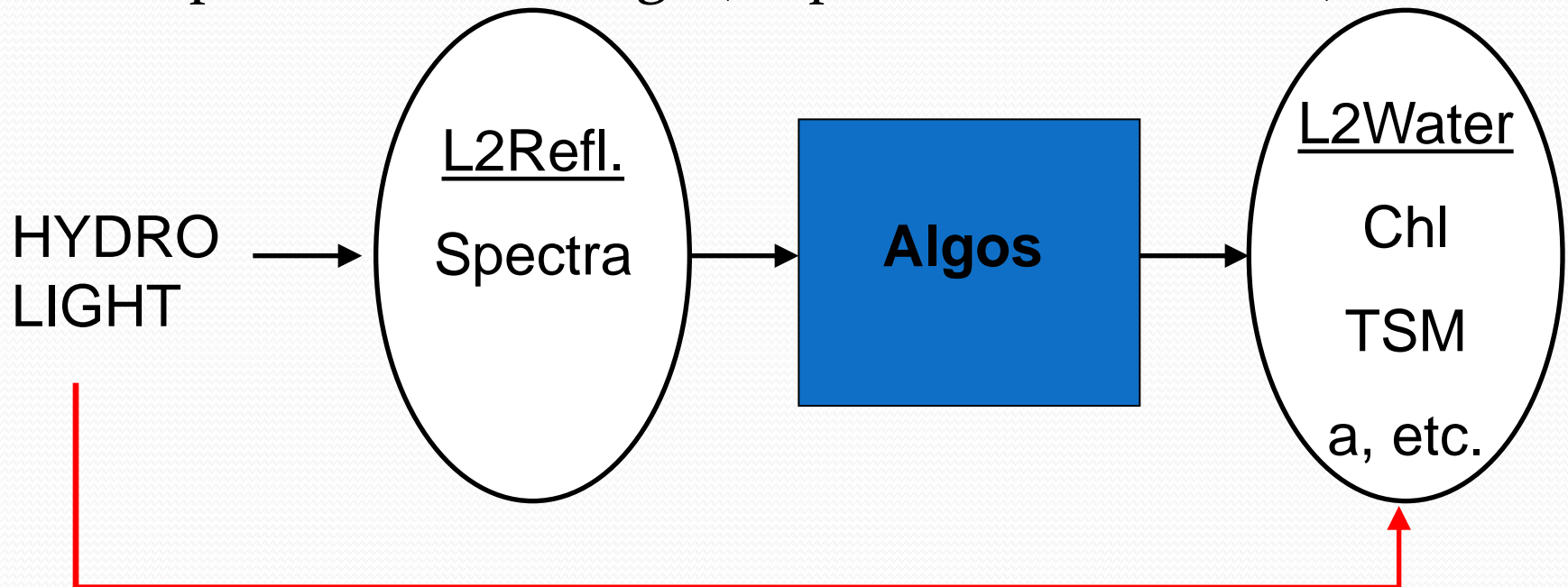
- All HYDROLIGHT files are provided
- 5nm output spectrally convolved for MERIS *and others*

8/19

Dataset c) Simulated (5000 spectra)
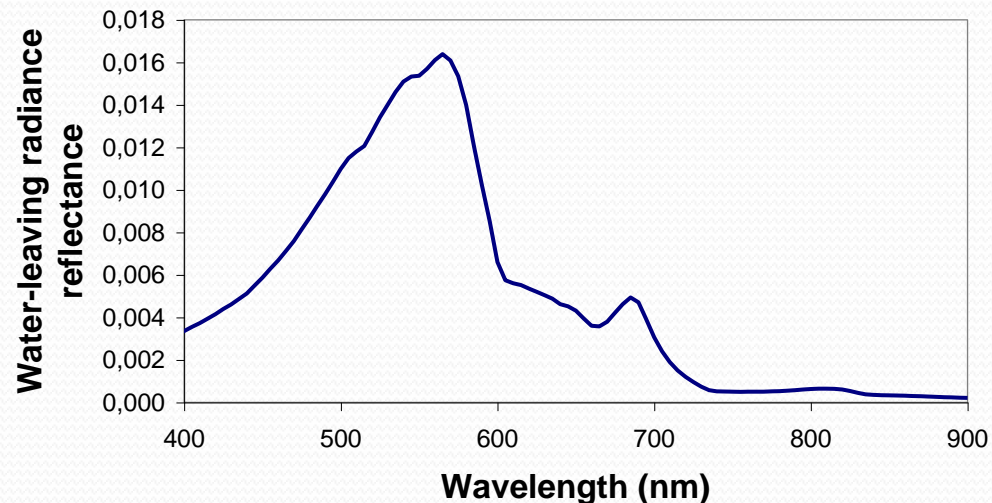
- Water-leaving radiance reflectance spectra available as:
  - MERIS bands
  - SeaWiFS and MODIS-AQUA bands
 - Hyperspectral (350-900nm)

Dataset d) Images

- Input: MERIS-FR/CC L1P+L2R and MEGS L1B+L2R
  - One image per test site (clouds, turbid water, sunglint, …)
- Output: L2W (CHL, IOPs, etc.) images
- Compares: WATER algo (+ ATCOR if L1)

Coastcolour Processor → **L2Refl.** MERIS images → **Algos** → **L2Water** Chl TSM a, etc.
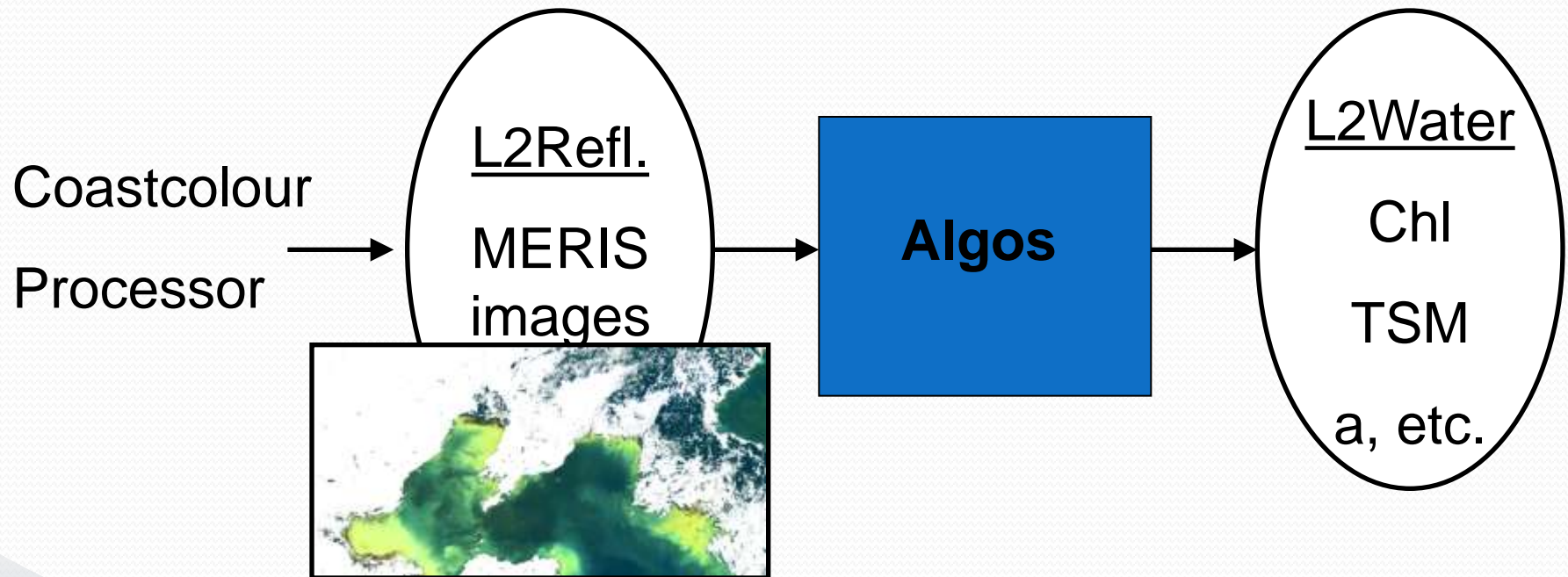
- Qualitative analysis, no reference output

Dataset a) Matchups

- Input: MERIS-FR/CC L2 and L1P and MEGS L1B and L2 (5*5)
- Output: L2W (CHL, IOPs, etc.) vs in situ (within 1 hour)
- Compares: WATER algo (+ ATCOR if L1P)

Coastcolour Processor → **L2Refl.** MERIS pixels → **Algos** → **L2Water** Chl TSM a, etc.
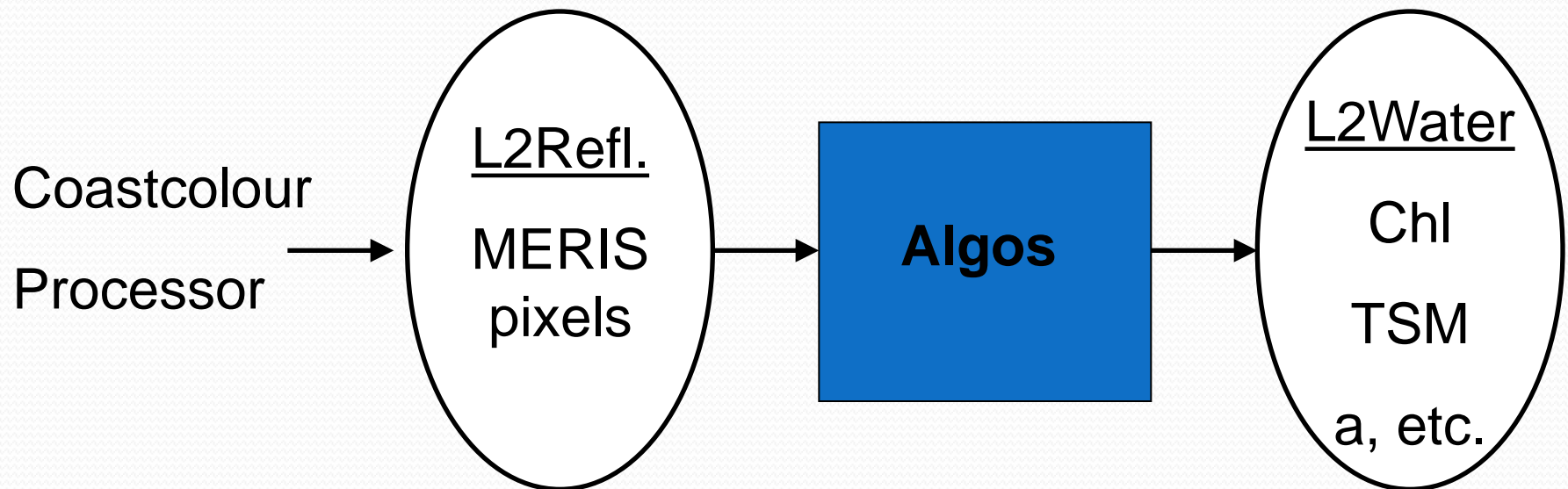
↑ In situ ref

- Notes:
  - In situ not distributed until results submitted

Dataset a) Matchups

- Available data (16 Nov 2010)
- All data since 2005
  - (busy identifying matchups)

In-situ data
for MATCH-ups

	Nr	Nr Sites
a_total	103	3
b_total	125	3
A_pig	385	2
A_ys	537	3
A_poc	628	2
Chl	1270	7
TSM	282	4
kd	133	1
z90-max	133	1
z-eu	tdb	tdb
z-SD	0	0
TFU	0	0

(8 sites completed)

Dataset b) In situ reflectance

- Input: In situ L2R (reflectance, Ed), 412-709nm, poss cloudy
- Output: L2W (CHL, IOPs, etc.) vs in situ
- Compares: WATER algo

In situ measurement → **L2Refl.** In situ spectrum → **Algos** → **L2Water** Chl TSM a, etc.
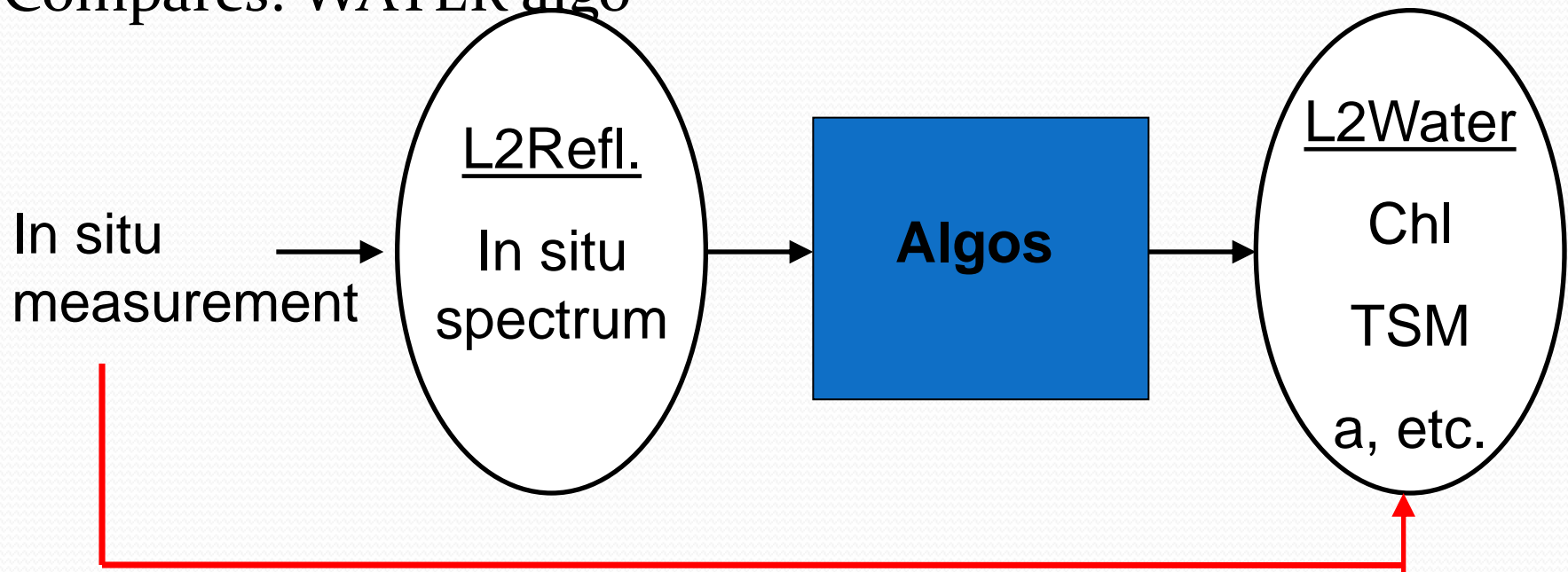
- In situ L2W not distributed until results submitted

Dataset b) In situ reflectances

- Data available (16 Nov 2010)
  - <u>With</u> 709nm band

| REFLECTANCE DATASET	Nr	Nr Sites
Rrs	327	5
CHL	294	4
TSM	173	3
a_tot	49	2

14/19

Round Robin protocol: « The Rules »

- Participation
  - Data Providers
  - Algorithm Providers
    - signature of in situ data policy
    - provision of complete reproducible algo info (or BEAM plugin)
    - recommended first submission Jan 2011
    - final submission Apr 2011 with report
- Round Robin Data Package (Nov 2010) by FTP
  - 4 input datasets (in situ is password-protected)
  - Product User Guide
  - RR Protocol
  - Accessible from www.**coastcolour**.org/**round_robin**.html
- Registration as Algorithm Provider
  - Form at www.**coastcolour**.org/**round_robin**.html
  - Necessary for in situ data, results upload, information

Harmonised Analysis

- a) Matchups: scatterplots, RMA regression stats
- b) In situ: idem
- c) Simulated: idem
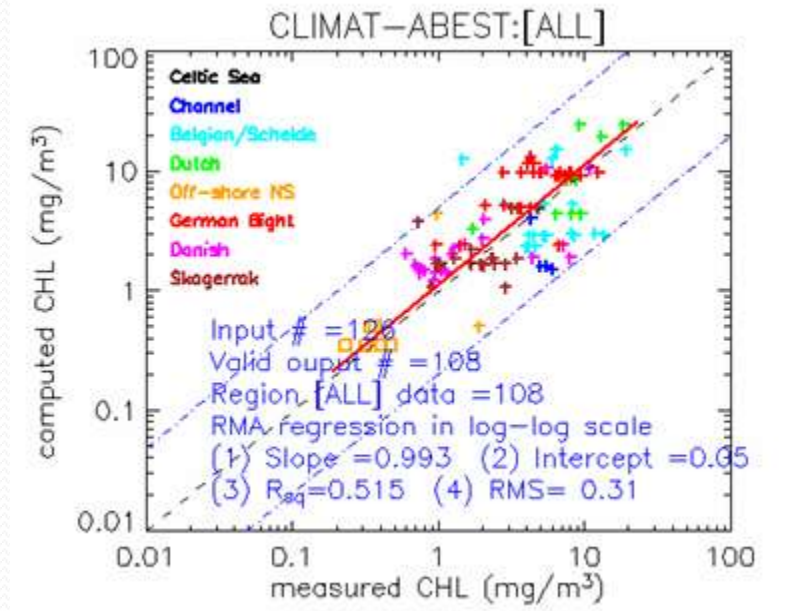
[Y.Park, REVAMP project]

- d) Images: graphical image (PNG) on common colour scale, histogram plots, scatterplot vs CC
- Common assessment (MUMM) + individual algo reports

Schedule

- Oct 2010: Distribution of CCRR Protocol
- Nov 2010: Distribution of CCRR Data Package
  - [Datasets c and d ready today, a and b in prep/QC]
- Nov-Dec 2010: Publicity and support for APs
- Jan 2011: Recommended preliminary submission by APs
- Apr 2011: <u>Final submission</u> of results and algos by APs
  - Afterwards possible to withdraw but not modify algorithm
- Jul 2011: Dist of draft report to stakeholders by MUMM
- Dec 2011: Final report (publish as IOCCG? Journal?)

www.coastcolour.org/round_robin.html

FTP server with data

Protocol Document

Registration Form

Index von /

Name	Größe	Änderungsdatum
CCRR-Dataset1-matchups-NOTREADYYET/		10.11.10 15:52:00
CCRR-Dataset2-insitureflectance-NOTREADYYET/		10.11.10 15:53:00
CCRR-Dataset3-simulated/		28.10.10 11:36:00
CCRR-Dataset4-images/		03.11.10 13:03:00
Coastcolour-PUG-v1.1.pdf	874 kB	16.11.10 07:36:00

How to Participate?

- Read about activity in CCRR Protocol
  - PDF from www.**coastcolour**.org/**round_robin**.html
- Fill in registration form to keep informed (and sign up for in situ data policy)
- Download datasets and documentation from
  - ftp.coastcolour.org or www.**coastcolour**.org/**round_robin**.html
- For more info:
  - Round Robin manager: K.Ruddick@mumm.ac.be
  - Or (general): carsten.brockmann@brockmann-consult.de