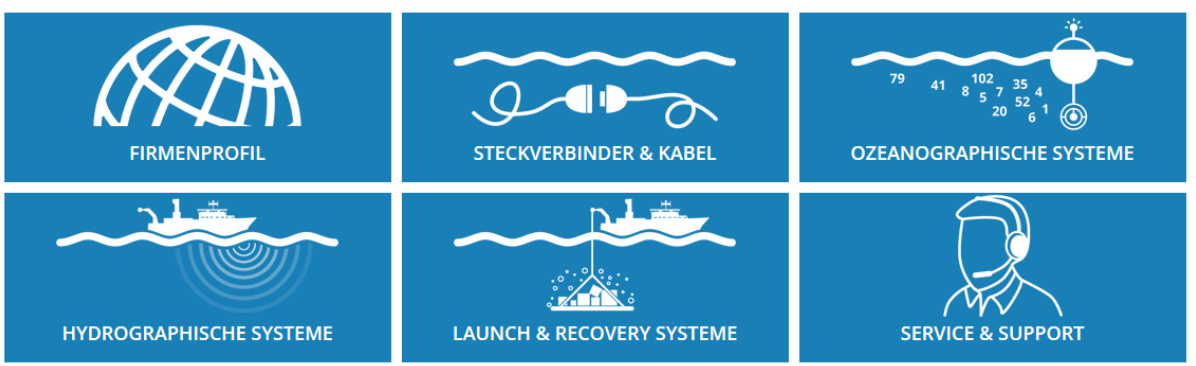
NuLAB wet chemistry nutrient analyser

Verena Dauben[1], Kristine Carstens[2], Alexander Davidov[1], Oliver Zenk[1] & Vincent Kelly[3]

[1] MBT GmbH, Kiel [2] Biological Institute Helgoland [3] Green Eyes Environmental LLC, MD, USA

MBT - Meerestechnisches Büro Turla GmbH, Kiel

www.m-b-t.com



Key facts:

- located in Kiel
- part of the MacArtney Group – with over 400 employees and offices or partner on all continents

  MBT – currently 19 employees with offices in Kiel and Bremen
- 5 oceanographers, 5 engineers, 1 software engineer, 4 electrical and mechanical technicians

What we do:

- Sales and engineering solutions in marine technology including
  - Underwater cables and connectors
  - Scientific winches
  - Oceanographic and hydrographic sensors and systems
- Providing complete customized solutions – design, manufacturing, installation, training and service
- Service, maintenance & calibration of oceanographic & hydrographic sensors

Co-operation with Green Eyes Environmental LLC:

- Since 2001 co-operation, service and support for former EnviroTech and later Green Eyes nutrient analysers
- Since 2016 sales representation of Green Eyes products in Europe
- 2017 – setting up of facilities at MBT GmbH to test and service Green Eyes nutrient analysers and prepare reagents
- Nutrient analyser training, installations and workshops

Green Eyes Environmental LLC:

- Based in Easton, Maryland, United States
- Founded in 2006 by Vincent Kelly, Chemical Oceanographer
- 2014 – taking over former EnviroTech EcoLAB and AutoLAB product lines for continuous *in situ* nutrient monitoring
- Further development into state of the art analysers

What NuLAB stands for:

Wet Chemical Analysers for Nitrate, Phosphate, Ammonia and Silicate

What NuLAB does:

- Application of established wet chemical methods to a field chemical analyser
- Precise volumes of sample
- On-Board-Standards (OBS)
- Reagents connected to a rotary valve and mixed by a syringe pump
- Analysed in high precision colorimeters.

Two NuLAB versions for various applications (third submersible in development)

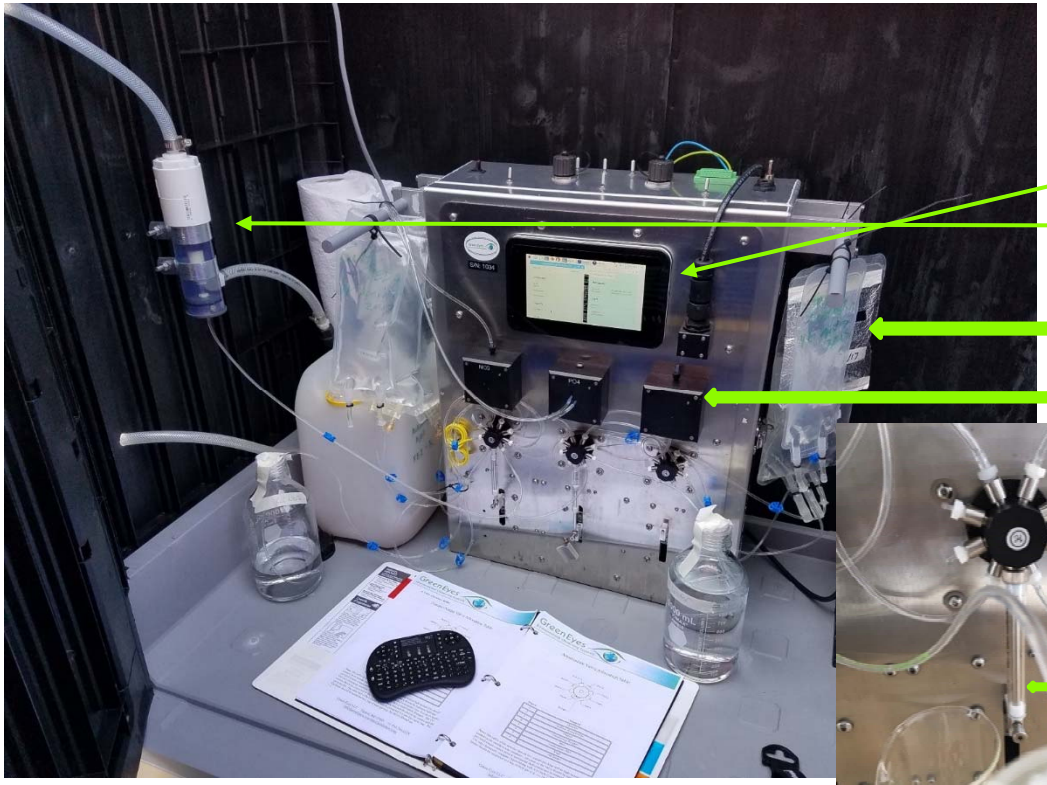
Basic NuLAB

- smaller size (1-2 channels)

NuLAB Plus

- Included touch screen controller, relays for pump and water2web data posting
- Up to 3 channels

NuLAB Plus Set-up



Controller

Inlet with filter

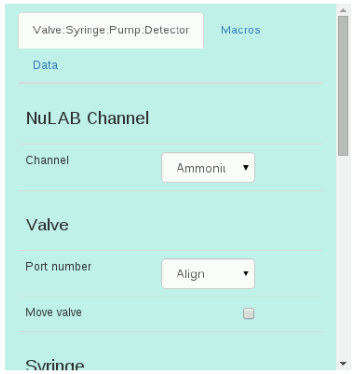
Reagent bags (gas tight)

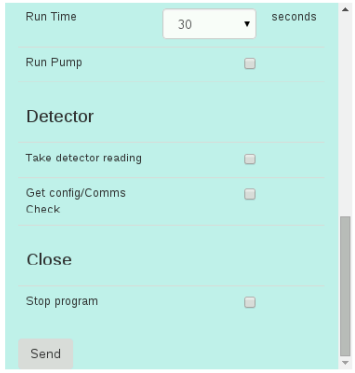
Detector

8-port rotary valve

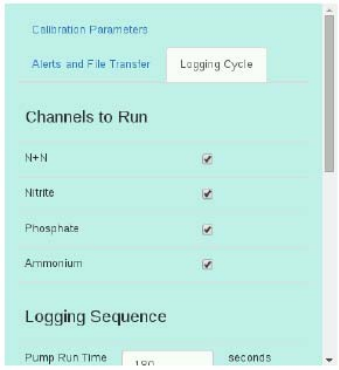
Syringe

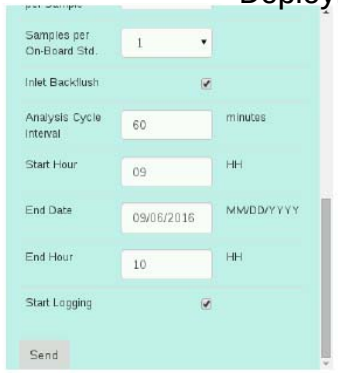
Manual Mode





Logging Mode





NuLAB Software

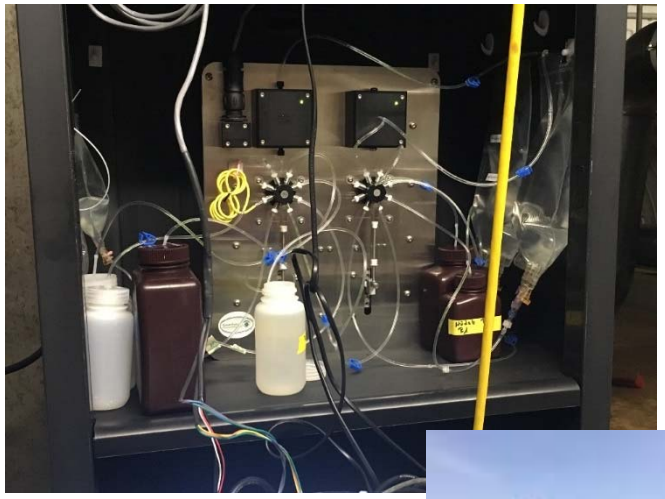
- NuLAB is operated via a software running on the controller
- Software includes two different modes (”Manual” & “Logging”)
- Analyses are executed by macros
- Macros can be selected via the software interface
- Individual channels can be selected
- Deployment mode is defined

Basic methodology of NuLAB

- The NuLAB adapts established wet chemical methods to a field chemical analyser.
- Data is calibrated via an On-Board-Standard (OBS) that precedes one or more samples.
- Operates with 8 pre-defined macros that determine how analyses are carried out
- NuLAB macros follow the protocols of the United States Environmental Protection Agency for nutrient analysis
- Macros can be customized to specific requirements and to third party analysis protocols

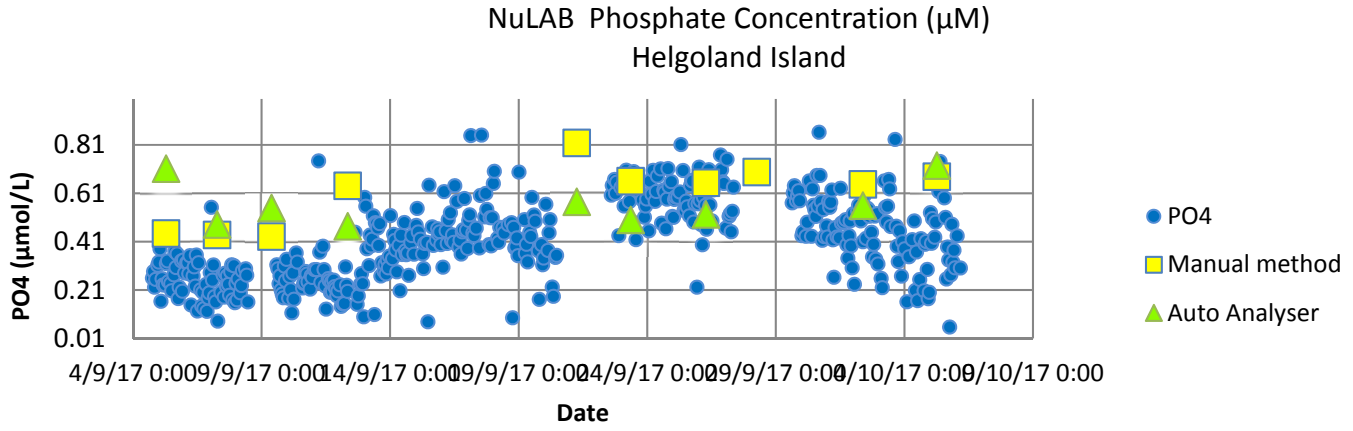
Strenghts of NuLAB

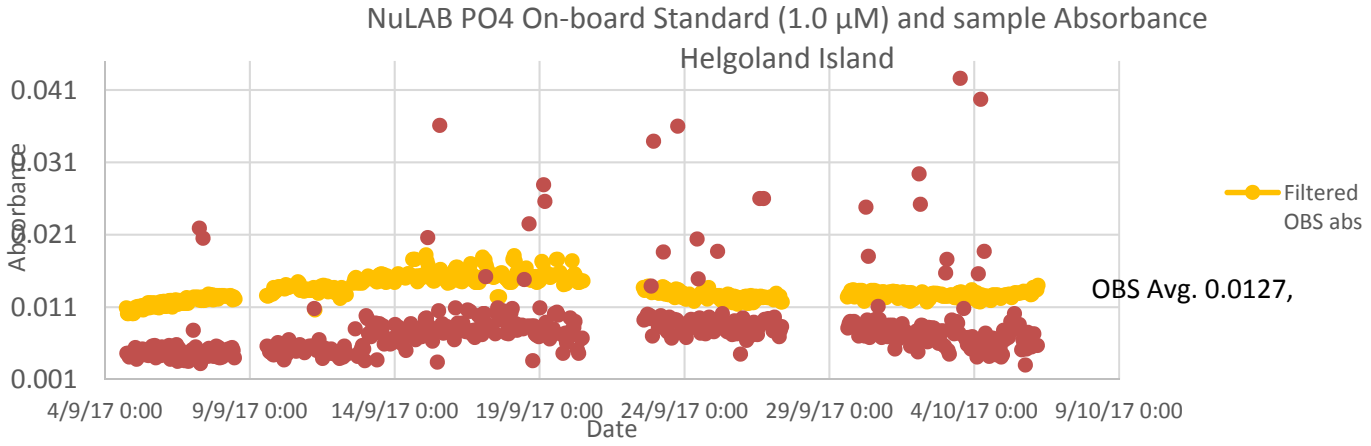
- NuLAB determines a reagent blank before each sample
- An OBS can be measured before each sample and NuLAB uses the most recent OBS for concentration calculation
- NuLAB macros are customizable
- NuLAB is easy to operate and easy to integrate into other systems (e.g. Ferry Box)
- Data can be transmitted via internet to web gateways (like MetOcean Gateway)



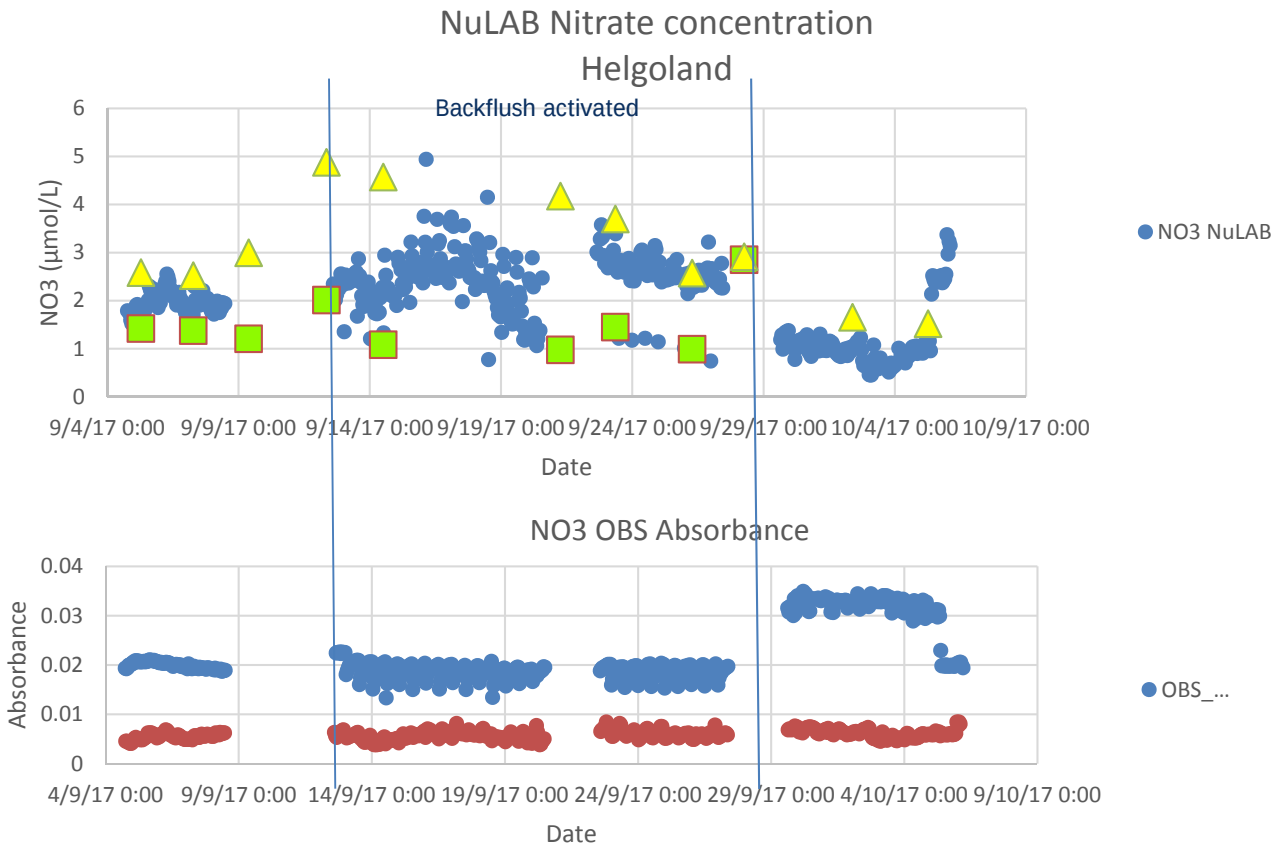
NuLAB installation at Helgoland

- Installation of a 2-channel NuLAB system (Nitrate & Phosphate) next to Ferry Box based at “Helgoland Einlaufbollwerk”
- Continuous test measurements since mid-July 2017
- Hourly samples of NO_3+NO_2 and PO_4 from Ferry Box sampling water





OBS Avg. 0.0127,


NuLAB Nitrate concentration
Helgoland
Backflush activated
NO3 (µmol/L)
6
5
4
3
2
1
0
9/4/17 0:00
9/9/17 0:00
9/14/17 0:00
9/19/17 0:00
9/24/17 0:00
9/29/17 0:00
10/4/17 0:00
10/9/17 0:00
Date
NO3 NuLAB
NO3 OBS Absorbance
Absorbance
0.04
0.03
0.02
0.01
0
4/9/17 0:00
9/9/17 0:00
14/9/17 0:00
19/9/17 0:00
24/9/17 0:00
29/9/17 0:00
4/10/17 0:00
9/10/17 0:00
Date
OBS_...

Thank you for your attention!

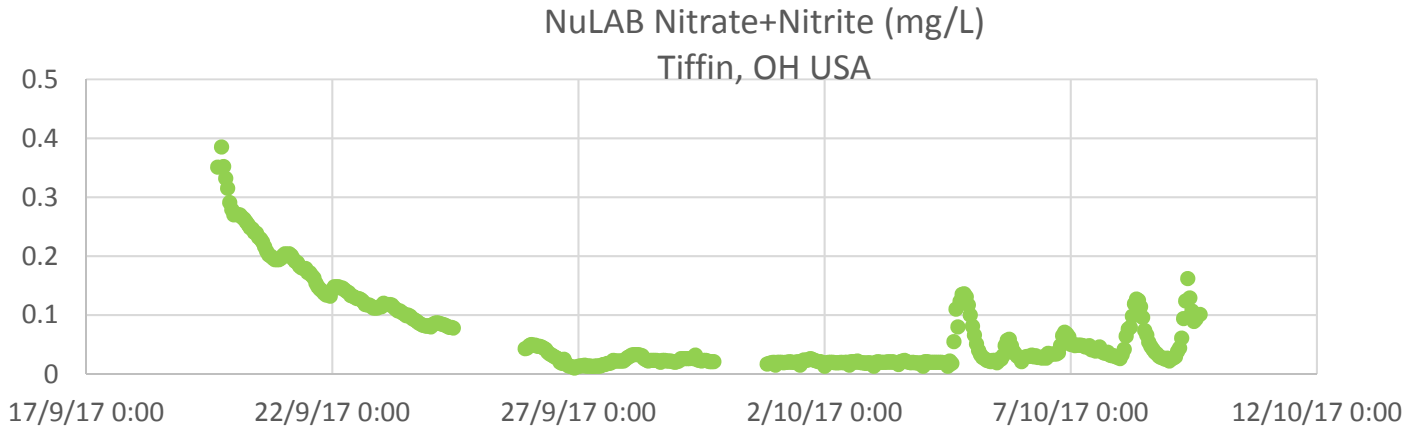
Contacts:

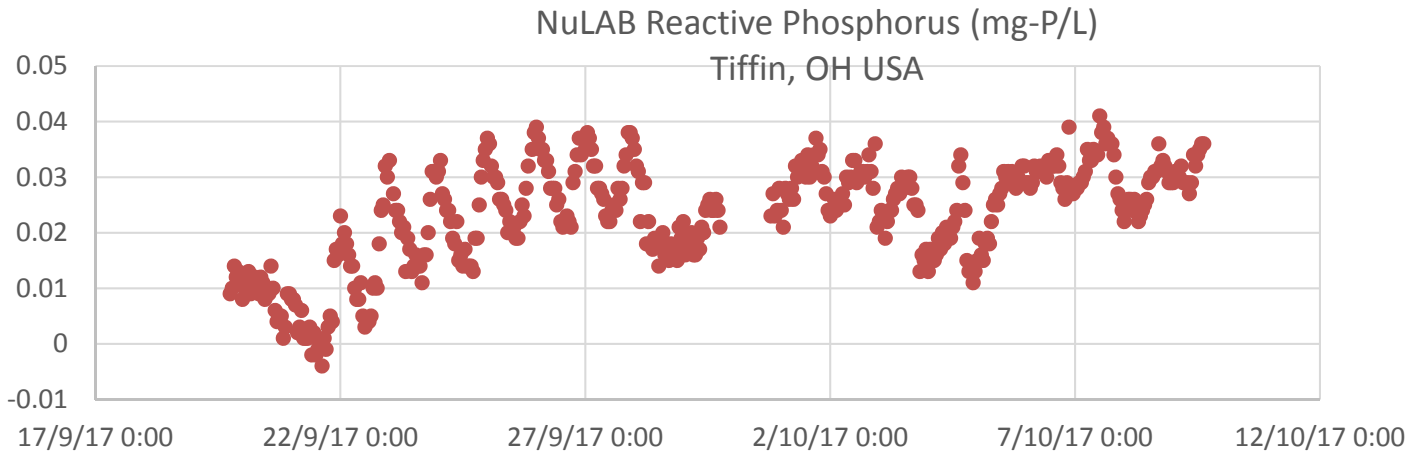
Dr Verena Dauben – MBT GmbH ✉ v.dauben@m-b-t.com

Dr Alexander Davidov – MBT GmbH ✉ a.davidov@m-b-t.com

Specification of NuLAB

	Nitrite	N+N	Phosphate	Ammonium	Silicate
Range (mg/l):					
High sensitivity detector	0.002 to 0.5	0.003 to 0.70	0.006 to 0.8	0.004-0.3	0.008 to 1.7
Low sensitivity detector	0.008 to 2.1	0.01 to 2.8	0.025 to 2.0	0.02 to 1.0	0.04 to 2.8
Precision (% of FS):	2	3	3	3	3
Accuracy:	Based on the accuracy of the preserved on-board standard and sample replicate precision				
Analyses time (min):	9	13	14	17	16


NuLAB Nitrate+Nitrite (mg/L)
Tiffin, OH USA
0.5
0.4
0.3
0.2
0.1
0
17/9/17 0:00
22/9/17 0:00
27/9/17 0:00
2/10/17 0:00
7/10/17 0:00
12/10/17 0:00


NuLAB Reactive Phosphorus (mg-P/L)
Tiffin, OH USA
0.05
0.04
0.03
0.02
0.01
0
-0.01
17/9/17 0:00
22/9/17 0:00
27/9/17 0:00
2/10/17 0:00
7/10/17 0:00
12/10/17 0:00

Environmental Protection Agency References

- Stickland & Parsons (1972)
- Grasshoff (1976)