

AquaLife 03.- 04.6.2014 Kiel

Marine benthic mesocosms

A facility for climate change research at the ecosystem level

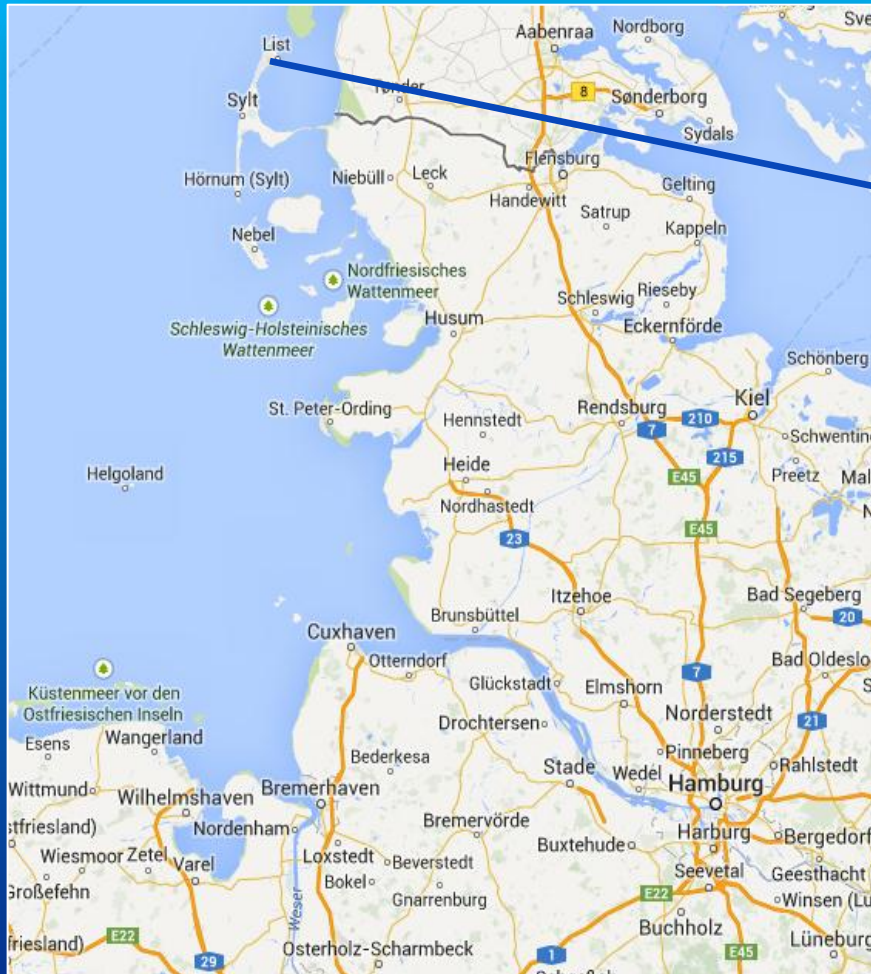
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Wadden Sea station Sylt



Content

- ❖ Location
- ❖ General information
- ❖ Single mesocosm
 - compartments
- ❖ Experiments
- ❖ Future plans

AWI Wadden Sea Station



General Information

- ❖ close gap between small scale and field experiments
 - ❖ constructed by 4H-Jena Engineering
 - ❖ finished in August 2013
 - ❖ 12 mesocosms → 12 independent experimental units
 - ❖ non filtered seawater from the Wadden Sea station
 - ❖ connected with the gas mixing facility of the institute
- made for climate change experiments at the ecosystem level

Single mesocosm

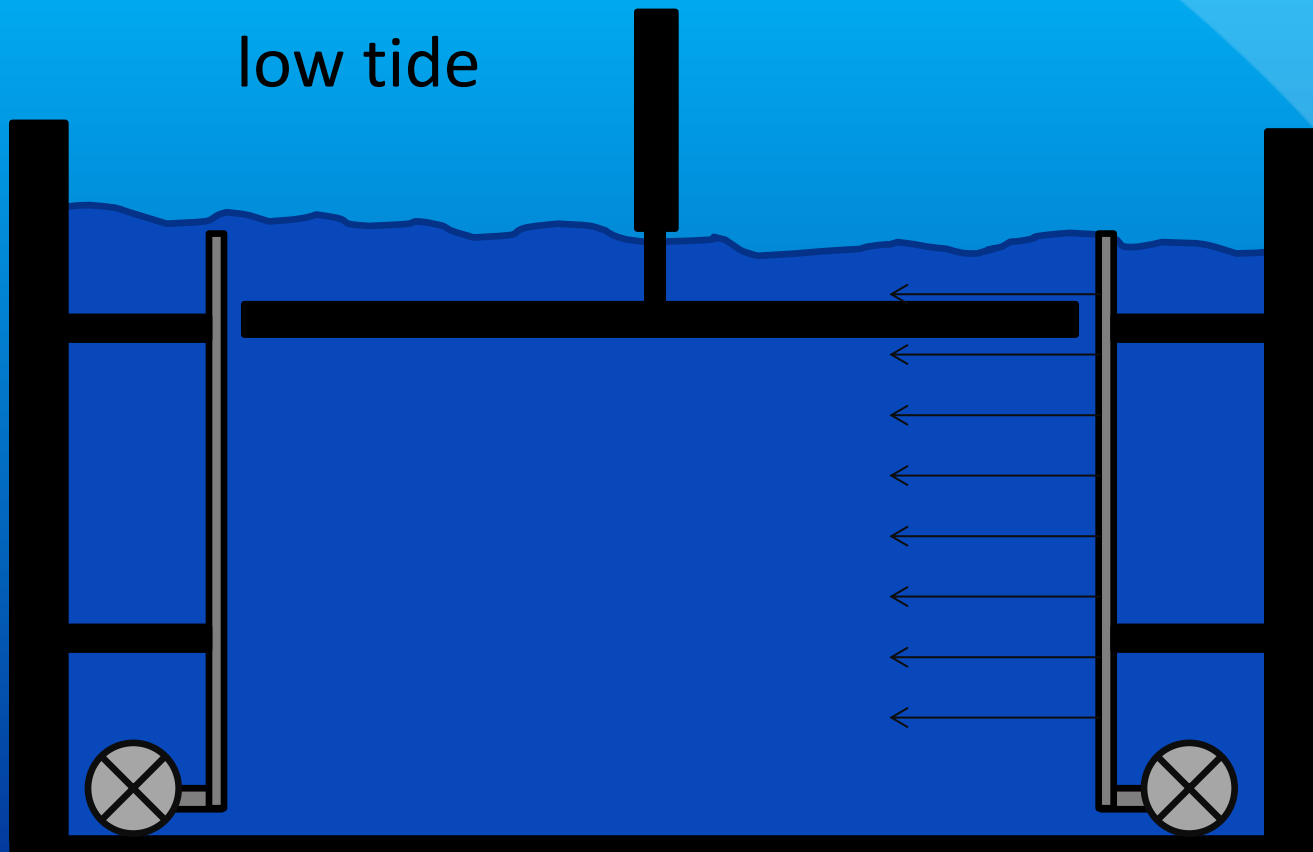
- ❖ 170 cm in diameter x 80 cm height
- ❖ 1800 l volume
- ❖ Insulated wall construction
- ❖ translucent lid
- ❖ tide simulation
- ❖ temperature regulation
- ❖ multiparameter measurement system
- ❖ flow through



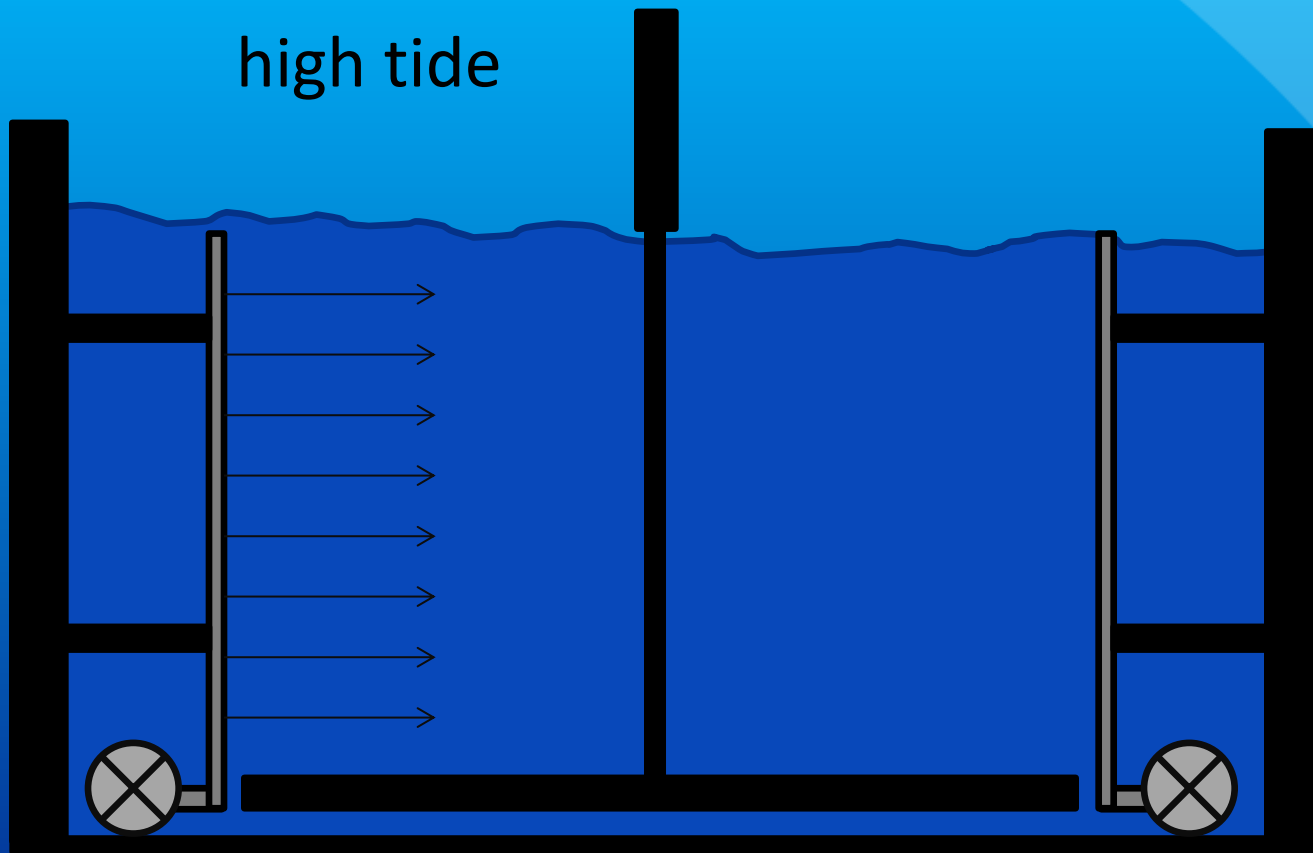
Tide simulation



Tide simulation



Tide simulation



Temperature regulation



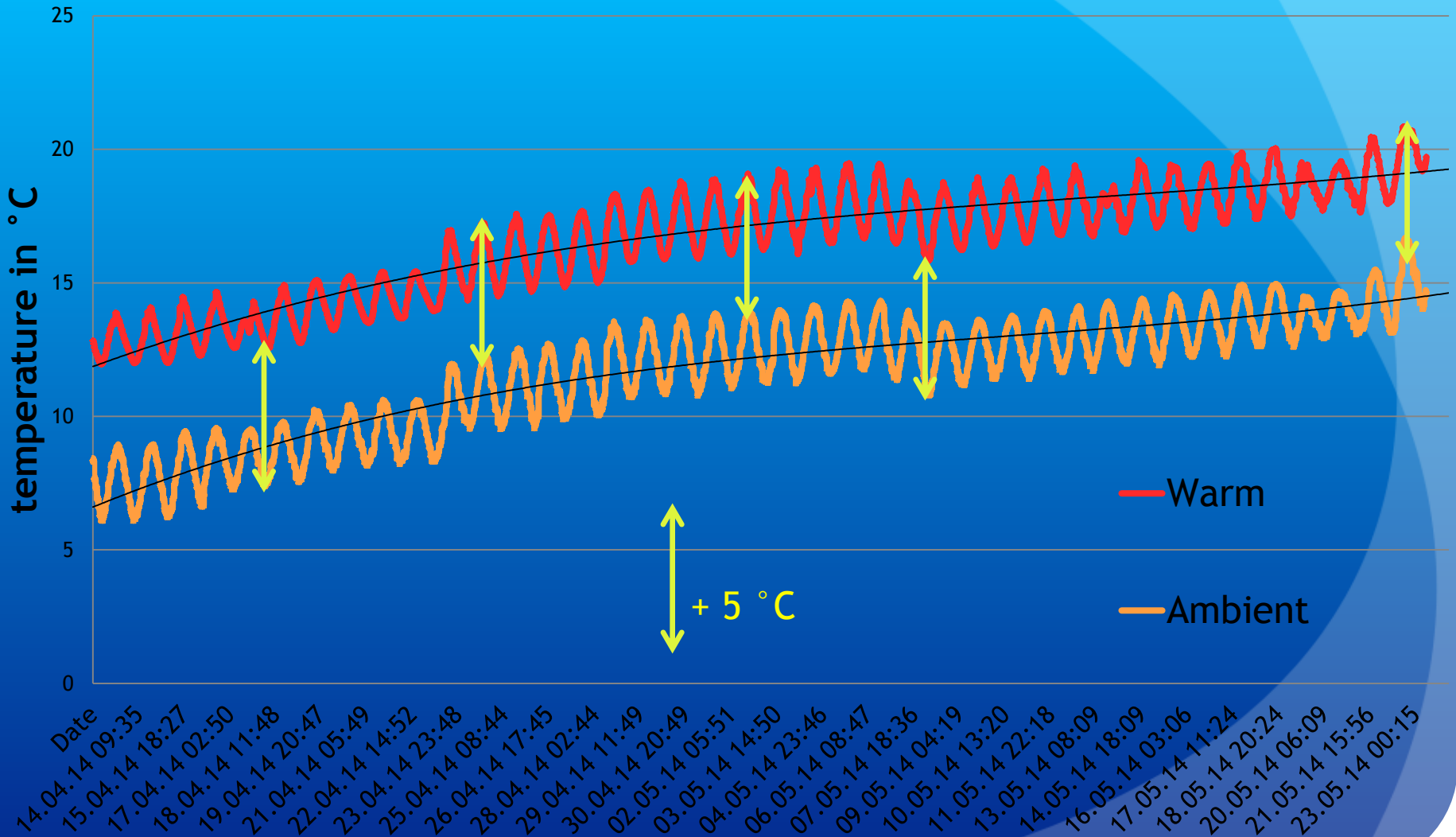
Auqa medic
Titanium heater
3 x 500 W

Auqa medic
Titan 2000 cooler
550 W

Software

- ❖ yearly max/min
- ❖ daily max/min
- ❖ adjusted by measured temperatures in the field

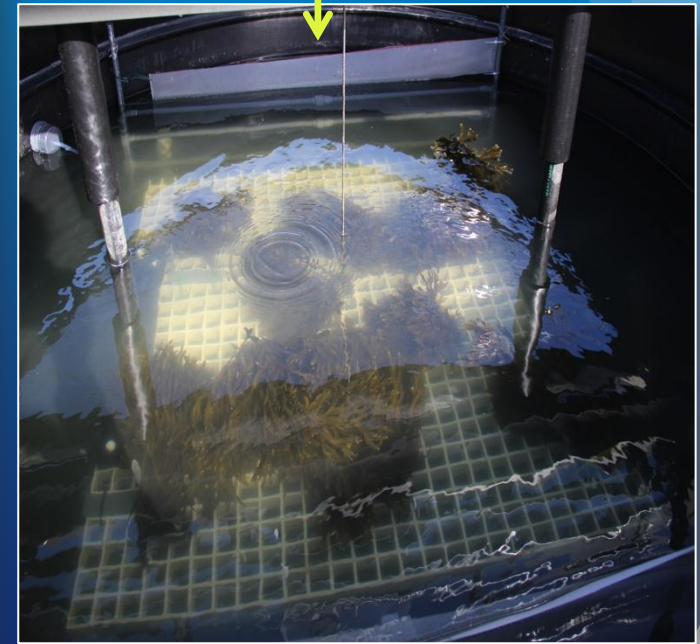
Temperature regulation



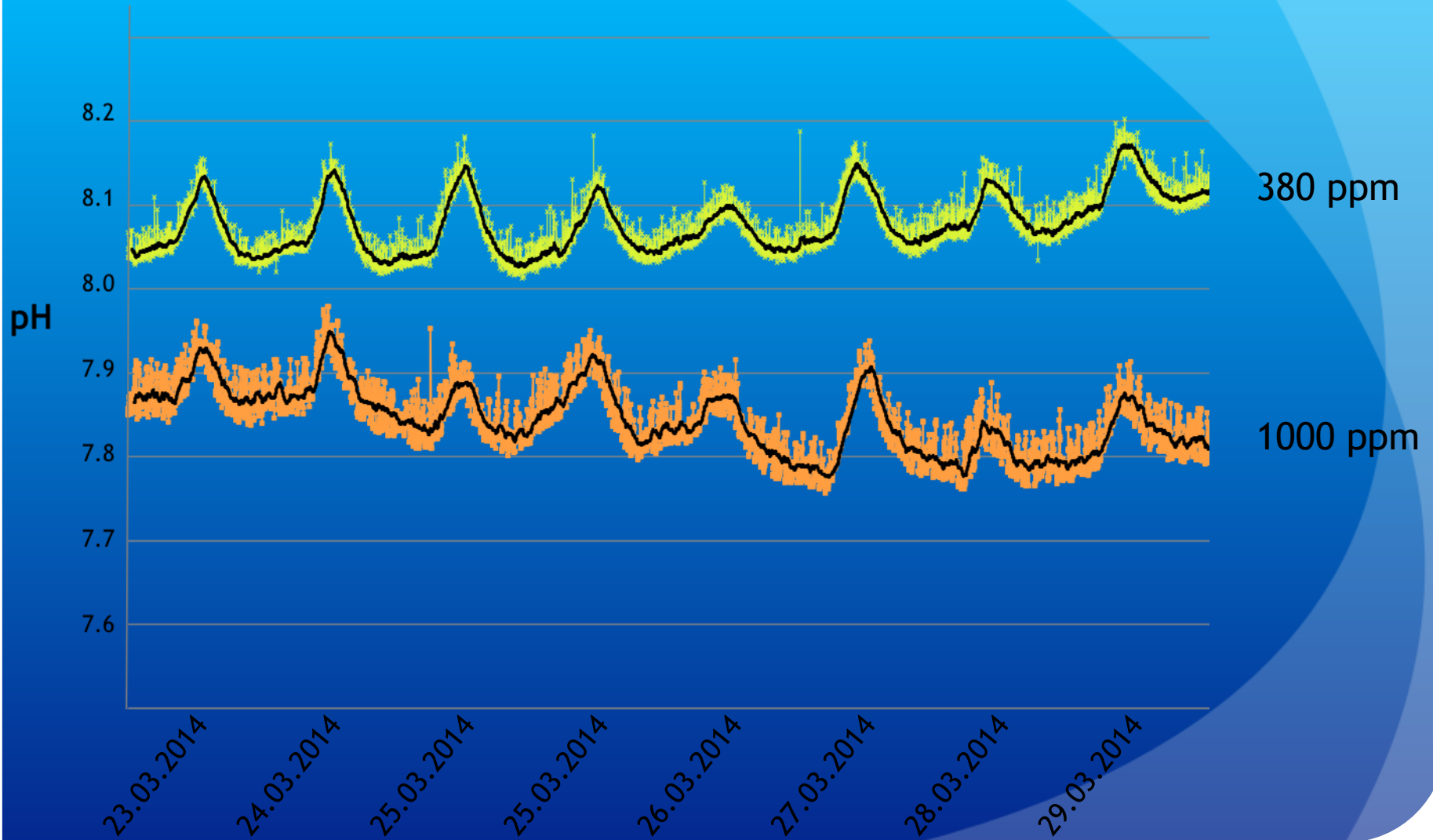
Gas mixing facility



seawater in the mesocosm is directly aerated with pre-mixed gas



Seawater acidification



Multiparameter measurement system



One system for two mesocosms: Hydrolab DS5X parameters measured at the moment

- ❖ temperature
- ❖ pH
- ❖ oxygen (Clark cell)
- ❖ conductivity

possible adjustments in the future

- ❖ chlorophyll
- ❖ turbidity
- ❖ Ammonium etc.

The software

-4H- MESOKOSMEN SYLT

UTC Time
08:39:38
26.09.2013

System Status

Working

Measurement

Tank 2 Flow Source Tank 1

NextSwitchTime (s)

600 500 400 300 200 100 0

Tides

Tide in %

Next Flood

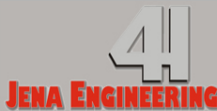
08:49 UTC

Direction

Rising

Next Ebb

14:59 UTC



<p>A</p> <p>SERVICE</p> <p>Kill switch Powerless</p>	<p>2</p> <p>Motor: MANUAL</p> <p>Heat</p> <p>Level: 3cm</p> <p>T_{js}: 10,9 °C T_{set}: 20,3 °C</p>	<p>Calibration Mode</p> <p>T2 <- [] AIR -> T1</p> <p>T2 -> [] PUMP <- T1</p> <p>[] FW [] OUT</p>	<p>1</p> <p>Motor: OFF</p> <p>Heat</p> <p>Level: 0cm</p> <p>T_{js}: 10,9 °C T_{set}: 15,3 °C</p>
<p>B</p> <p>SIMULATION</p> <p>Kill switch Powerless</p>	<p>2</p> <p>Motor: TIDE</p> <p>Heat</p> <p>Level: 0cm</p> <p>T_{js}: 15,3 °C T_{set}: 20,3 °C</p>	<p>Measure</p> <p>T2 <- [] AIR -> T1</p> <p>T2 -> [] PUMP <- T1</p> <p>[] FW [] OUT</p>	<p>1</p> <p>Motor: TIDE</p> <p>Heat</p> <p>Level: 0cm</p> <p>T_{js}: 14,8 °C T_{set}: 15,3 °C</p>
<p>C</p> <p>SIMULATION</p> <p>Kill switch Powerless</p>	<p>2</p> <p>Motor: OFF</p> <p>Heat</p> <p>Level: 0cm</p> <p>T_{js}: 21,4 °C T_{set}: 20,3 °C</p>	<p>Measure</p> <p>T2 <- [] AIR -> T1</p> <p>T2 -> [] PUMP <- T1</p> <p>[] FW [] OUT</p>	<p>1</p> <p>Motor: TIDE</p> <p>Heat</p> <p>Level: 0cm</p> <p>T_{js}: 15,1 °C T_{set}: 15,3 °C</p>
<p>D</p> <p>SIMULATION</p> <p>Kill switch Powerless</p>	<p>2</p> <p>Motor: TIDE</p> <p>Heat</p> <p>Level: 0cm</p> <p>T_{js}: 20,9 °C T_{set}: 20,3 °C</p>	<p>Measure</p> <p>T2 <- [] AIR -> T1</p> <p>T2 -> [] PUMP <- T1</p> <p>[] FW [] OUT</p>	<p>1</p> <p>Motor: TIDE</p> <p>Heat</p> <p>Level: 0cm</p> <p>T_{js}: 14,9 °C T_{set}: 15,3 °C</p>
<p>E</p> <p>SIMULATION</p> <p>Kill switch Powerless</p>	<p>2</p> <p>Motor: TIDE</p> <p>Heat</p> <p>Level: 0cm</p> <p>T_{js}: 19,3 °C T_{set}: 20,3 °C</p>	<p>Measure</p> <p>T2 <- [] AIR -> T1</p> <p>T2 -> [] PUMP <- T1</p> <p>[] FW [] OUT</p>	<p>1</p> <p>Motor: TIDE</p> <p>Heat</p> <p>Level: 0cm</p> <p>T_{js}: 15,1 °C T_{set}: 15,3 °C</p>
<p>F</p> <p>SIMULATION</p> <p>Kill switch Powerless</p>	<p>2</p> <p>Motor: TIDE</p> <p>Heat</p> <p>Level: 0cm</p> <p>T_{js}: 20,1 °C T_{set}: 20,3 °C</p>	<p>Measure</p> <p>T2 <- [] AIR -> T1</p> <p>T2 -> [] PUMP <- T1</p> <p>[] FW [] OUT</p>	<p>1</p> <p>Motor: TIDE</p> <p>Heat</p> <p>Level: 0cm</p> <p>T_{js}: 15,1 °C T_{set}: 15,3 °C</p>

User Inputs

- Expert Mode
- Set Tank Status
- Set Motor Position
- Set Temperature
- Mail to Supervisor
- Show service tabs
- Reset Motor Error

- Errors
- Pair A: Powerless
 - Pair A: Temp. Tank 1
 - Pair A: Temp. Tank 2
 - Pair A: Motor 1 FAIL
 - Pair B: Temp. Tank 1
 - Pair C: Motor 2 FAIL

Experiments

spring 2014 + autumn 2014

- ❖ Macro alga (*Fucus vesiculosus*) community
- ❖ CO₂ x temperature
- ❖ 3 month
- ❖ 4 Treatments (3 replicates)

summer 2014 + winter 2014/15

- ❖ *Fucus vesiculosus* community
- ❖ (CO₂ x temperature) x eutrophication



Future plans

- ❖ experiments on *Seagrass* and its associated fauna
- ❖ test of more relevant stressors, stress combinations, species, life stages and communities

e.g.

- ❖ fish larvae, small fish
- ❖ turbidity, deoxygenation, hyposalinity, sedimentation, micro plastics

Thanks

