APPLICATION AND EXPERIENCES WITH AUTOMATED CARBON SENSORS IN FERRYBOX SYSTEMS

Martina Gehrung

KOI

Genova, 26 April 2019

Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research

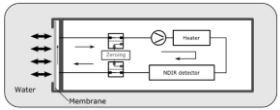
Additional sensors for FerryBox

- pCO2 sensor (HydroC CO2FT, KM Contros)
  - Membrane with gas detection
- Total Alkalinity sensor (Hydro FIA TA, KMContros)
  - Spectrophotometric detection, Titration
- pH sensors
  - Glas electrode (Meinsberg)
  - ISFET electrode (Endress+Hauser)
  - FIA-pH (HydroFIA-pH,KM Contros)

pCO2 sensor, Total alcalinity sensor

pCO2 Sensor :

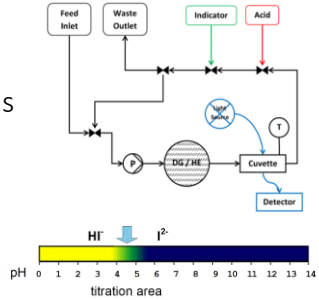
- Dissolved gasses and water vapor equilibrate through the membrane
- Gas concentration is measured by NDIR



Annual maintenance, pre- / recalibration

Total alkalinity sensor:

- Acidic titration with hydrochloric acid is performed . The pH value during the titration is measured by the acid-base indicator dye bromocresol green.

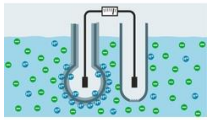


Reference with CRM

pH Sensors

Glas electrode:

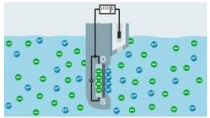
- common technic, H+ ions of the solution are concentrated at the diaphragm. The potential difference to the reference is measured.



Sensor drifted easily-> short calibration interval, Accuracy 0.01

ISFET electrode:

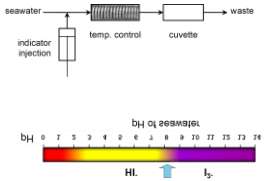
- FET measures ionic strength. The more H+ ions accumulate on the base of the transistor, the more current can flow between the source and drain.



Longtime stable -> long calibration interval, needs time to adapt in seawater

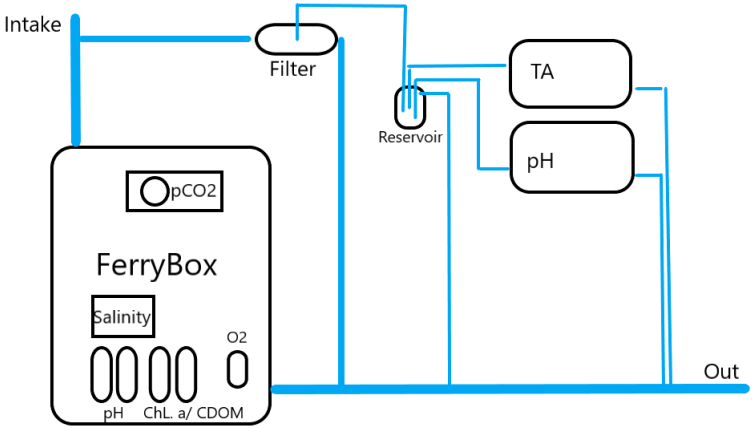
HydroFIA-pH:

- Injection of an indicator dye (*m*-cresol purple) to a continuous seawater stream. The indicator dye has different extinction coefficients in its acid (HI^-) and in its base state (I^{2-}), which can be used for spectrophotometric determination of the pH value.



Accuracy 0.003, no user calibration, specified of 20 to 40 PSU, Range pH 7 to 9

Applications for flowsystem

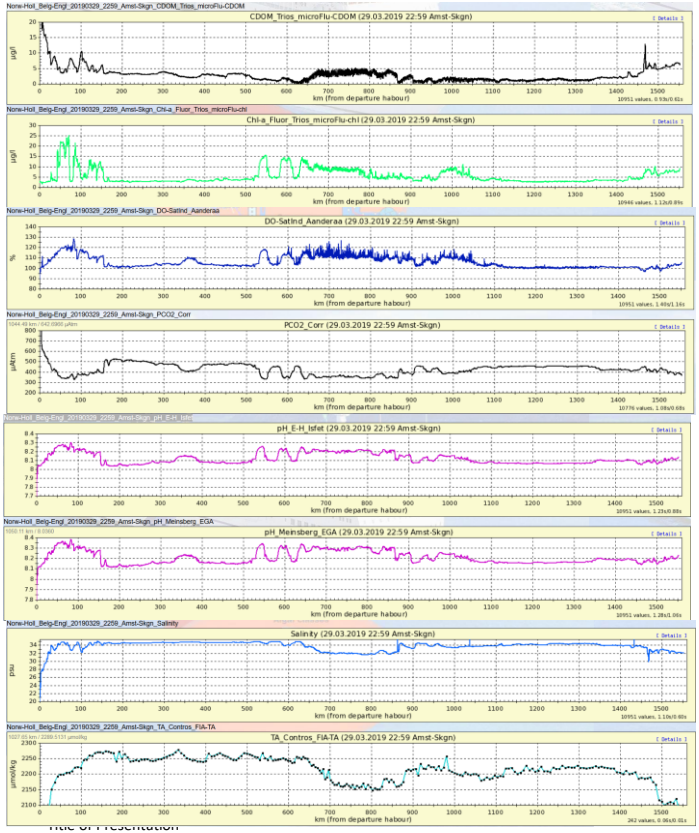


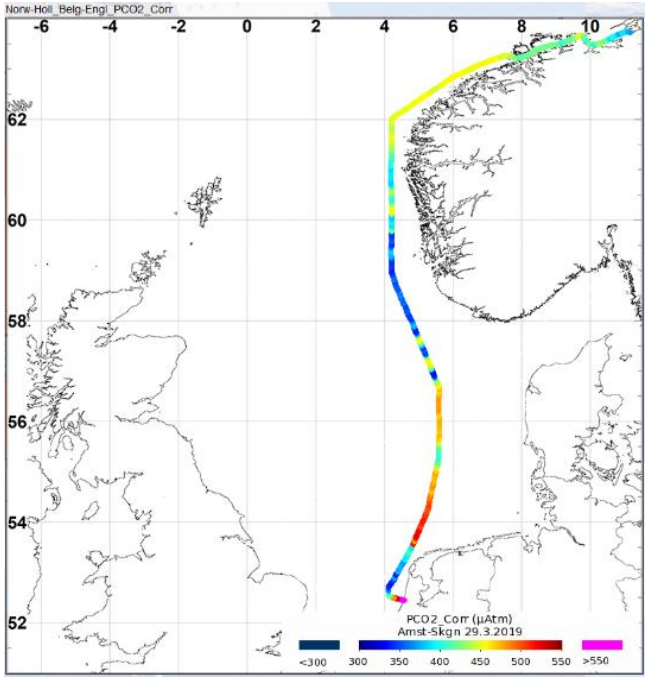
- All these sensors are integrated in FerryBox flowsystem
- HydroFIA TA and pH need filtered water, which is provided from a Crossflowfilter
- All sensors are controlled by FB software
- HydroFIA TA and pH get salinity from FB online

APPLICATION AND EXPERIENCES WITH
AUTOMATED CARBON SENSORS IN FERRYBOX SYSTEMS

Operational use on FB-routes

Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research





preparation in lab, qualitity control during operation

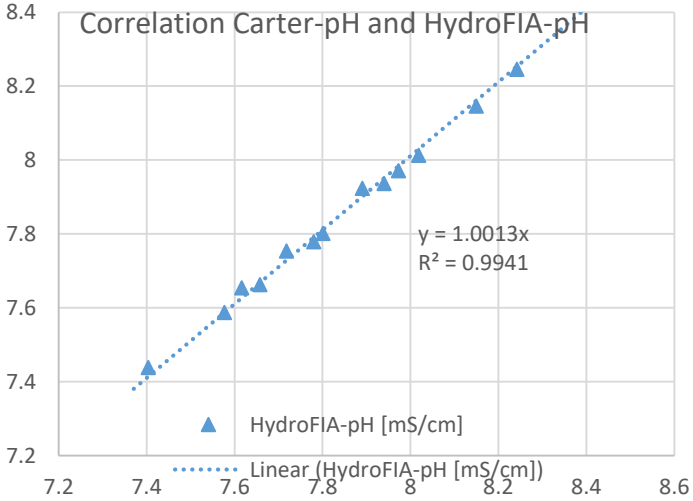
- Preparation of the sensors:
  - ✓ FIA TA
    - New Acid and Indicator dye connect and run sensor with seawater for a few hours
    - If the measurements stable run CRM from Dickson
    - Calibrate with CRM
    - Check with CRM
    - Check with seawater
  - ✓ FIA pH
    - Check with CRM from Dickson or Trisbuffer from Dickson
  - ✓ ISFET pH
    - Calibration with trisbuffer and seawater, which is specified with FIA_pH (calibration by 25°C)
- Currently quality check of TA:
  - Measurements with seawater and CRM after installation in FB
  - During FB maintenance check with seawater and CRM, optionally flush with acid
  - After operational use measurements with CRM to detect eventually drifts (in lab)
- In future:
  - Automatically CRM measurements during the crouse

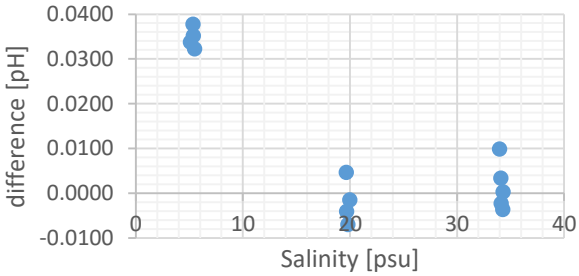
Sensors:

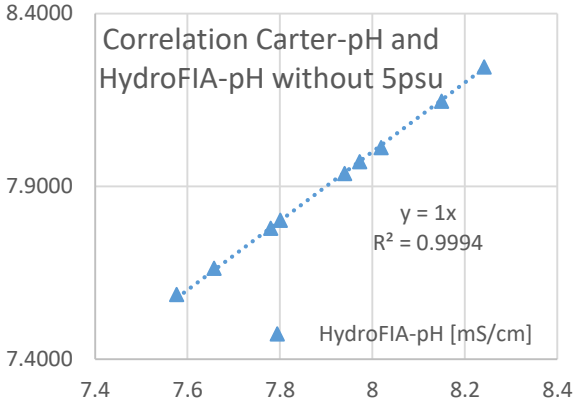
- pCO2 (HydroC CO2FT)
- FIA-TA (HydroFIA-TA)
- FIA-pH (HydroFIA-pH)
- pH-ISFET (CPS471D)
- Salinity Sensor (Citadel TS-NH)

Salinity PSU	CO2 200 µatm	400	800
5	10°C/20°C	10°C/20°C	10°C
20	10°C/20°C	10°C/20°C	10°C
35	10°C/20°C	10°C	10°C

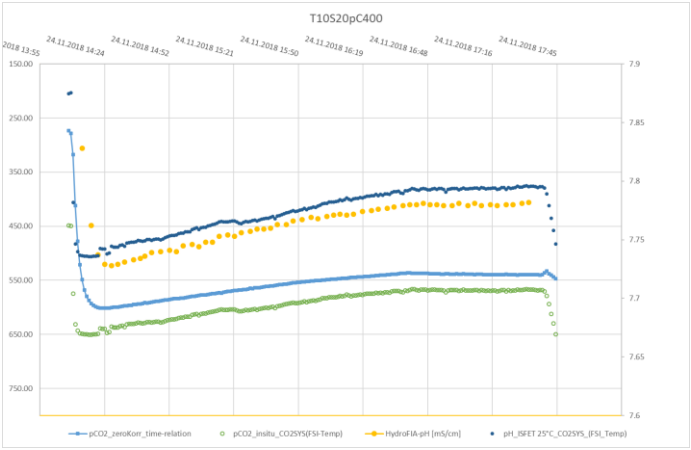
Corralation FIA-pH with discreet samples measured

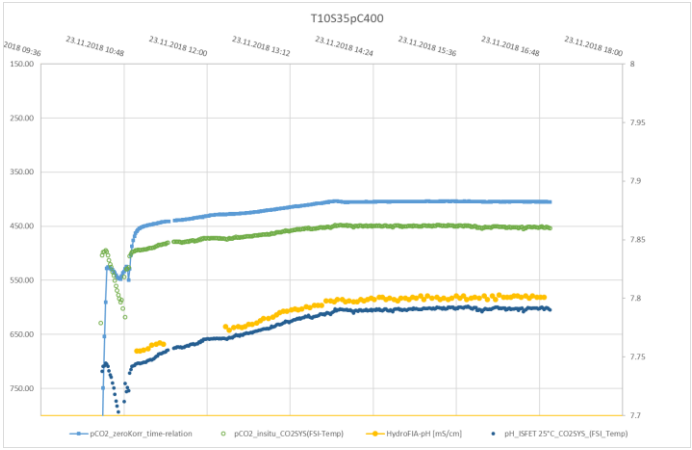






Sensor behavior in different salinity





Helmholtz-Zentrum
Geesthacht
Centre for Materials and Coastal Research

Thank you for you attention….

Costal observatory COSYNA:
www.cosyna.de
FerryBox community:
www. ferrybox.org
JERICO-NEXT:
www.jerico-ri.eu