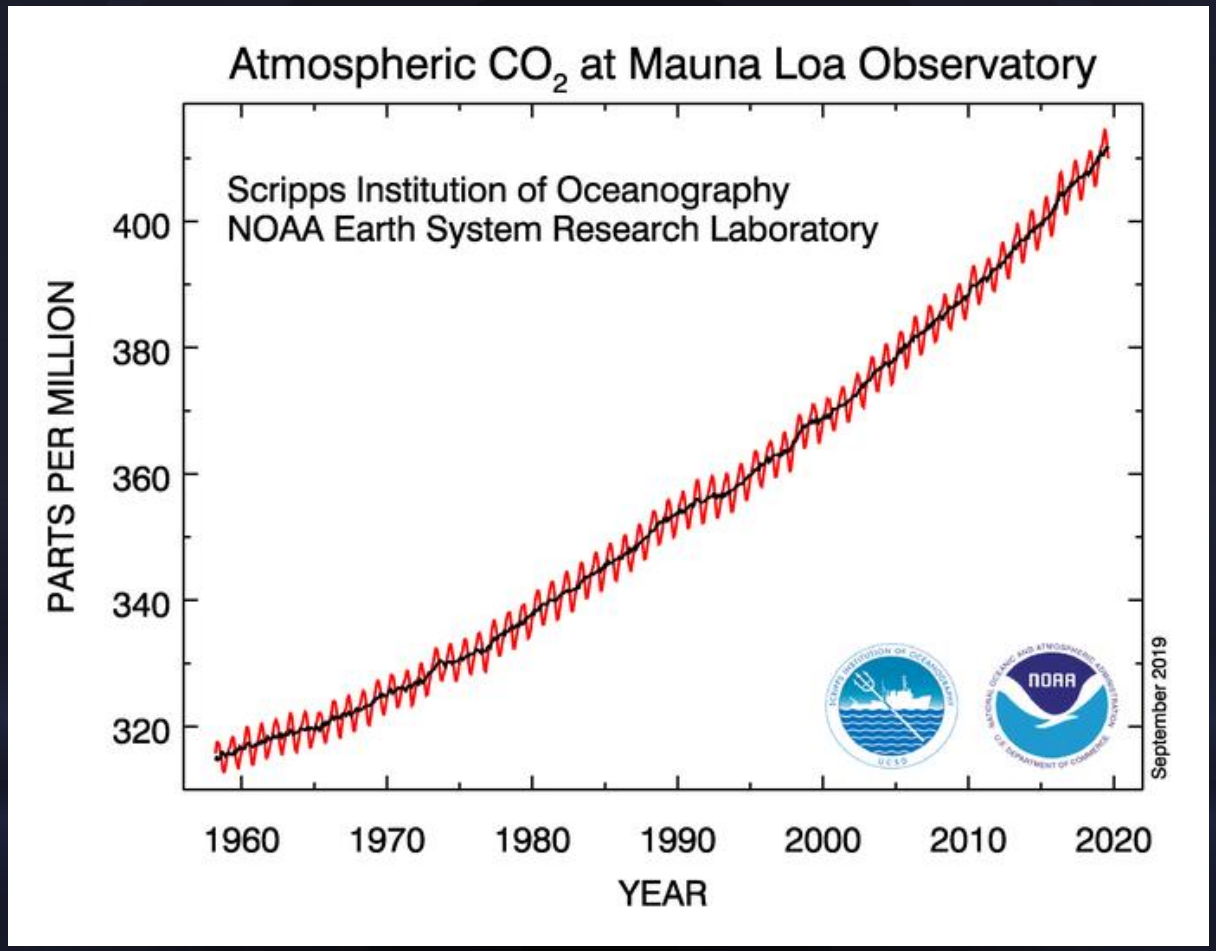
OCEAN ACIDIFICATION: PERSPECTIVE WITH MOHID

Marta López Mozos- MARETEC (IST)

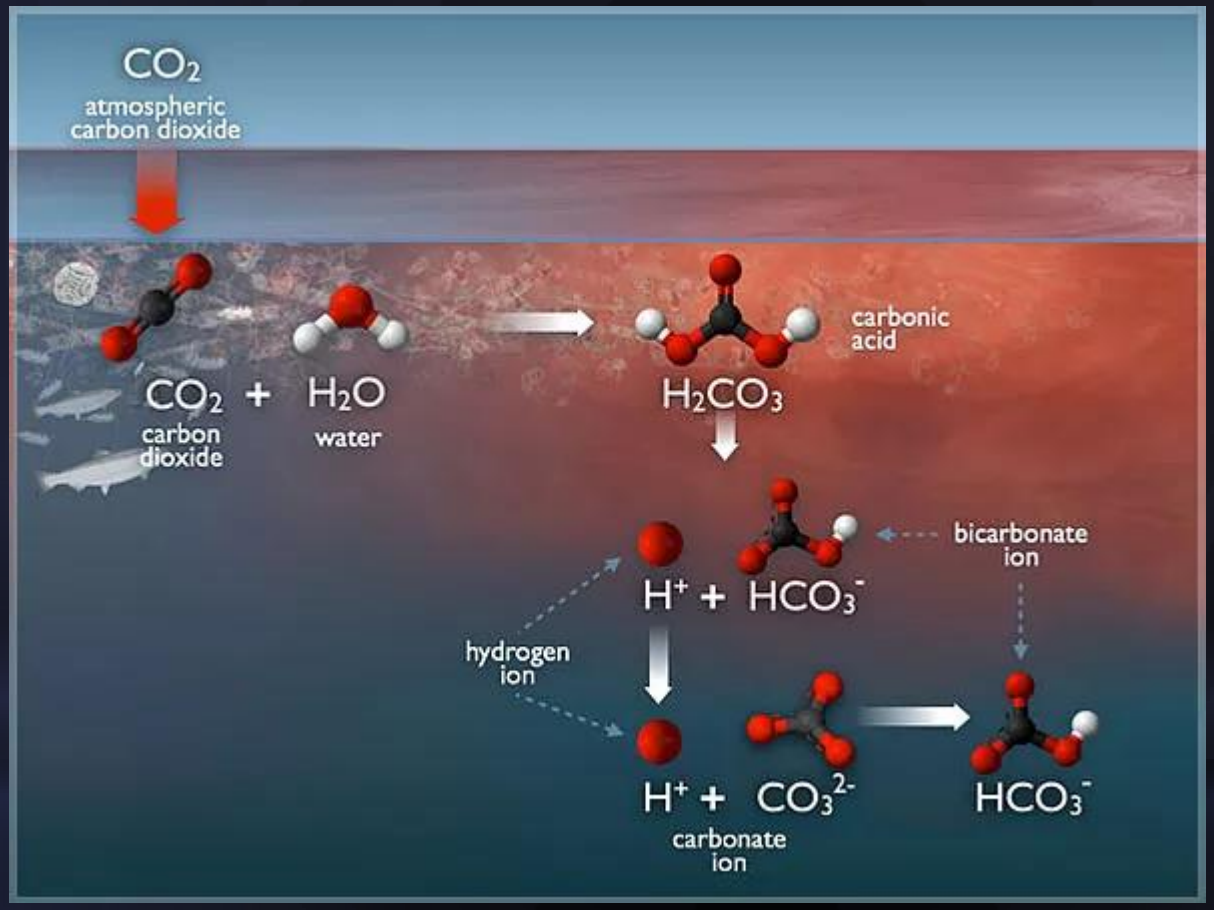
MOHIDing
11th and 12th December 2019, Lisbon

Atmospheric carbon dioxide



NOAA, 2019

CO2 in seawater



Ocean Acification program, NOAA, 2019

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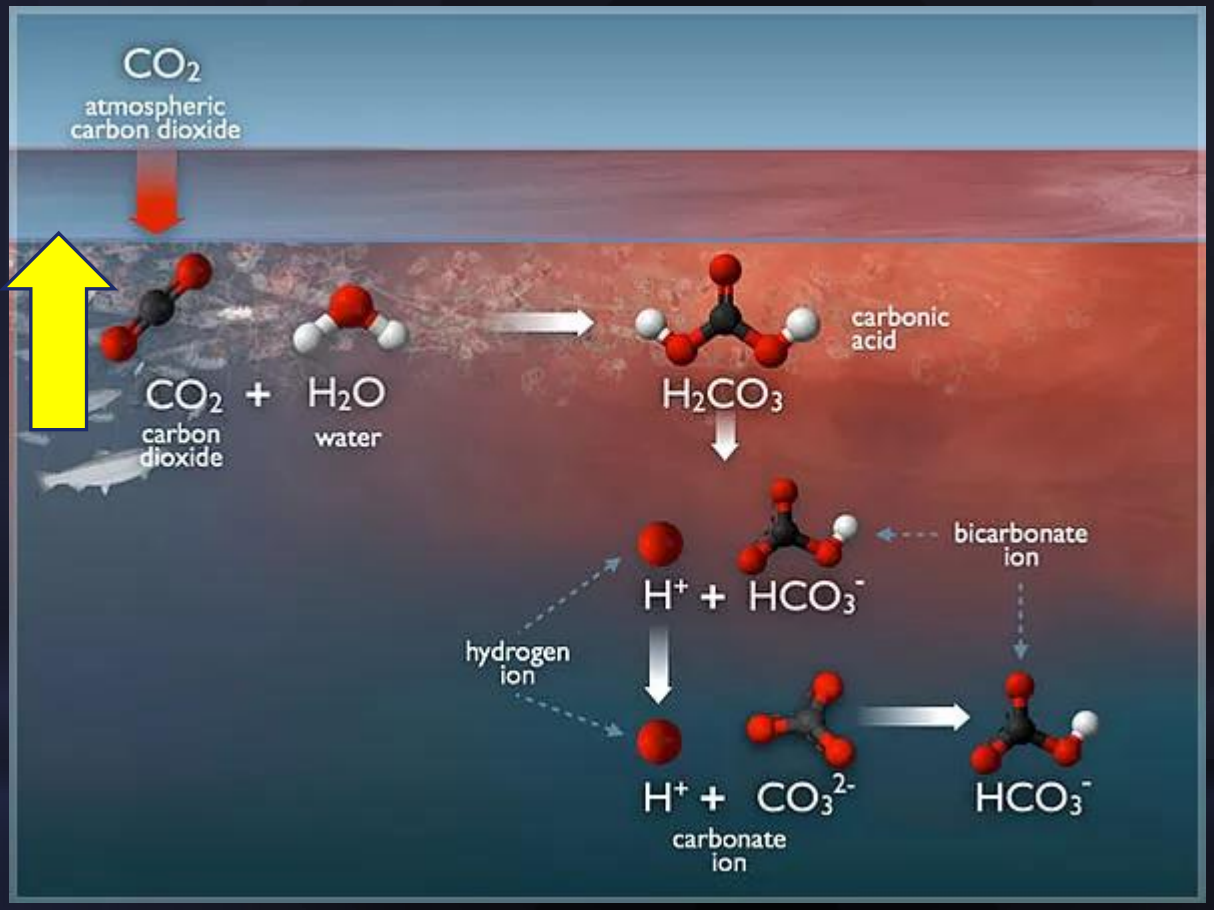

Ocean Acification program, NOAA, 2019

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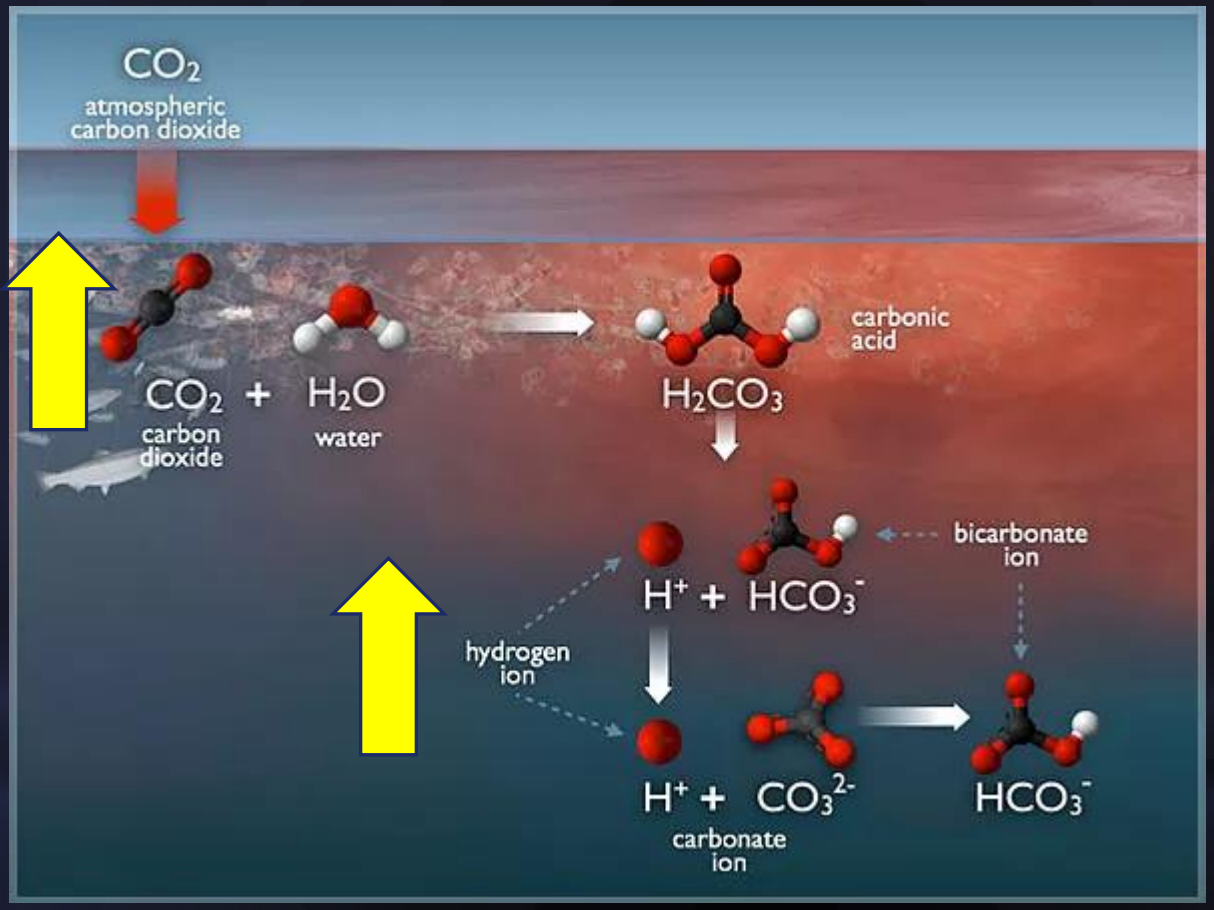
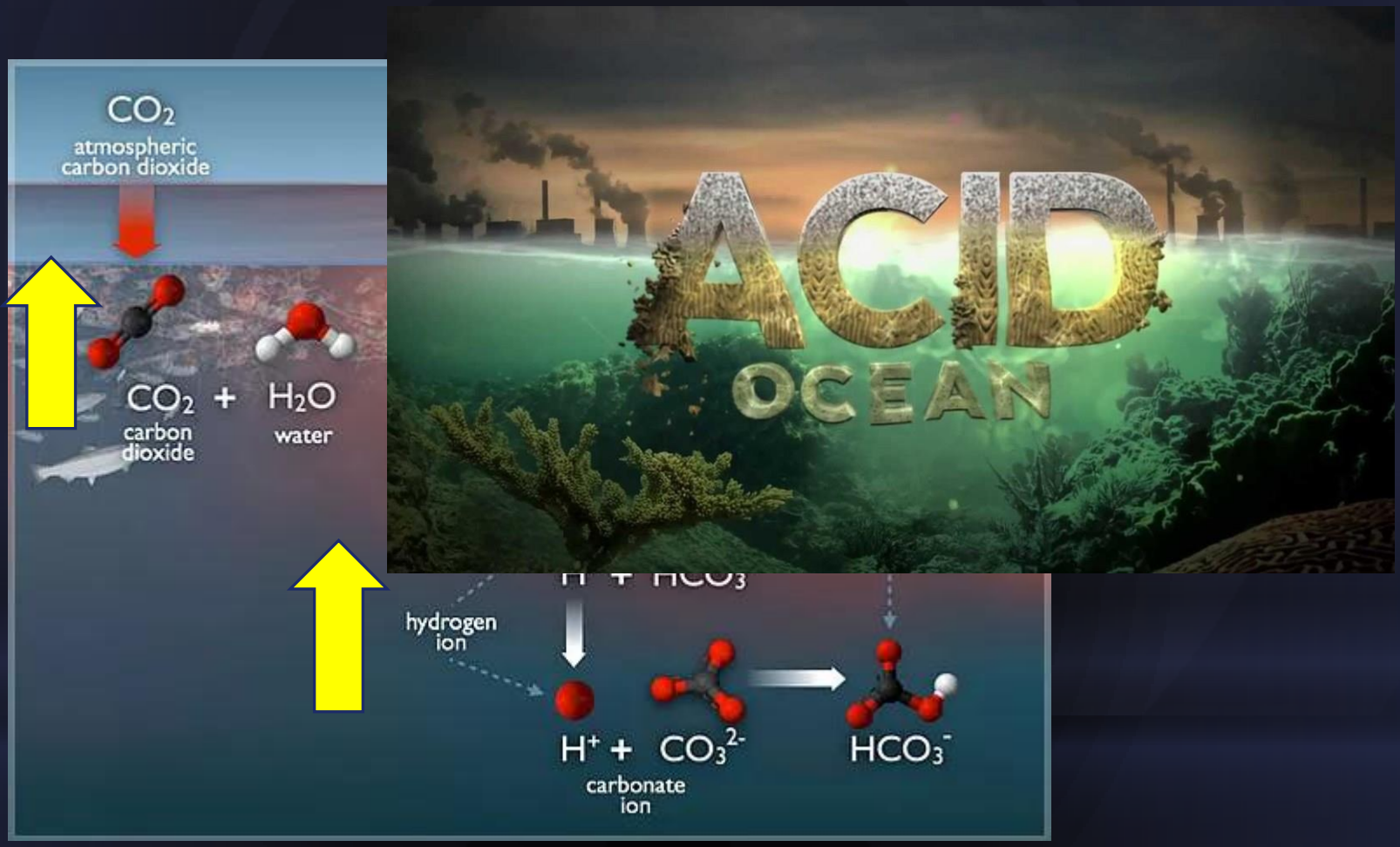


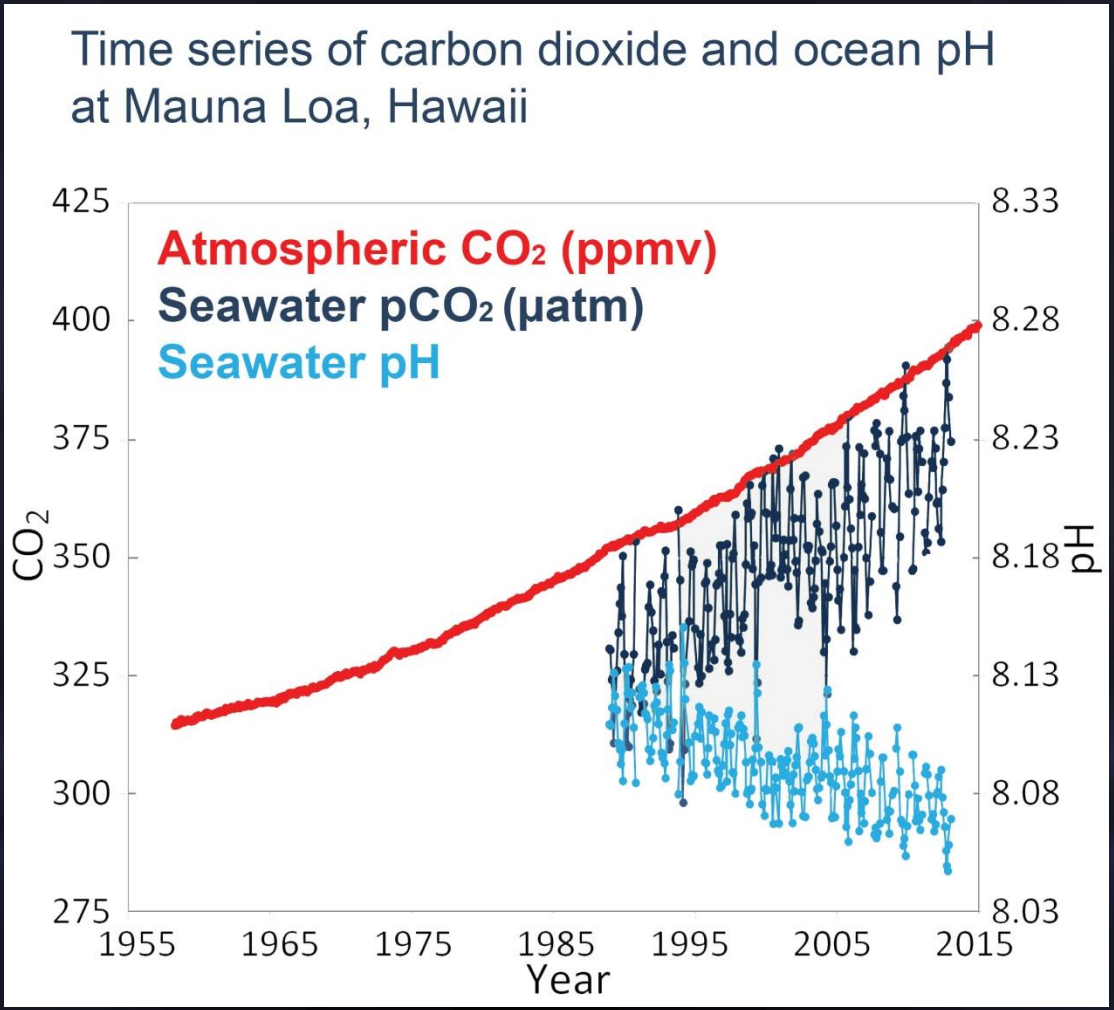
Ocean Acification program, NOAA, 2019

CO2 in seawater



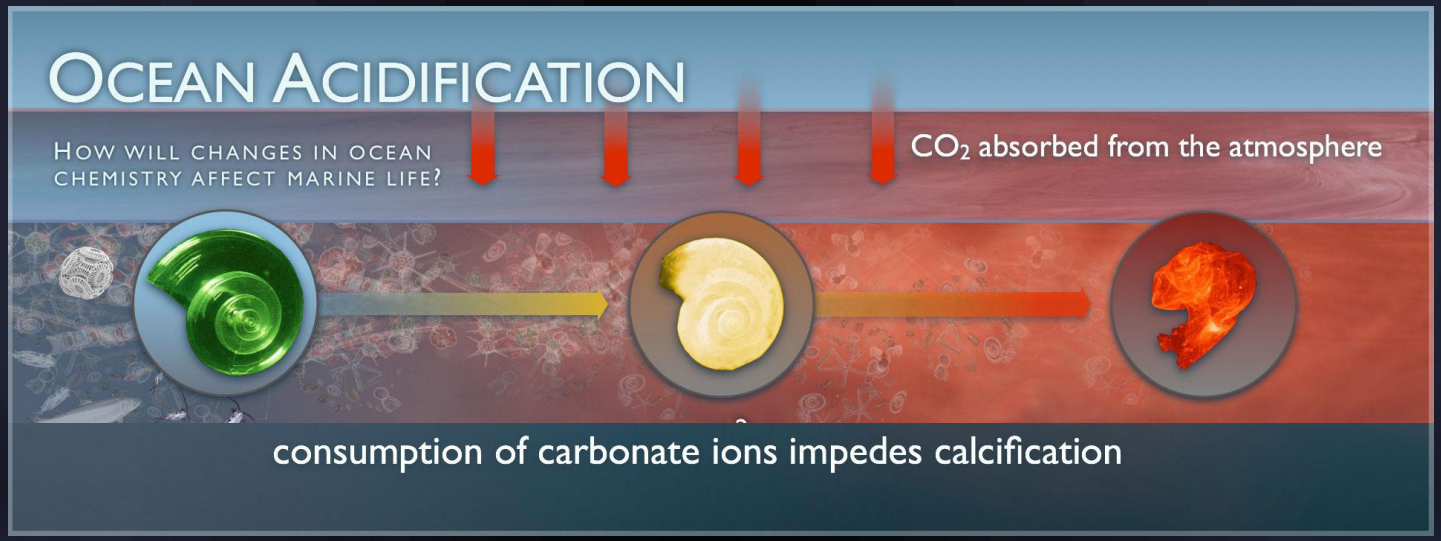
Ocean Acification program, NOAA, 2019

Ocean acidification



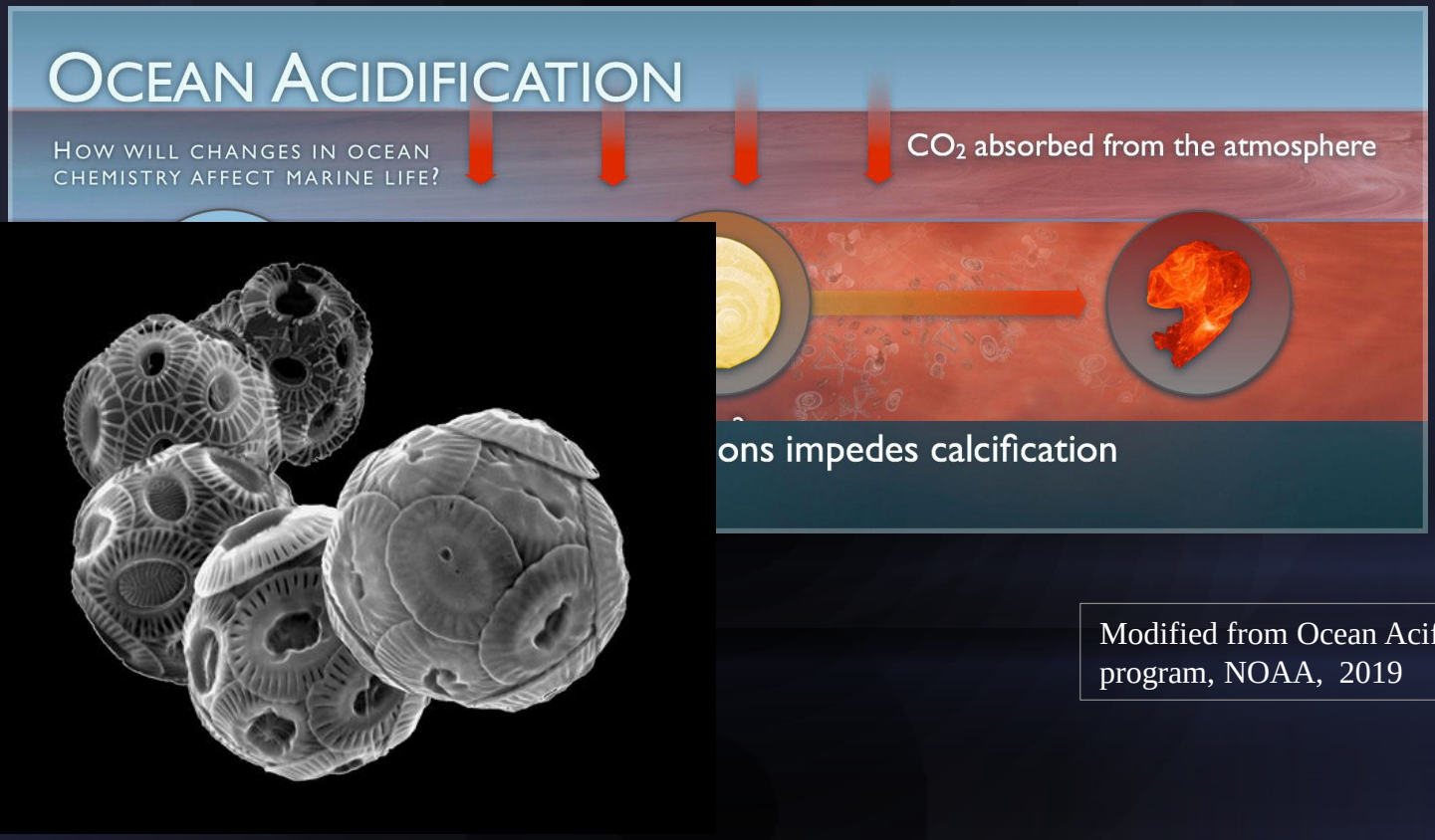
Ocean Acification program, NOAA, 2019

Ocean acidification and calcification



Modified from Ocean Acification program, NOAA, 2019

Ocean acidification and calcification



Modified from Ocean Acification program, NOAA, 2019

Ocean acidification and calcification

How we model this process?

CO2 in seawater

- **CO2 seawater system = four parameters**

  - Alkalinity
  - DIC (Dissolved Inorganic Carbon)
  - pCO2/fCO2 (Partial pressure of CO2/fugacity)
  - pH

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$$DIC \equiv \Sigma CO_2 = [CO_2] + [HCO_3^-] + [CO_3^{2-}]$$

Zeebe and Wolf-Gladrow, 2001

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$$[Na^+] + 2[Mg^{2+}] + 2[Ca^{2+}] + [K^+] + 2[Sr^{2+}] + \ldots - [Cl^-] - [Br^-] - [NO_3^-] - \ldots TPO_4 + TNH_3 - 2TSO_4 - THF - THNO_2 = TA_{ec}$$

Wolf-Gladrow et al., 2007

MOHID Water

- Model
- Water quality
- Cequal
- Hydrodynamic
- Water properties
- Life
- Many others

MOHID water


Model
MOHID
Water Modelling System
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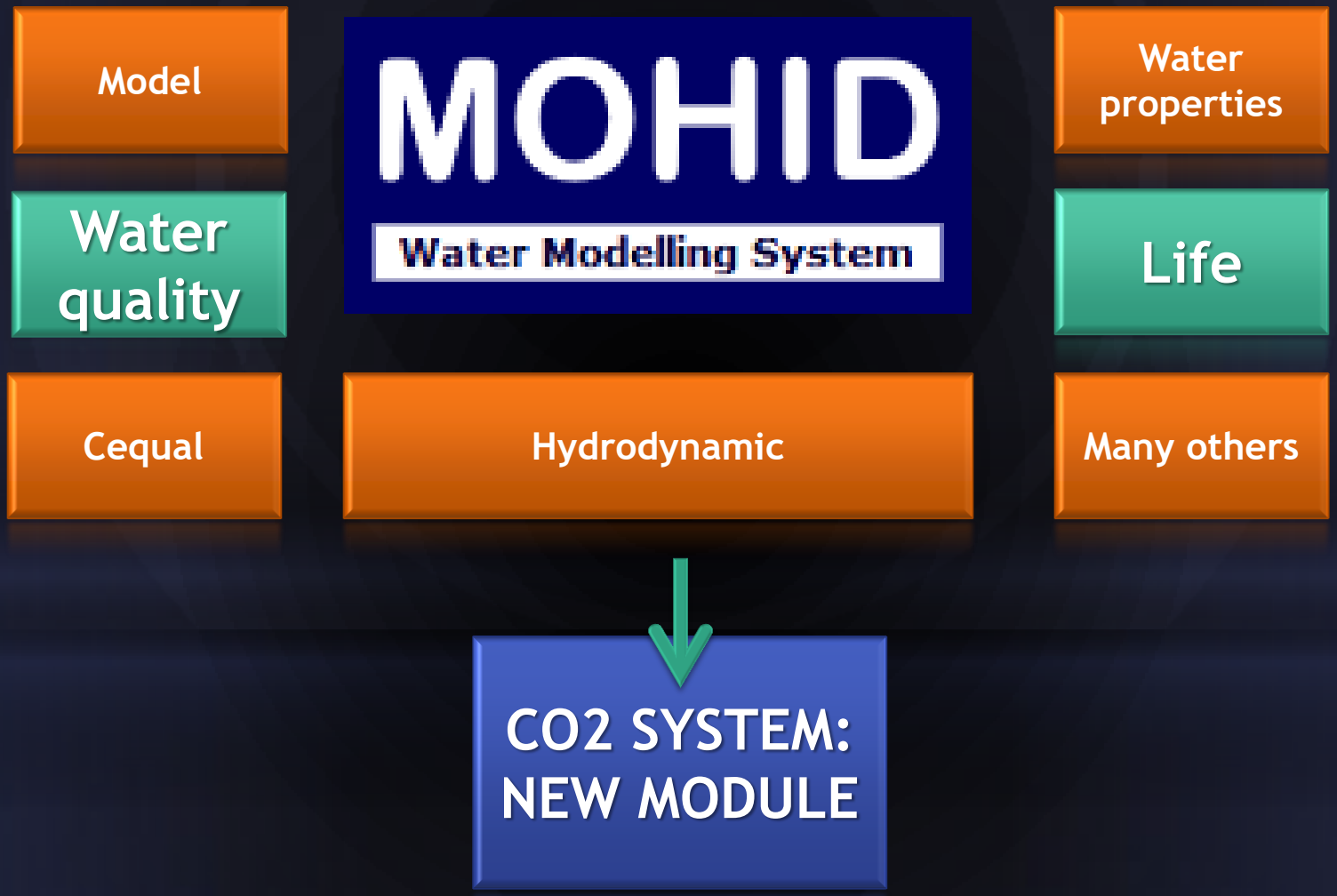
Model
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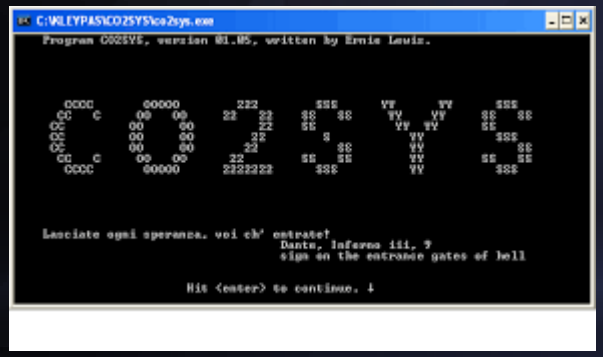
CO2 SYSTEM: NEW MODULE

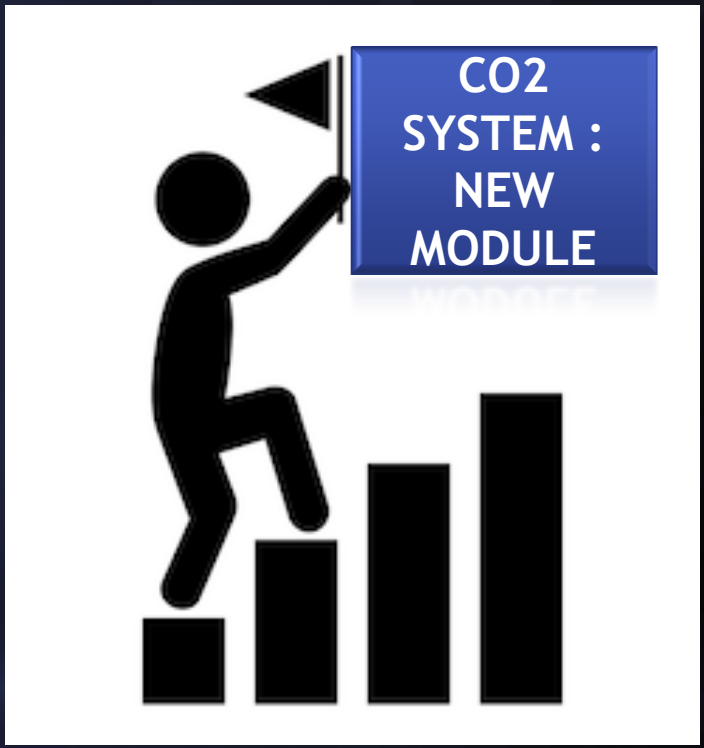
CO2 system: new module

- Two master variables
  - Alkalinity
  - DIC
- Calcium carbonate dissolution and precipitation
- Support of CO2Sys program (Lewis et al., 1998)



- Expected outputs: alkalinity, DIC, pH, pCO2, between many others

CO2 system module: accurate and challenges



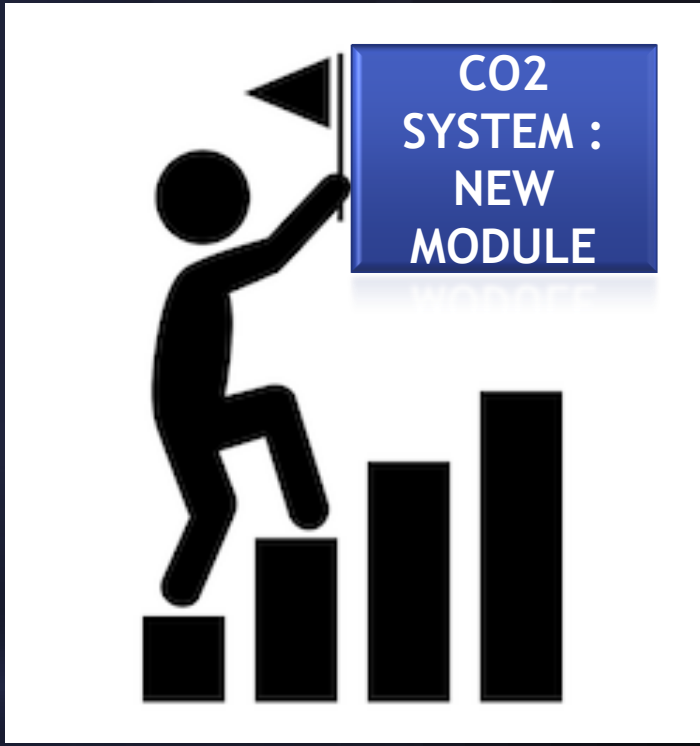
INPUTS FOR THE MODULE:

- Chemical constants depend on temperature and pressure and are high sensitives.
- WATER QUALITY module doesn't model CO2.

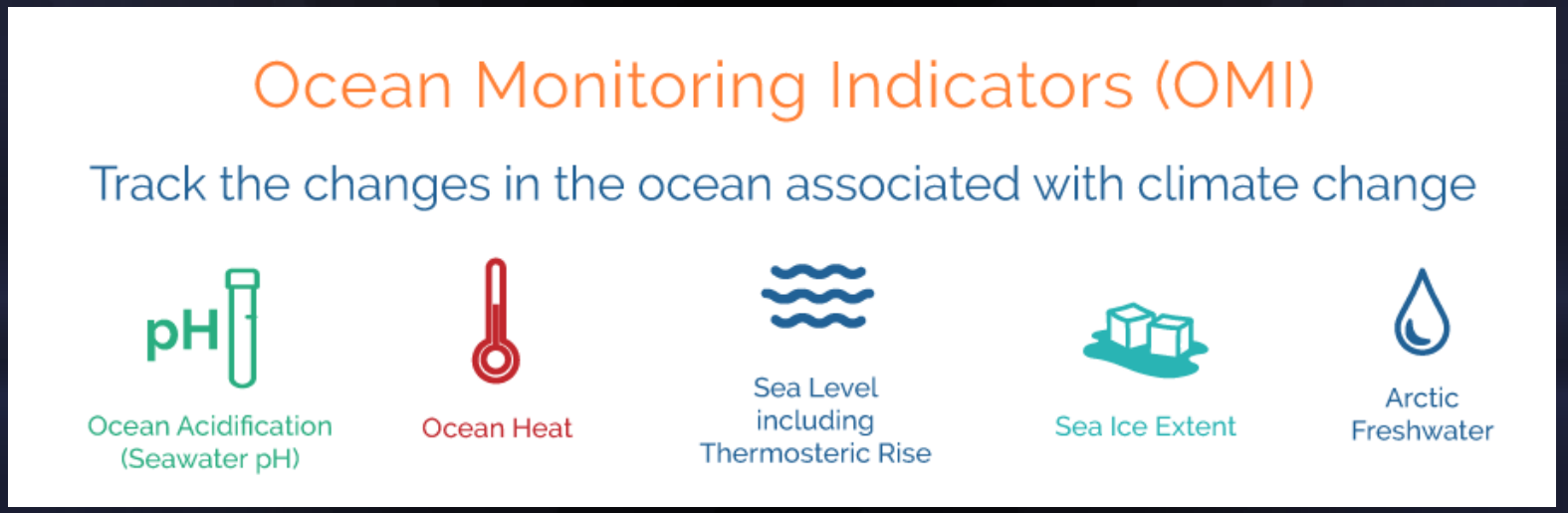
PROGRAMMING DIFFICULTIES:

- New cycles: calcium carbonate precipitation and dissolution. Sulphure cycle ? Improvement of Water Quality?
- Construction of a new module, dependent on other modules
- To add CO2Sys program
- New module = low computational cost

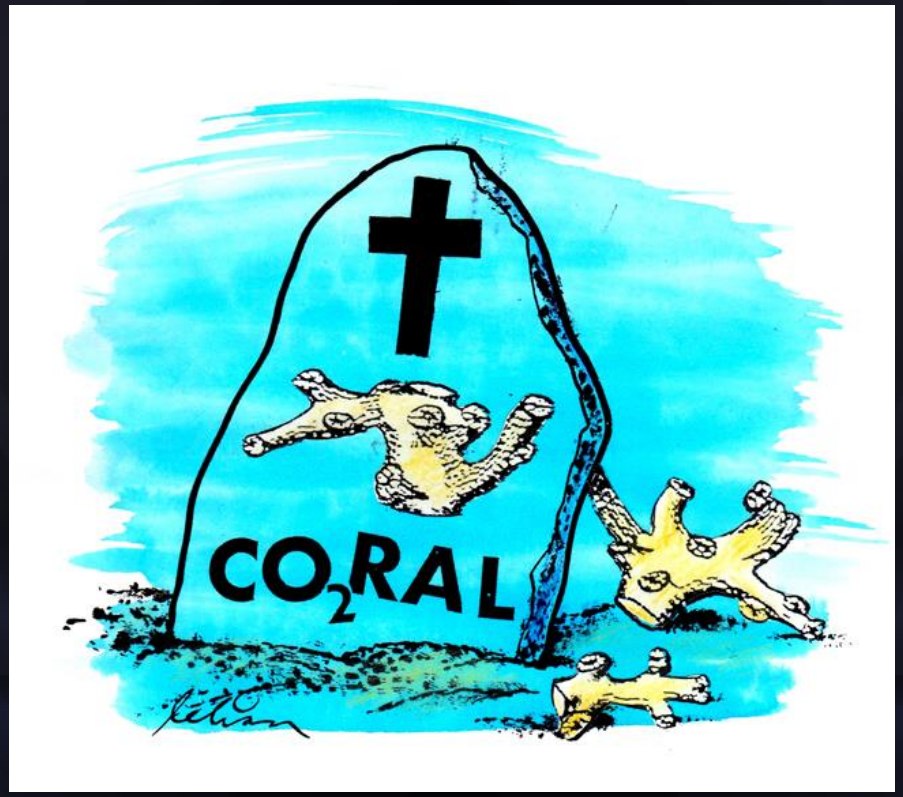
CO2 system module: accurate and challenges



CO2 system module: forcings and initial conditions



THANK YOU FOR YOUR ATTENTION



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MARETEC
MARINE, ENVIRONMENT & TECHNOLOGY CENTER

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