History of ocean pCO$_2$ intercomparison

- **1994 Scripps**
  - A. Dickson and CO$_2$ panel
  - Laboratory intercomparison with small seawater pool
  - Successful but water supply problem

- **1998 R/V Meteor**
  - A. Koertzinger
  - Onboard intercomparison using natural surface seawater
  - Very successful but difficulties from natural variation of pCO$_2$ and on board laboratory share
International ocean pCO$_2$ intercomparison using indoor seawater pool

- SCOR/IOC CO$_2$ Panel activity
  - (Chair, D. Wallace)
- Merit of large indoor seawater pool
  - small T change
  - large water supply capacity
  - manageable pCO$_2$ with HCl and NaOH

- Facility
  - Floating in the pool for buoy type systems
  - Pool side deck installation for on board underway systems
  - calibrated standard gas supply (0, 270, 330, 390, 450ppm)
  - 100, 200V 50Hz AC power
International ocean pCO$_2$ intercomparison using indoor seawater pool

- **Date**
  - March 10 (Mon)–14 (Fri), 2003
- **Post experiment workshop**
  - around October 7, 2003
- **Sponsorship**
  - Ministry of Environment, Japan
  - National Institute for Environmental Studies (NIES)
- **Location**
  - Hazaki, Japan
  - 44 km east of Tokyo/Narita Airport
International ocean pCO$_2$ intercomparison using indoor seawater pool

• **Target**
  – critical comparison at 0.3 µatm level in ideal indoor laboratory condition

• **How to do?**
  – keep steady pool pCO$_2$ (ref. 1998 result)
  – critical T comparison of each equilibrator by calibrated T sensor

• **Study for error causes in pCO$_2$ equilibrators**
  – Pool pCO$_2$ can be changed by HCl/NaOH. Test at 250, 350, and 450 µatm can identify error relating to pCO$_2$
  – Pool T change (15 and 20 degree C) can identify error relating to T.
Indoor Seawater Pool in National Research Institute of Fishery Engineering

see web page
how to access
http://ss.nrife.affrc.go.jp/index_e.html
pool facility
http://ss.nrife.affrc.go.jp/plant/gyogun/gyogun_e.html

Seawater pool of 170t!
stable temperature and pCO₂
manageable pCO₂ by HCl/NaOH

Pool building with wet and dry laboratories

•dimension = 15 x 8 m, 2 m in depth
•temperature control by heater
•uniform temperature by circulation
Photo of Japanese Domestic Intercalibration in 1998

• Seawater line of 300L/min flow rate.

• Standard gas supply lines to all the pCO$_2$ system.
We will prepare the best set up for inter-comparison after the experience from the 1998 Japanese domestic inter-comparison.

Standard gas (0, 270, 330, 390, 450 ppm CO₂ in air) supply lines to all the pCO₂ system will be installed.

Main water line of 300 L/min will be installed on the deck.

Two Thermosalinograph are installed at the upper and lower stream of the water line to ensure no temperature difference.

Calibrated temperature sensors (0.02 degree C accuracy) will be supplied to all the equilibrators to ensure 0.3 µatm resolution in pCO₂ comparison.
Result of Japanese Intercomparison in 1998

4 μatm pCO$_2$ agreement excluding bubbling system

Bubbling equilibrator with low bias

Stable water temperature
Planned participants

- **On board system**
  - US 2
  - Europe 2
  - Korea 1
  - Japan
    - Tandem (NIES)
    - Shower head

- **Drifter/Mooring system**
  - CARIOCA
  - MBARI