

# Ocean Carbon & Biogeochemistry

*Studying marine biogeochemical cycles  
and associated ecosystems  
in the face of environmental change*

OCB OCEAN ACIDIFICATION SHORT COURSE

NOVEMBER 2-13, 2009

## Choosing the Right Parameters to Measure (Discussion Period)



Goal: To discuss the pros and cons of choosing various carbon parameters for different experimental designs.

But first, some points to consider:

Precision: The ability of a measurement to be consistently reproduced.

Accuracy: The ability of a measurement to match the actual value of the quantity being measured.



High precision, but low accuracy



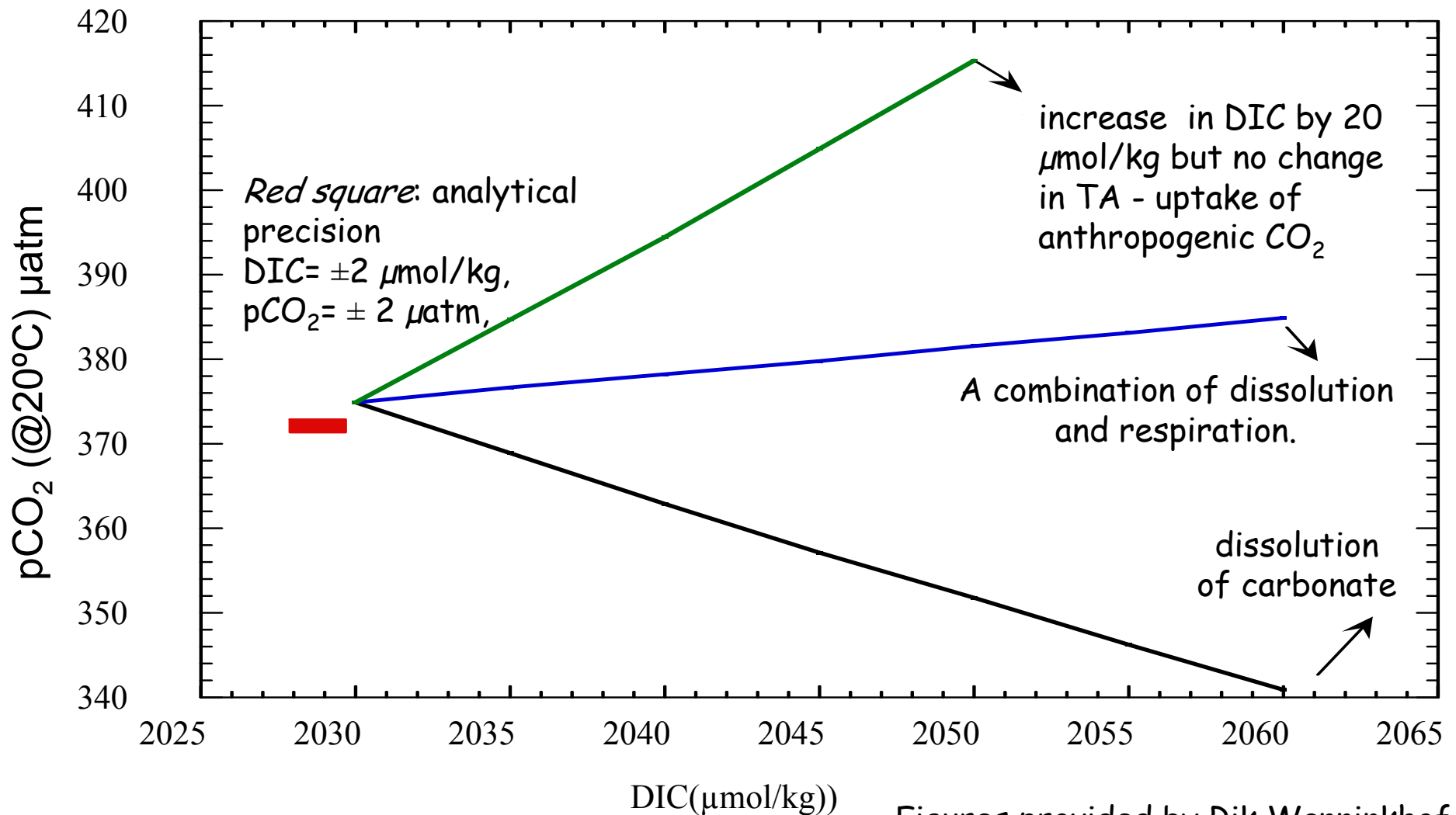
High accuracy, but low precision

Trajectory of  $p\text{CO}_2$  against DIC starting at a condition of:

$\text{DIC} = 2030 \mu\text{mol/kg}$ ,  $\text{TA} = 2300 \mu\text{mol/kg}$ ,  $p\text{CO}_2$  (@20°C) =  $375 \mu\text{atm}$ ,

$\text{pH}_{\text{sw}}$  (@20°C) = 8.058,  $T = 20^\circ\text{C}$ ,  $S = 36$ ,  $\text{PO}_4$ ,  $\text{Si} = 0$

(From  $\text{CO}_2\text{SYS}$  with Mehrbach constant constants as modified by Dickson & Millero )



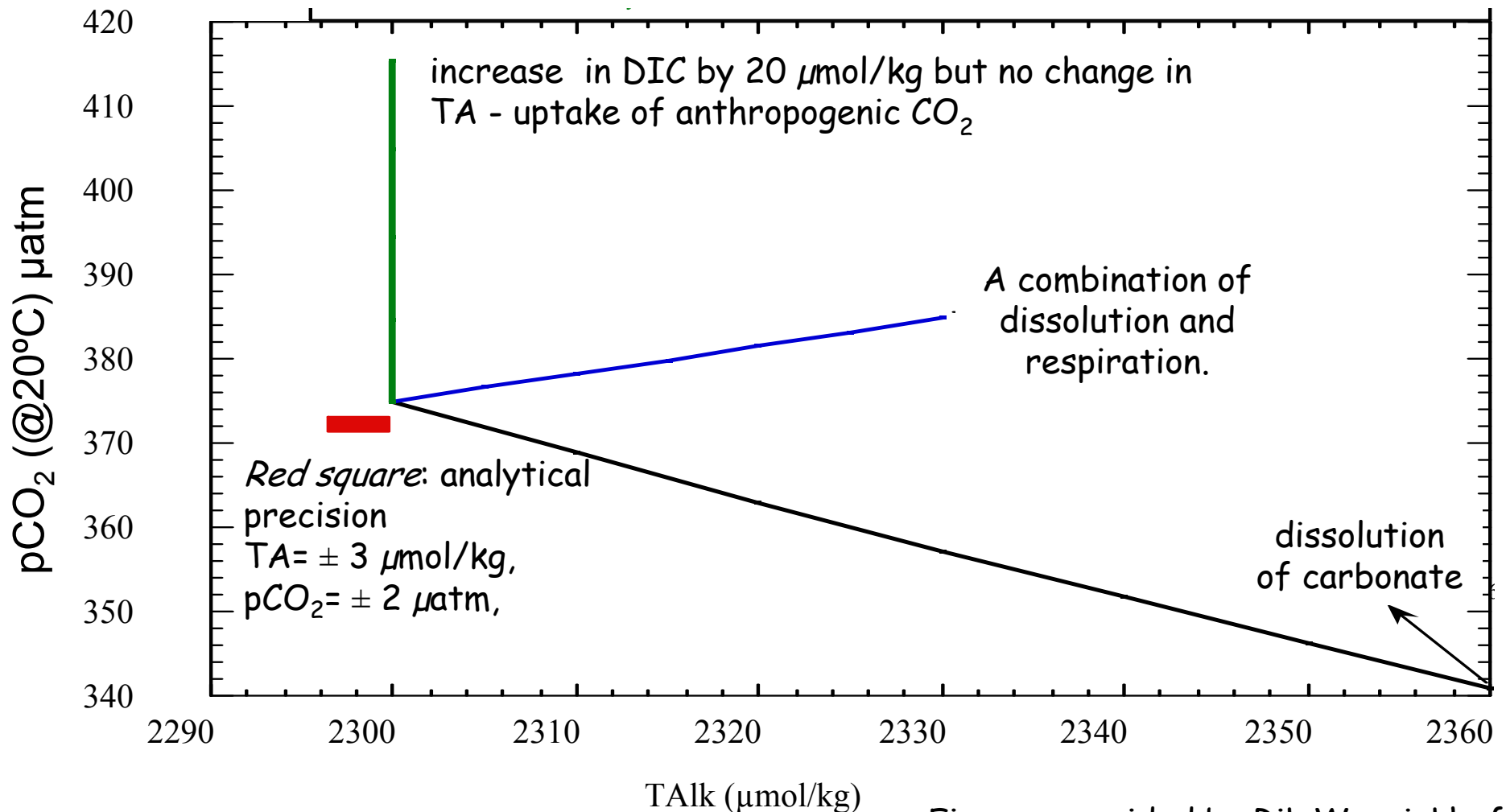
Figures provided by Rik Wanninkhof

Trajectory of  $p\text{CO}_2$  against DIC starting at a condition of:

$\text{DIC} = 2030 \mu\text{mol/kg}$ ,  $\text{TA} = 2300 \mu\text{mol/kg}$ ,  $p\text{CO}_2$  (@20°C) = 375  $\mu\text{atm}$ ,

$\text{pH}_{\text{sw}}$  (@20°C) = 8.058,  $T = 20^\circ\text{C}$ ,  $S = 36$ ,  $\text{PO}_4$ ,  $\text{Si} = 0$

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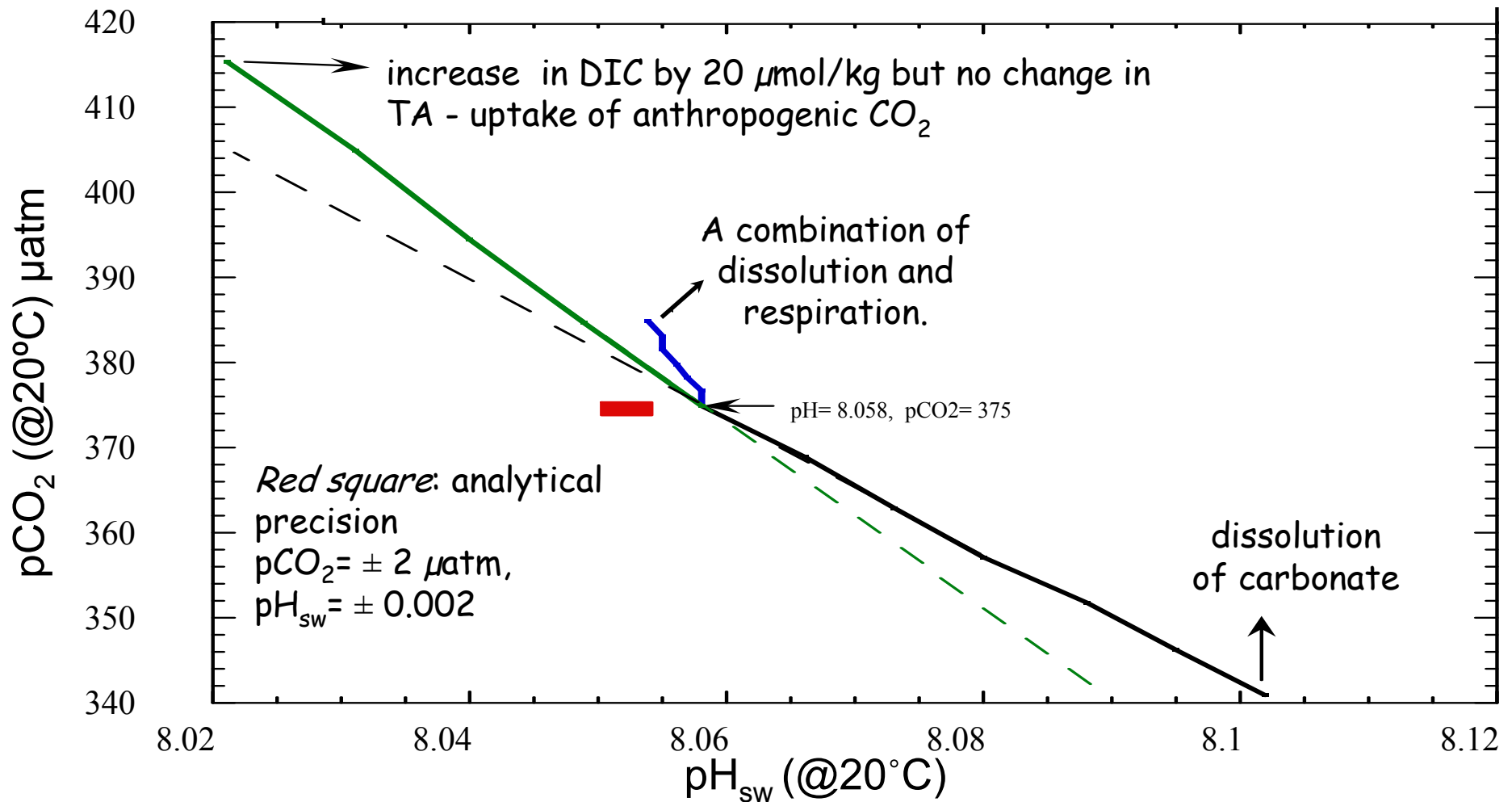
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Figures provided by Rik Wanninkhof

## Other Issues to Consider

|                  | difficulty<br>discrete | cost<br>discrete | sample<br>store | T, P<br>depend | continuous<br>meas. | moored<br>meas. |
|------------------|------------------------|------------------|-----------------|----------------|---------------------|-----------------|
| DIC              | high                   | high             | <3mo.           | No             | res. mode           | in dev.         |
| TA               | mod.                   | Low              | <6mo.           | No             | res. mode           | in dev.         |
| pH               | low                    | mod.             | <2h             | Yes            | com.                | com.            |
| pCO <sub>2</sub> | v. high                | m/v. hi          | <24h            | Yes            | com.                | com.            |

Questions to ask yourself:

Do I need continuous readings or can I store samples for later analysis?

What processes am I trying to characterize?

What are the master variables (e.g. if controlling pCO<sub>2</sub> do you meas. pCO<sub>2</sub>)?

How important are precision and accuracy?

Do the meas. need to be autonomous or can someone oversee analysis?

Consider the cost of buying instruments vs. sending samples for analysis.