Autumn depression in pCO_2 in the Japan Sea and contribution of Changjiang diluted water

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Purposes of this research are…

To supply new CO_2 datasets obtained by vessels of Japan Meteorological Agency in autumn from 2010 to 2014 in the Japan Sea.

To compare CO_2 chemistry in the autumn Japan Sea with that in the western North Pacific.

To discuss the reasons for CO_2 variations in the Japan Sea.

Air-Sea CO_2 flux in the marginal sea

Marginal sea is **NOT** a part of open ocean.

- Riverine input of nutrients, carbonates and particles
- Shallow continental shelves
- Anthropogenic discharge from populated area

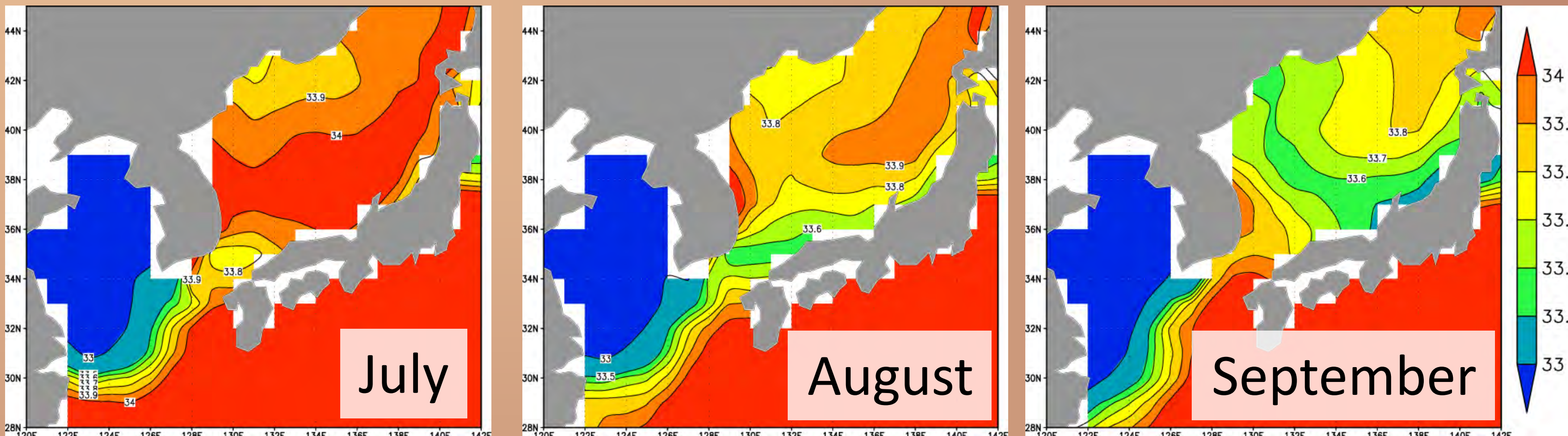
CO_2 sink in the global marginal sea was estimated to 0.19-0.45 PgC/year.
(>40% larger than in the open ocean per area)

[Laruelle et al., 2014]

Geography of the Japan Sea

CDW: Changjiang Diluted Water

Climatology of surface salinity



Discharge of Changjiang River peaks in June - July.

CDW affects biogeochemistry in the East China Sea.

However, <u>its impact on the Japan Sea is still unclear.</u>

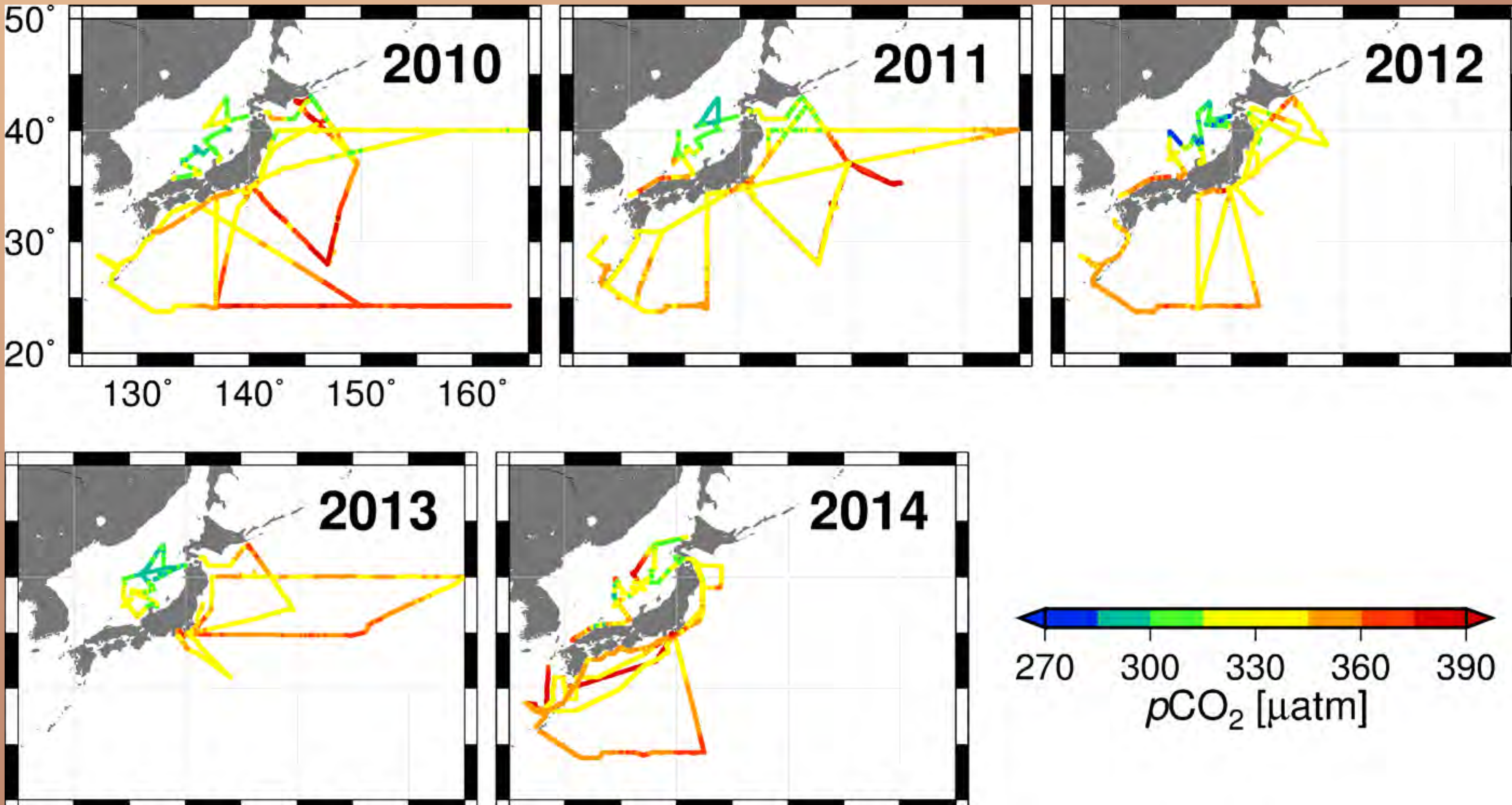
Parameters for analysis

Continuous measurement of surface $p$$CO_2$ with an equilibrator and NDIR (LI-COR LI6252)

Column profile of T, S with CTD (SBE) and subsamples for DIC and TA

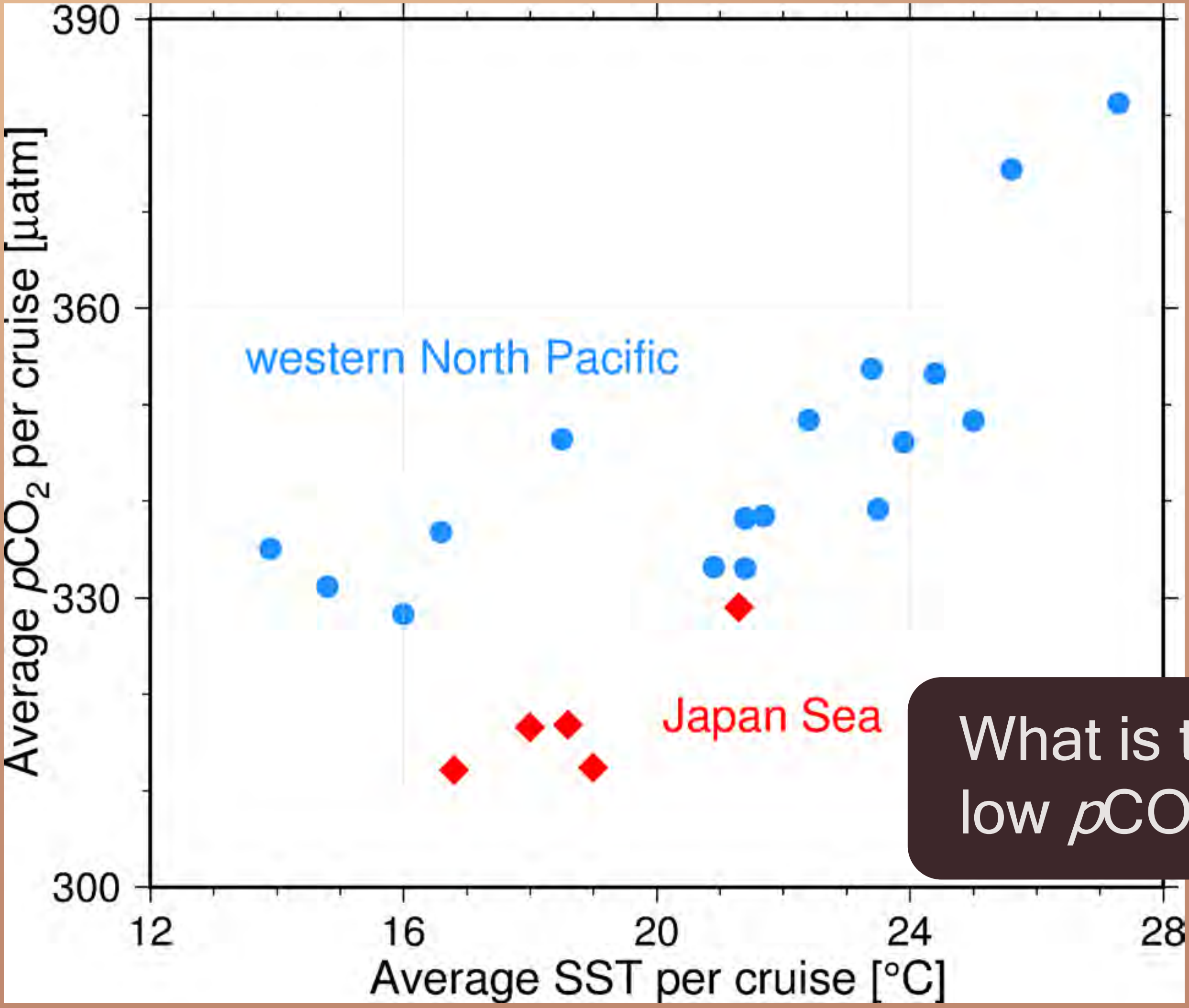
Gridded reanalysis data of climate (JRA-55 by JMA) and of ocean (MOVE-G by MRI)

Surface pCO_2 (between Sep. and Dec.)



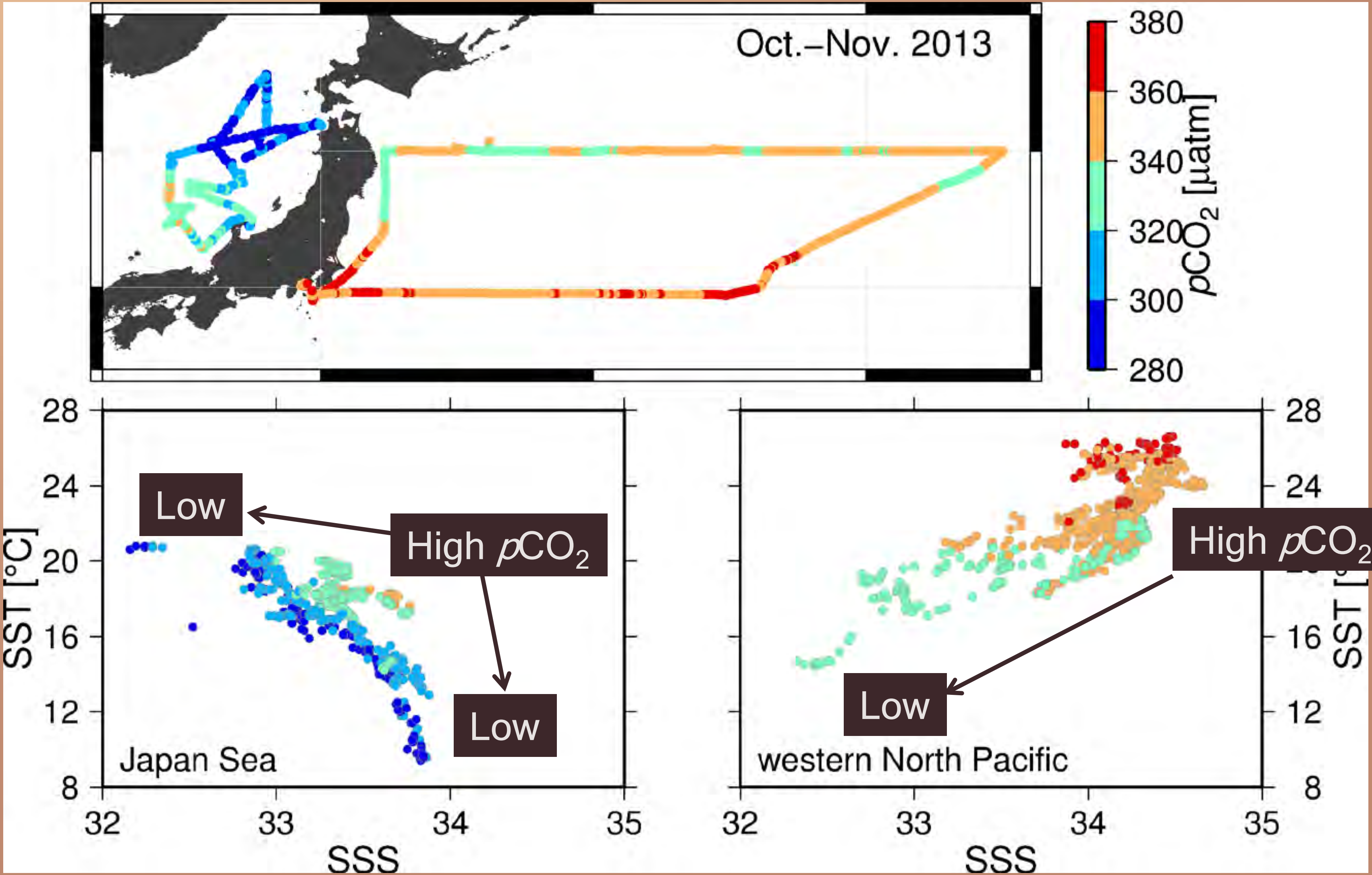
5 cruises in the Japan Sea and 17 in the North Pacific

Relation between SST and pCO_2

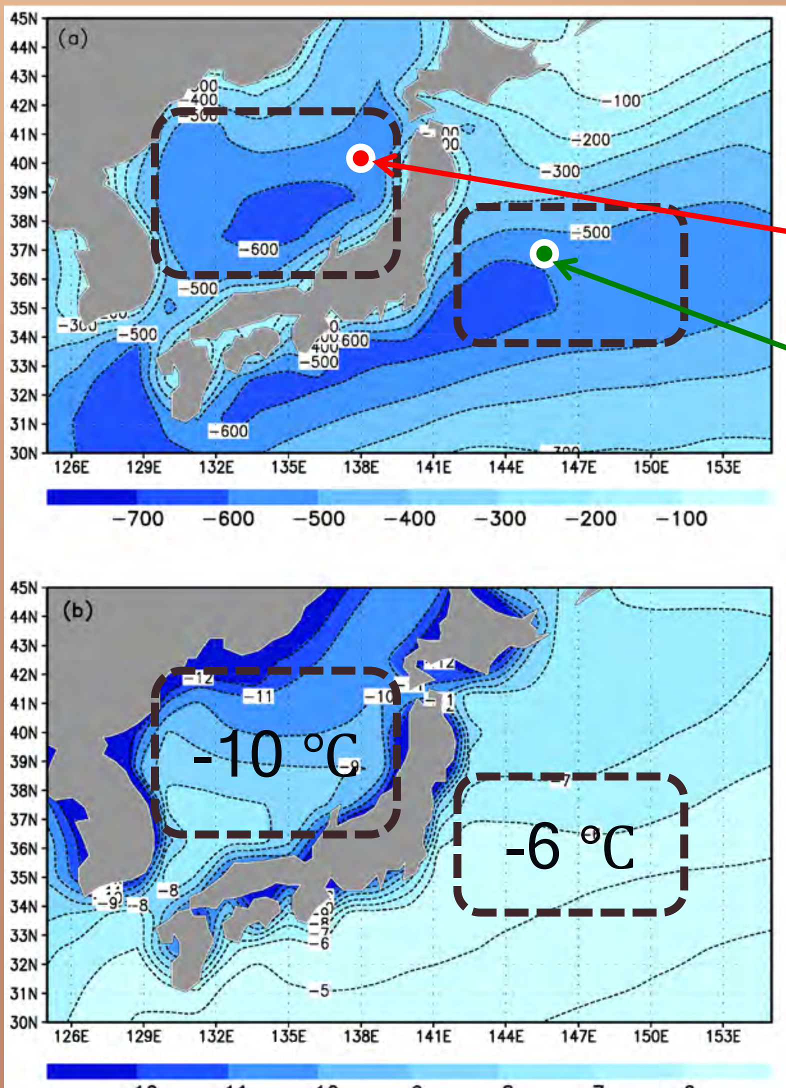


What is the reason for low pCO_2 in the Japan Sea?

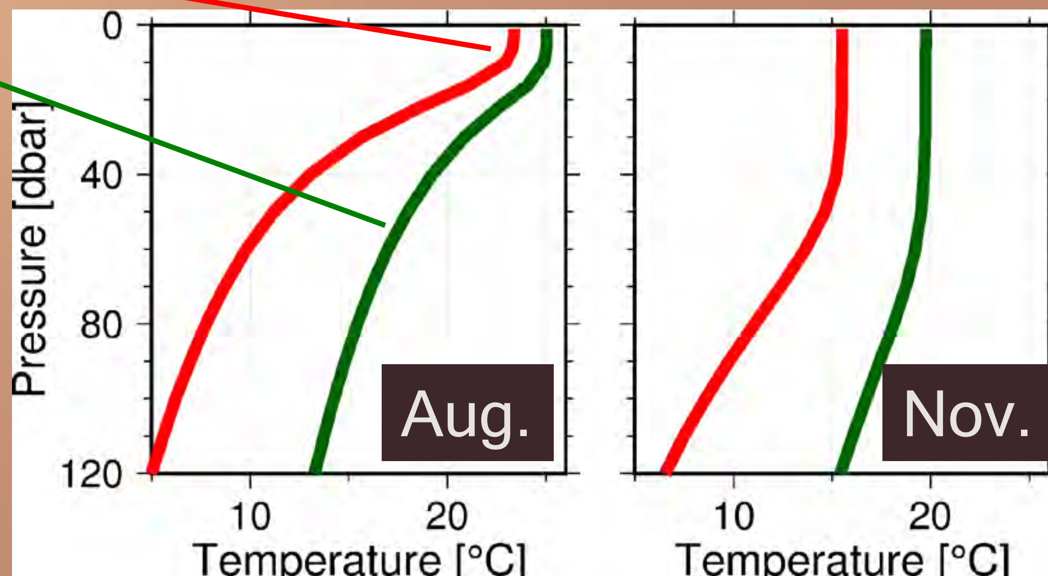
Regional difference in pCO_2



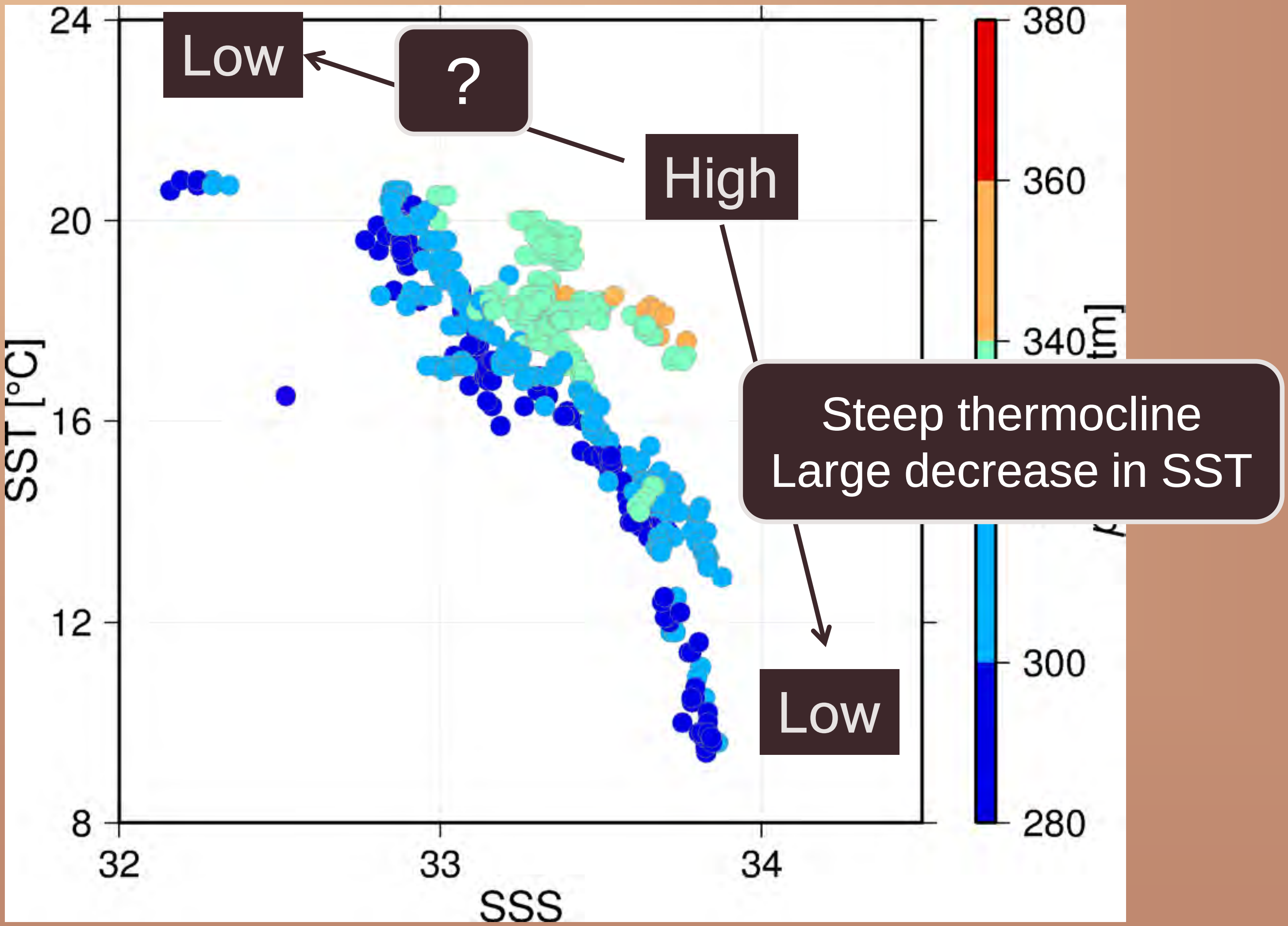
(Top) Heat efflux [Sep.-Nov.]
(bottom) Decrease in SST [Aug.-Nov.]



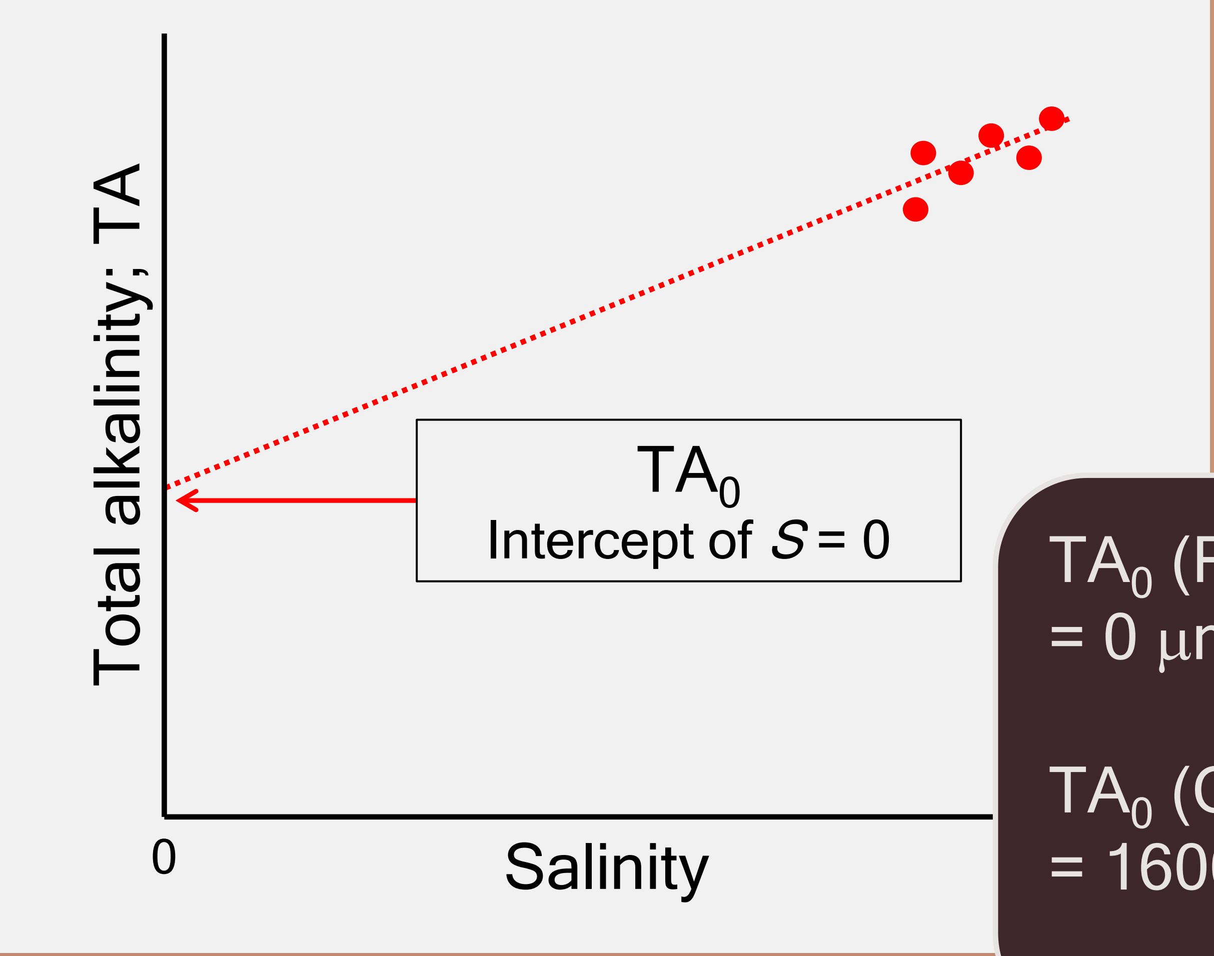
Larger decrease in SST relative to heat efflux



What is another reason for low pCO_2?



Salinity-TA plot

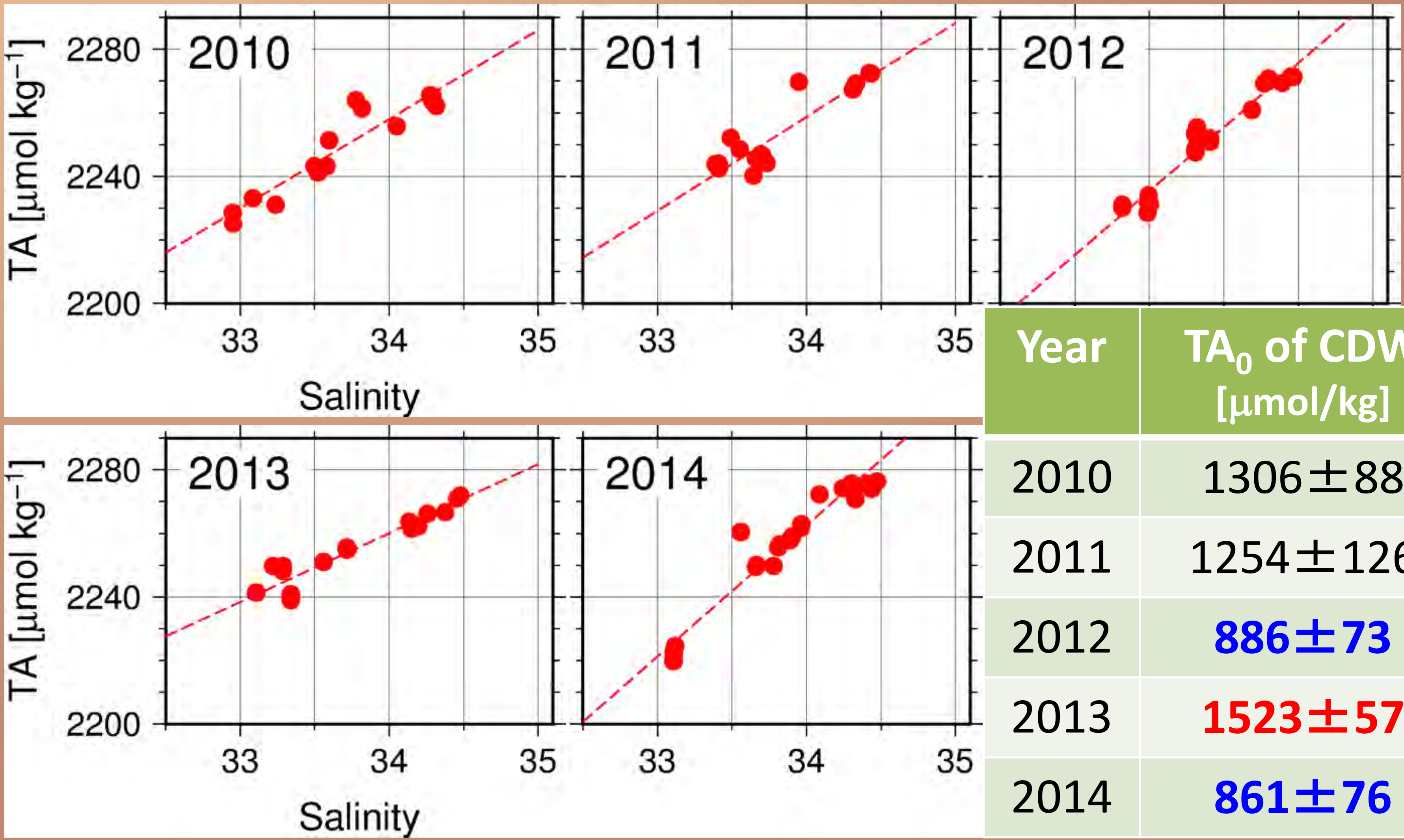


TA_0 (Rain)
= 0 μmol/kg

TA_0 (Changjinang)
= 1600 - 1800 μmol/kg

[Zhai et al., 2007]

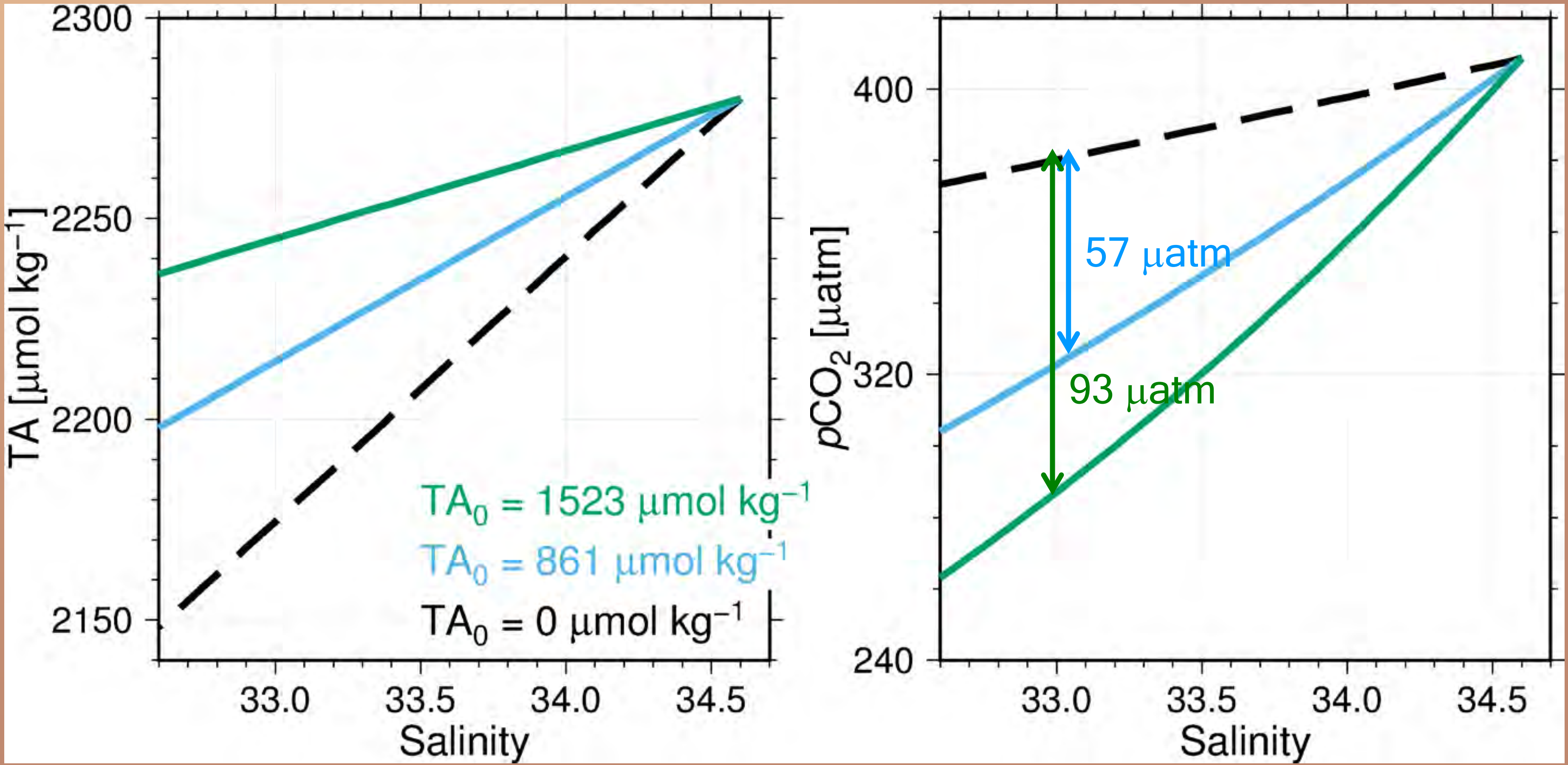
Yearly salinity-TA plot (Temp > 10℃)



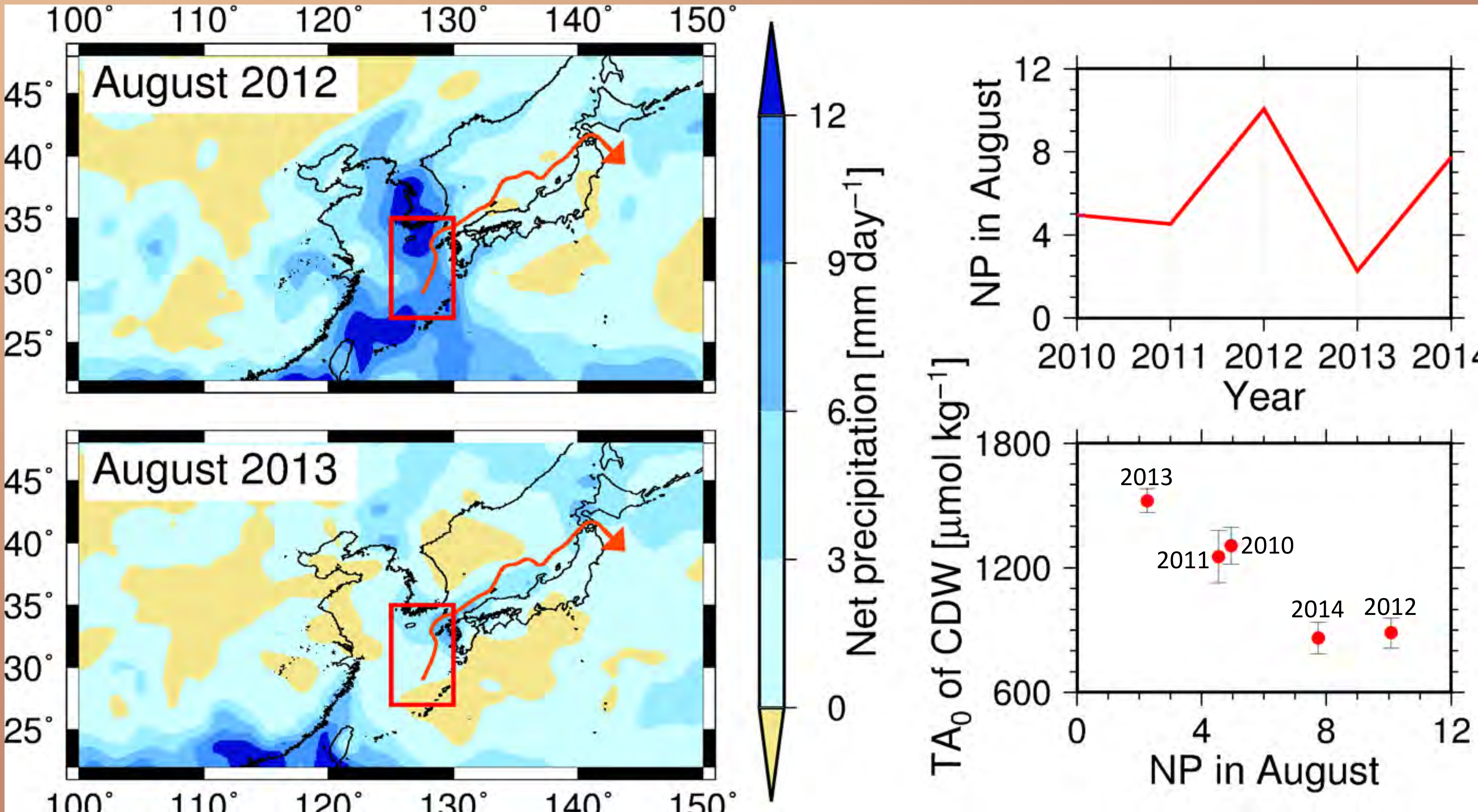
Year	TA_0 of CDW [µmol/kg]
2010	1306±88
2011	1254±126
2012	**886±73**
2013	**1523±57**
2014	**861±76**

TA and pCO_2 with various TA_0

Initial: T = 24 ℃, S = 34.6, DIC = 2000 μmol/kg, TA = 2280 μmol/kg



Dilution by precipitation



Net precipitation (NP) = precipitation - evaporation

Summary and conclusion

In the Japan Sea, autumn pCO_2 was lower than that in western North Pacific in the same season.

Two reasons for low pCO_2 in the Japan Sea

1. Large decrease in SST because of steep thermocline
2. Excess riverine alkalinity in CDW

We revealed complexities of CO_2 chemistry in the Japan Sea (<u>and possibly other marginal sea!</u>).