# 258: Response of Low-Level Clouds to the Kuroshio Extension Front in the Early Summer: Field Measurements 2:30-4:00 5 Jan. 2015 (Mon)

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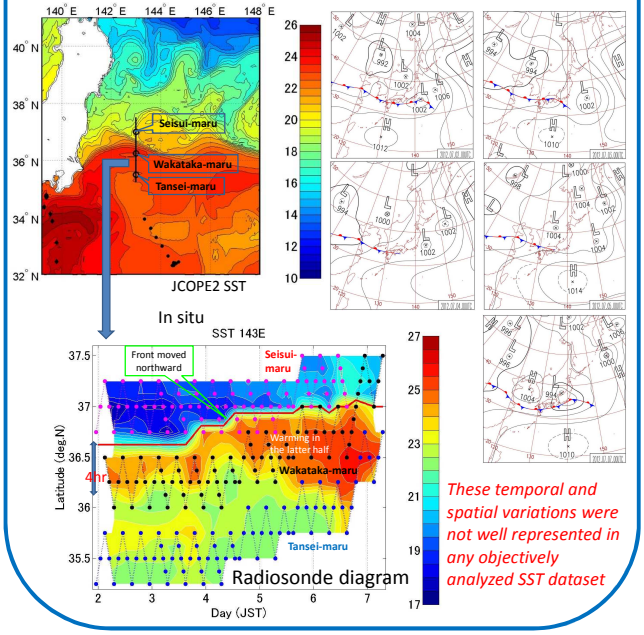
**Atmospheric responses to SST fronts in the mid latitudes are obvious in the cold season. However, some studies indicated that SST fronts definitely affected the overlying atmosphere even in the early summer. We performed intensive observations across the Kuroshio Extension (KE) front using three vessels to capture the atmospheric responses in the Baiu season, with a focus on low-level clouds and downward longwave radiation.**

## Three-vessel Simultaneous Observations in 2-7 July 2012

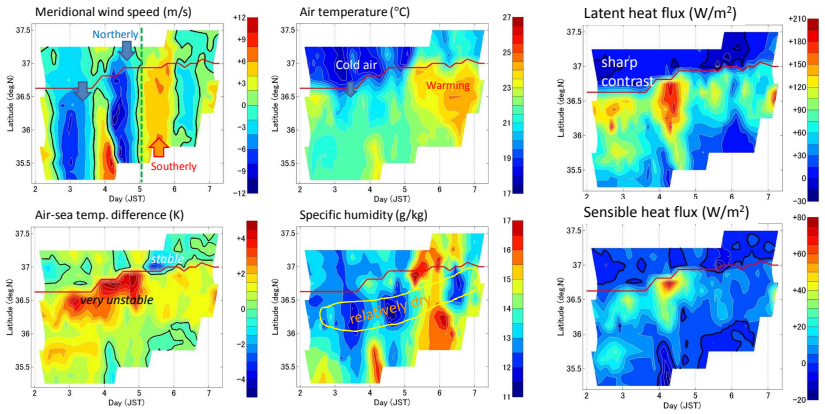
- aligned vessels across the front
- each vessel moved back and forth along 143°E
- radiosondes were launched every 1 or 2 hours




*These temporal and spatial variations were not well represented in any objectively analyzed SST dataset*

Kawai et al. (2015) Journal of Oceanography, in press

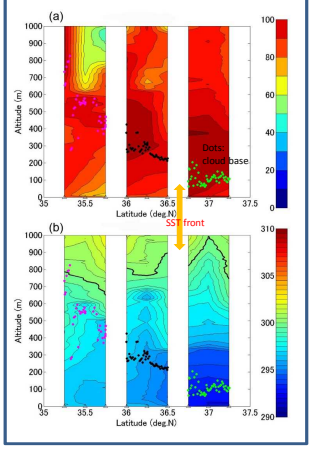
## Near-surface meteorology



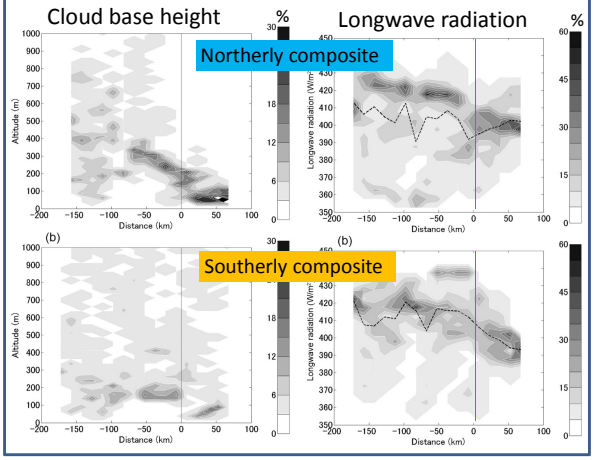

- Northerly in the first half, and changed to southerly. Stability also changed
- SST was highest and humidity was lowest south of the front
- Latent heat flux peaked about 50 km away from the front

## Example on 3 July (07-11 JST)

*Higher cloud base south of the front*




## Histogram throughout the period



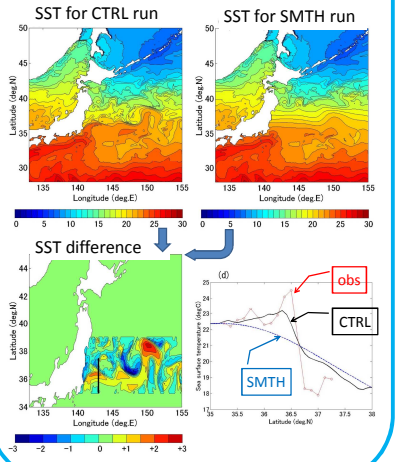

- Meridional contrast of cloud base height was obvious in the northerly cases
- Meridional contrast can be seen in downward longwave radiation (DLR), too
- DLR was sometimes low south of the front in the northerly cases due to less water vapor

Examine the effect of the SST front

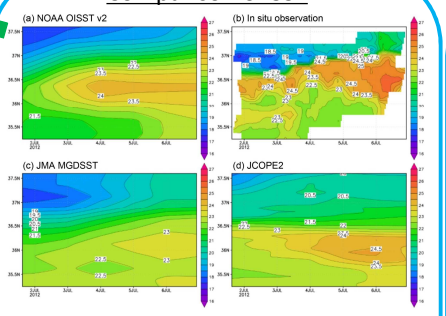
## Model experiments

- Two kinds of regional model with a horizontal resolution of 1/12°
- **JCOPE2 (3DVAR ocean reanalysis, 1/12°) SST** was used
- SST was smoothed around the KE for the smoothed run (SMTH)

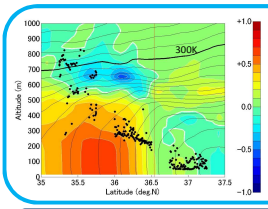
| | IPRC-RAM | WRF |
|---|---|---|
| Hydrostatic approximation | Yes | No |
| Vertical resolution | 38 levels | 58 levels |
| Lateral boundary | MSM (JMA) | NCEP-FNL |




## Comparison of SST



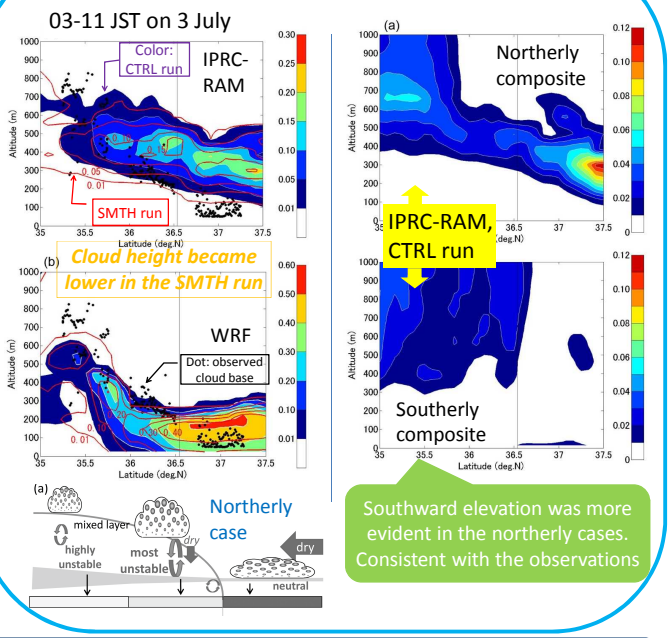

- None of these objectively analyzed SSTs can well reproduce the observed one.
- JCOPE2 SST is better for the experiments because the meridional gradient was the steepest.




03-11 JST on 3 July

IPRC-RAM, CTRL run
Contour: **virtual potential temp.** (0.5K)
Color: difference from SMTH run

## Cloud liquid water (g/kg)




Southward elevation was more evident in the northerly cases. Consistent with the observations

**The observations captured fine structural changes of the MABL across the SST front, which were particularly evident in cloud base height and downward long-wave radiation (DLR) at the surface.**
**High-resolution atmospheric model experiments conducted with and without the frontal SST gradient have confirmed its critical importance for the MABL structure and low-level clouds.**