

Low-level wind jets in the Tsugaru Strait by high-resolution satellite observations and numerical simulations

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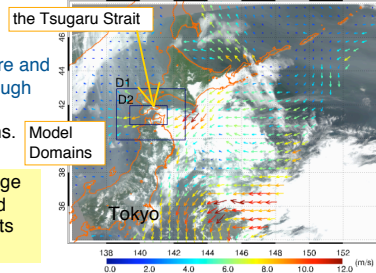
Introduction

- The summertime easterly wind associated with the Okhotsk High continuously accompanies low-level cool and wet air to northern Japan.
- The wind blows into a sea-level terrestrial gap (Tsugaru Strait), promoting the formation of the localized wind jets.

Goal

This study first addresses structure and evolution of the wind blowing through the Tsugaru Strait using satellite observations and MM5 simulations.

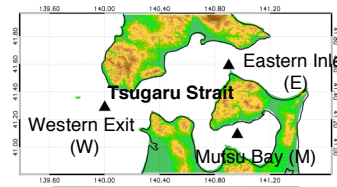
MODIS visible composite image (2003-06-08T1216+0900) and SeaWinds wind measurements (2003-06-08T1033+0900).



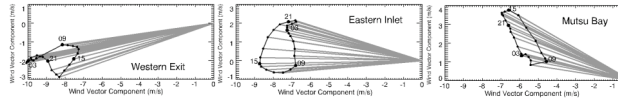
Diurnal variation of the wind jets

Hereafter, we shall look into the diurnal wind variation, focusing on the three locations indicated by the triangles.

- Wind speeds are maximum.
- They are on the main routes of wind.

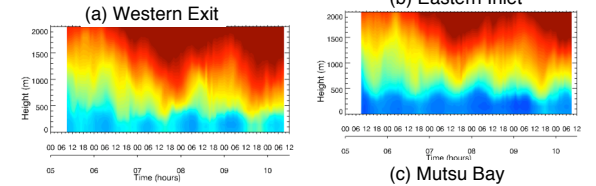


Diurnal Variations of wind and air temperature



Hodographs of diurnal variation of mean wind during the study period. (Diurnal variations are clear.)

Vertical structures of the atmosphere



Time-height diagrams of potential temperature. The mixed layer heights are:
 (a) Western exit: ~300m, warmer
 (b) Eastern inlet: 400-500m
 (c) Mutsu Bay: ~500m, most regular diurnal cycle

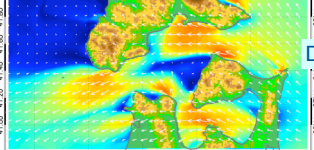
Case Study Selection: June 5-10 2003

Diurnal Variations & Two Routes of Wind

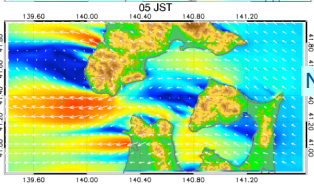
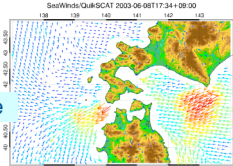
SeaWinds Observations

MM5 simulations (10-m wind)

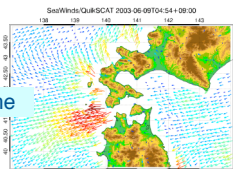
17 JST



Daytime

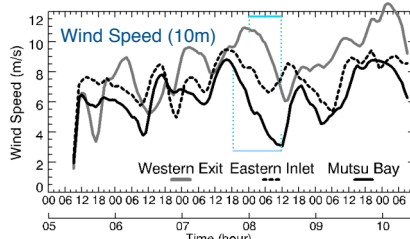
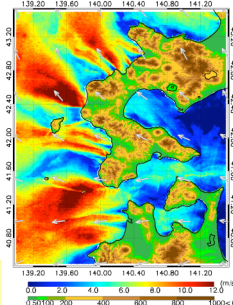


Nighttime

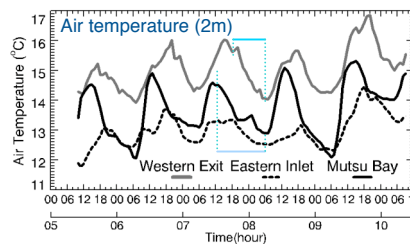


- There are **two main routes** of low-level wind passages.
- The low-level easterly winds show **regular diurnal cycles** with a time lag between east and west of the strait.
- The satellite wind observations verify the structures and diurnal variations of the simulated winds.

RADARSAT-derived wind field (2003-06-09T05:44+0900).

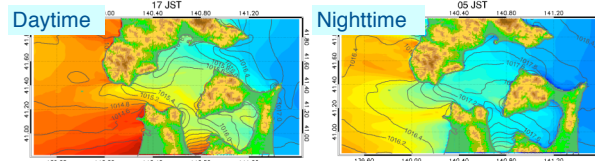


- Clear diurnal variations in time-series of wind speed and air temperature.
- The time lags between wind speed and air temperature (~6 h).



- M: larger amplitude
- E: the smallest amplitude
- W: It reflects the wind confluence and air temperature rising due to the SST.

Cold air intrusion and the resulting SLP fields

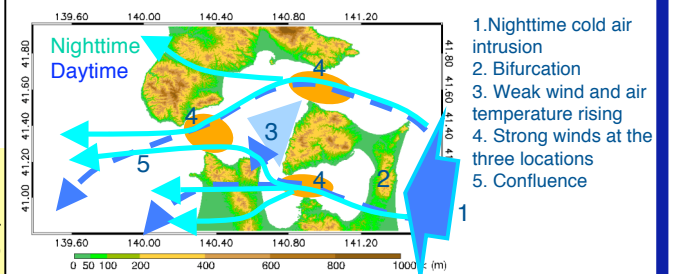


Mean fields of 2-m air temperature and SLP. Higher SLP corresponds to lower air temperature. This suggests that cold air advection determines the SLP, inducing gap-exiting winds.

Summary

We have presented a case study to focus on the strong wind formation and its diurnal variation in the Tsugaru Strait under the easterly wind.

Wind Structure in the strait



Diurnal Variations of wind in the east and west



Future Direction

- We have to investigate the cause of the diurnal cycle of low-level cold air intrusion and its transformation in passing through the strait.
- It is important to look into the dynamics responsible for the gap winds and the differences of the gap winds at the three locations.