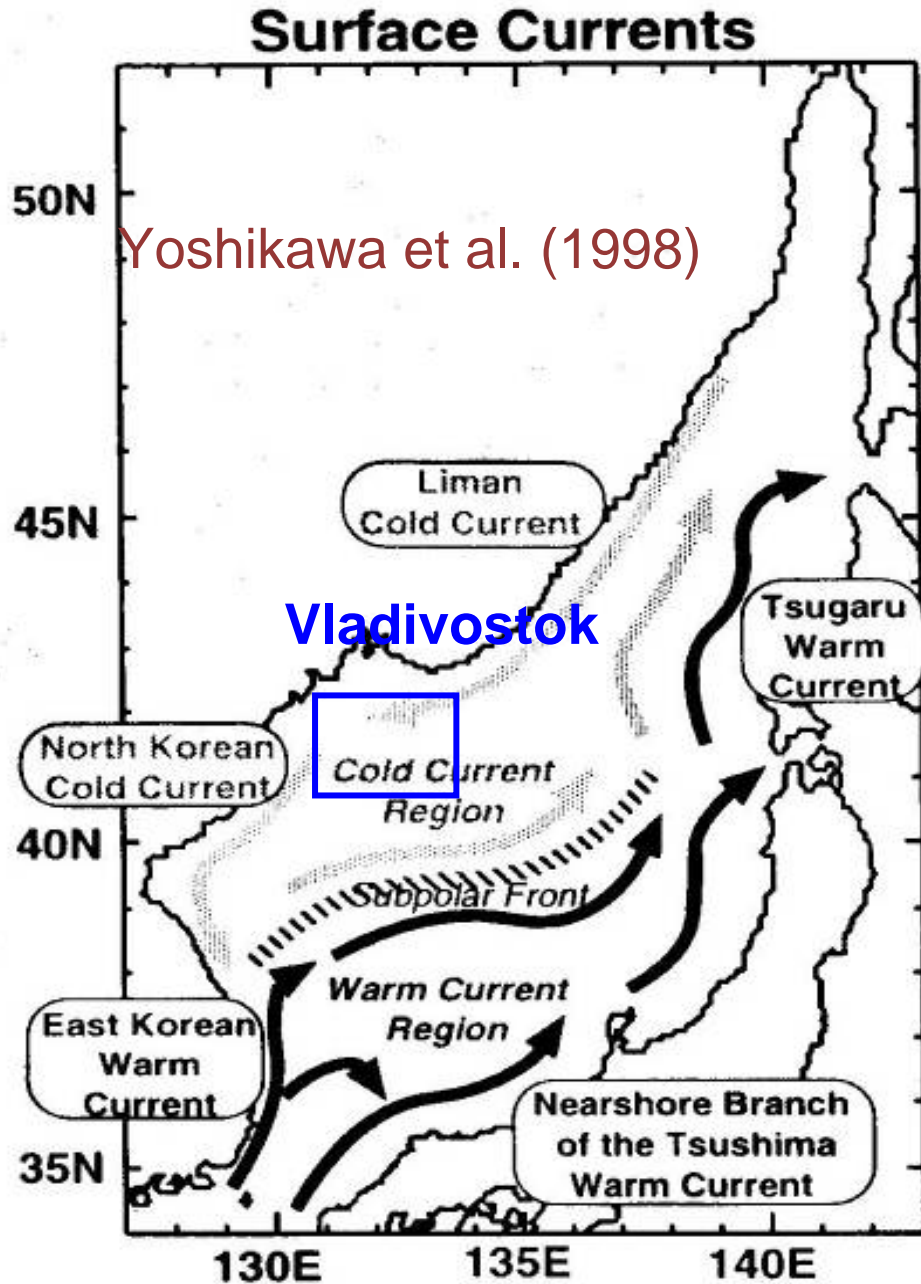


Interdecadal Oscillation of Japan Sea Proper Water related to Arctic Oscillation

Yanlin Cui ¹ · Tomoharu Senju ²

1. Interdisciplinary Graduate School of Engineering Sciences, Kyushu University
2. Research Institute for Applied Mechanics, Kyushu University

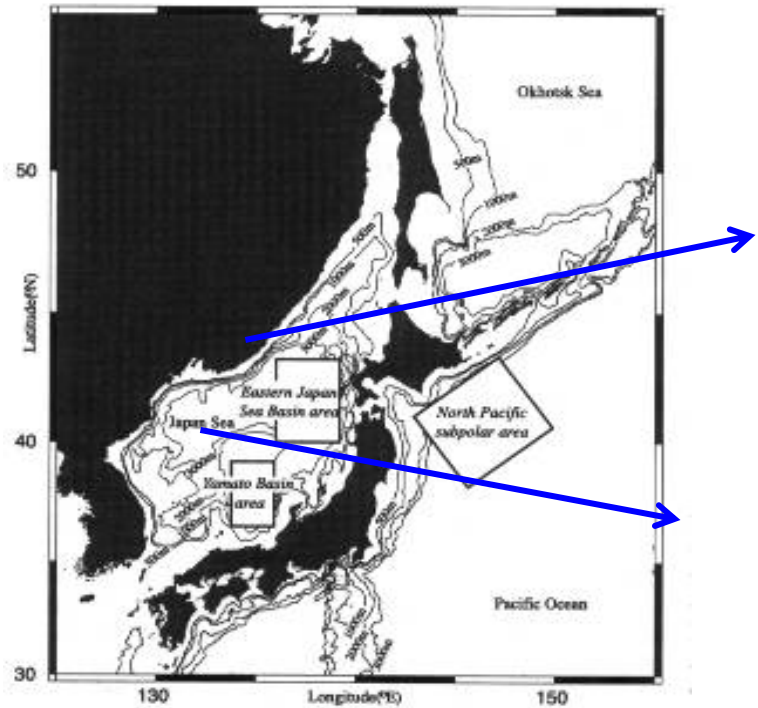
Japan Sea Proper Water (JSPW)



- Uda, 1934
- $0\text{ }^{\circ}\text{C} < \theta < 1\text{ }^{\circ}\text{C}$
- $34.0 < S < 34.1$
- Rich Dissolved Oxygen (DO)
- The most homogeneous water of the adjacent seas in the world ocean (Worthington, 1981)

Long-term variation of JSPW

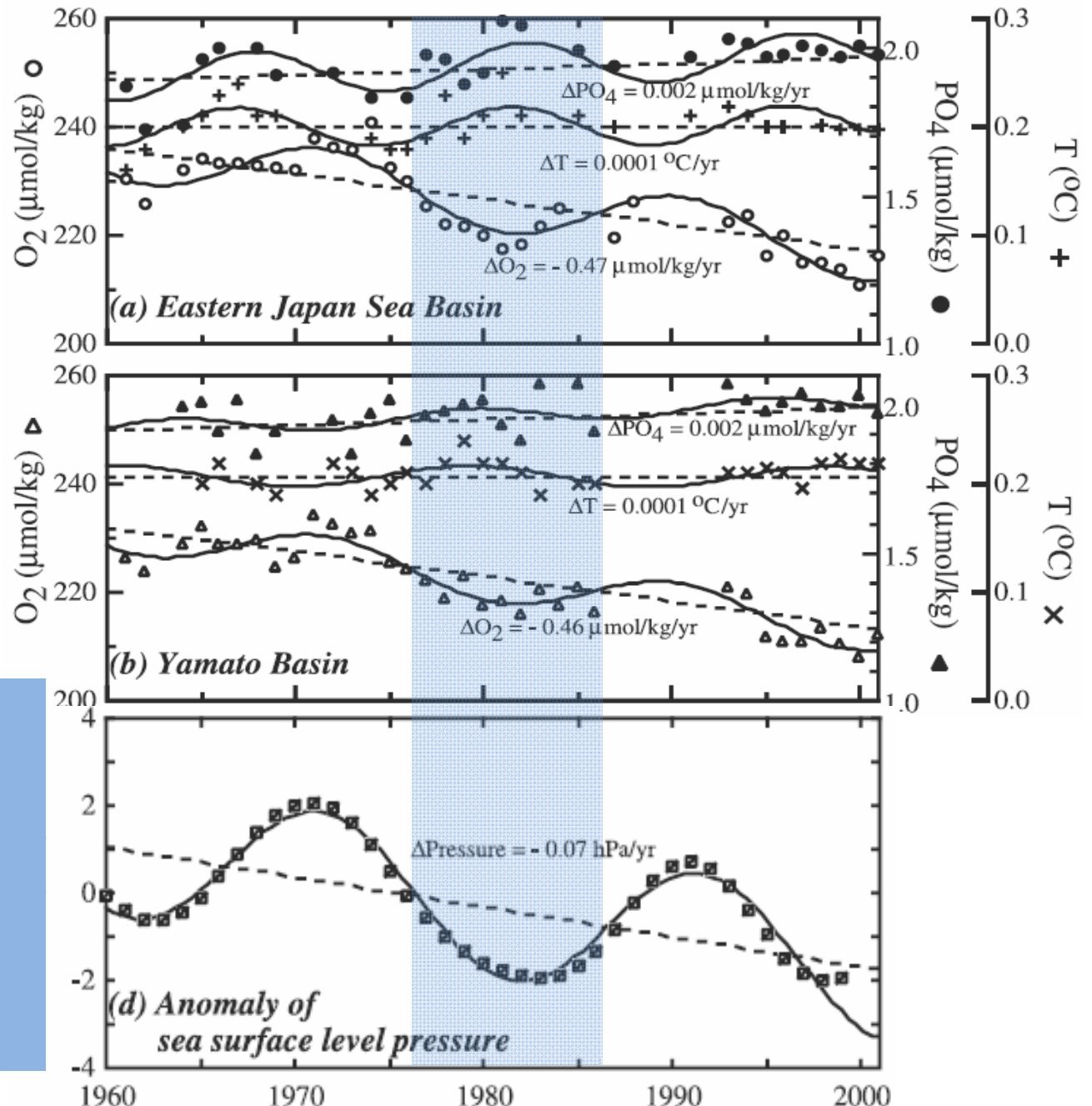
Background



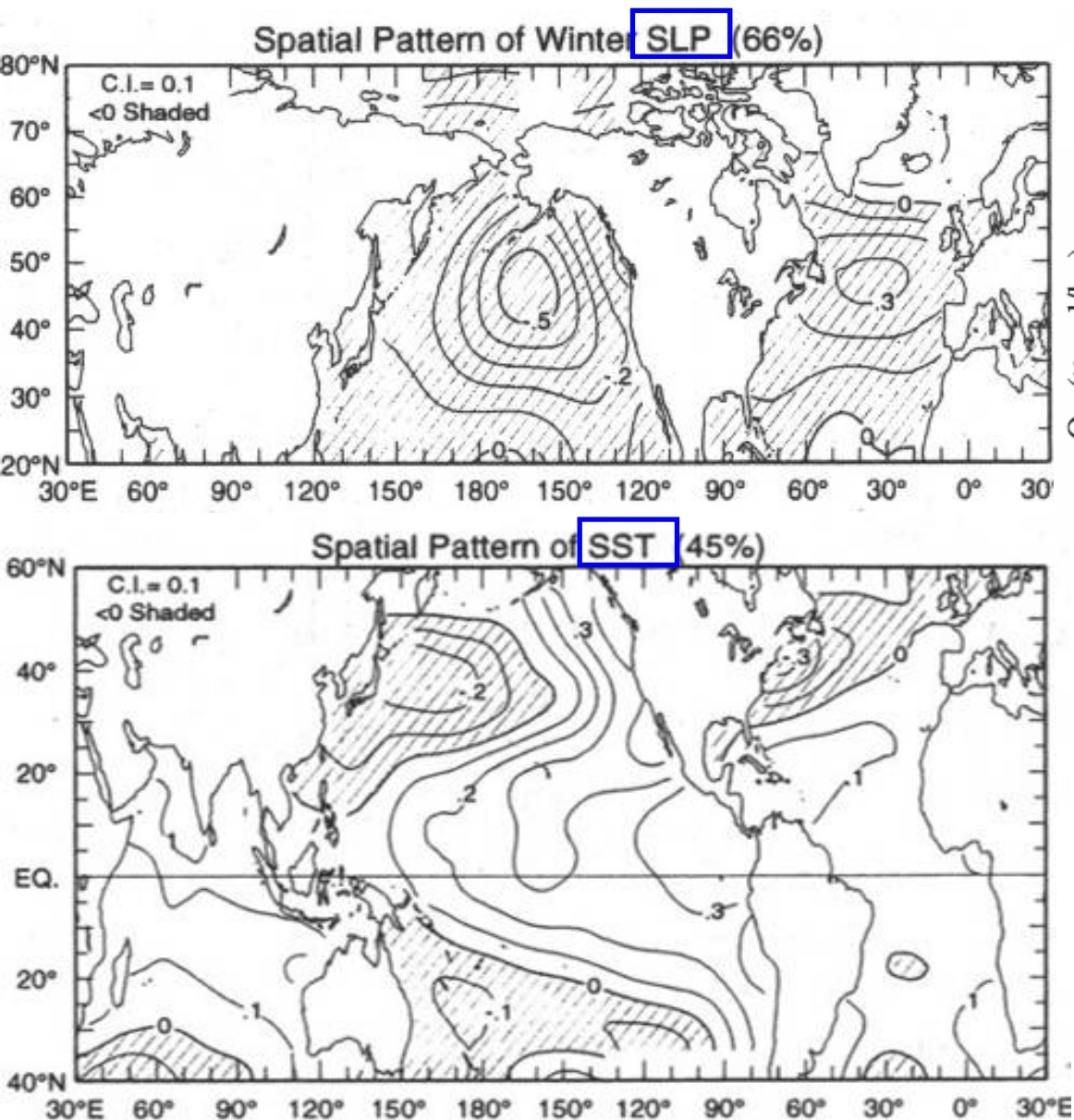
Watanabe et al. (2003)

North Pacific Index (NPI):

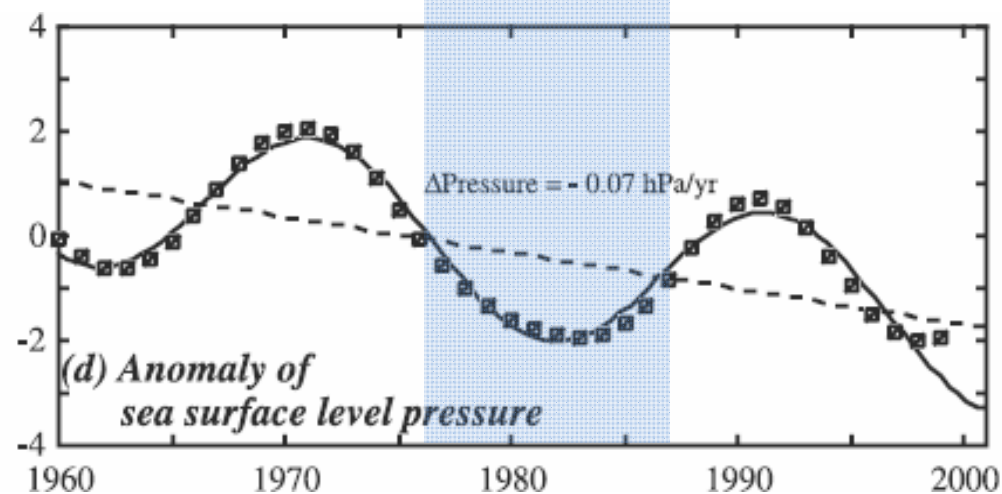
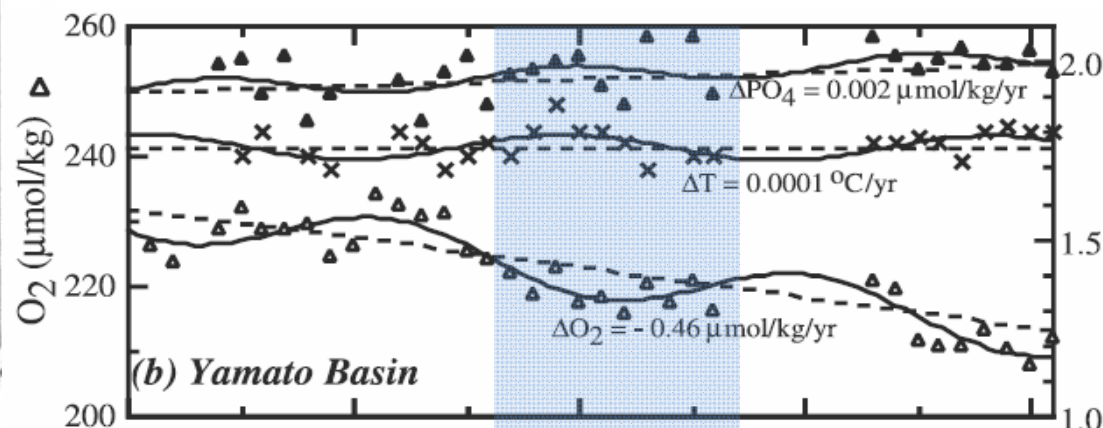
- area-weighted SLP over the region 30°N-65°N, 160°E-140°W
- index for the intensity of the Aleutian Low



How to explain this contradiction?

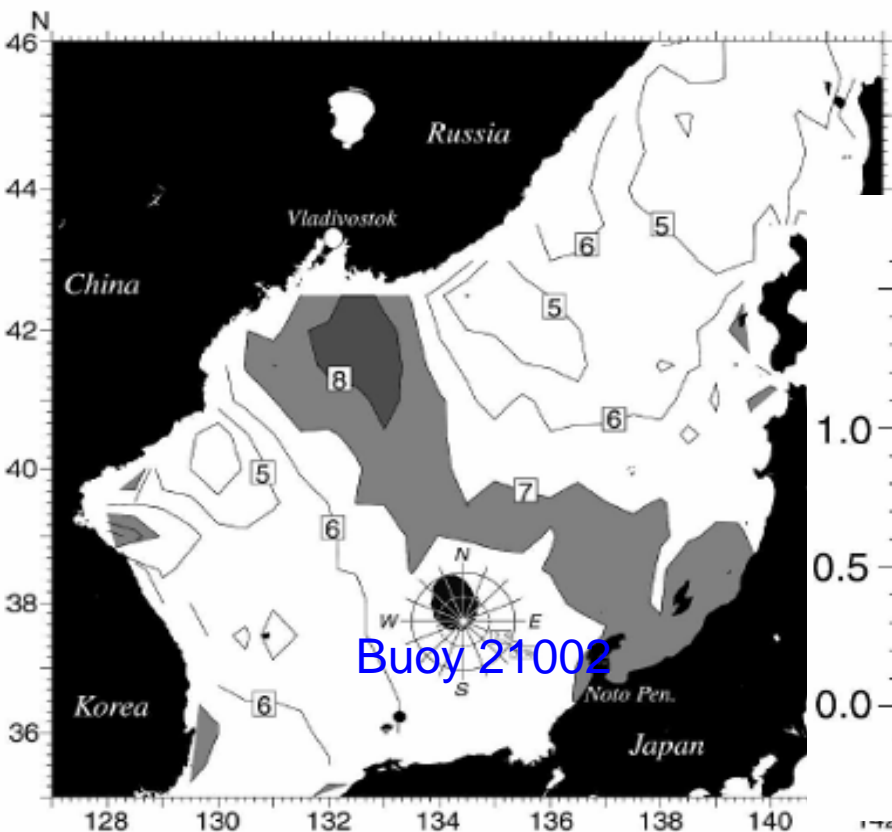


White and Cayan (1998)



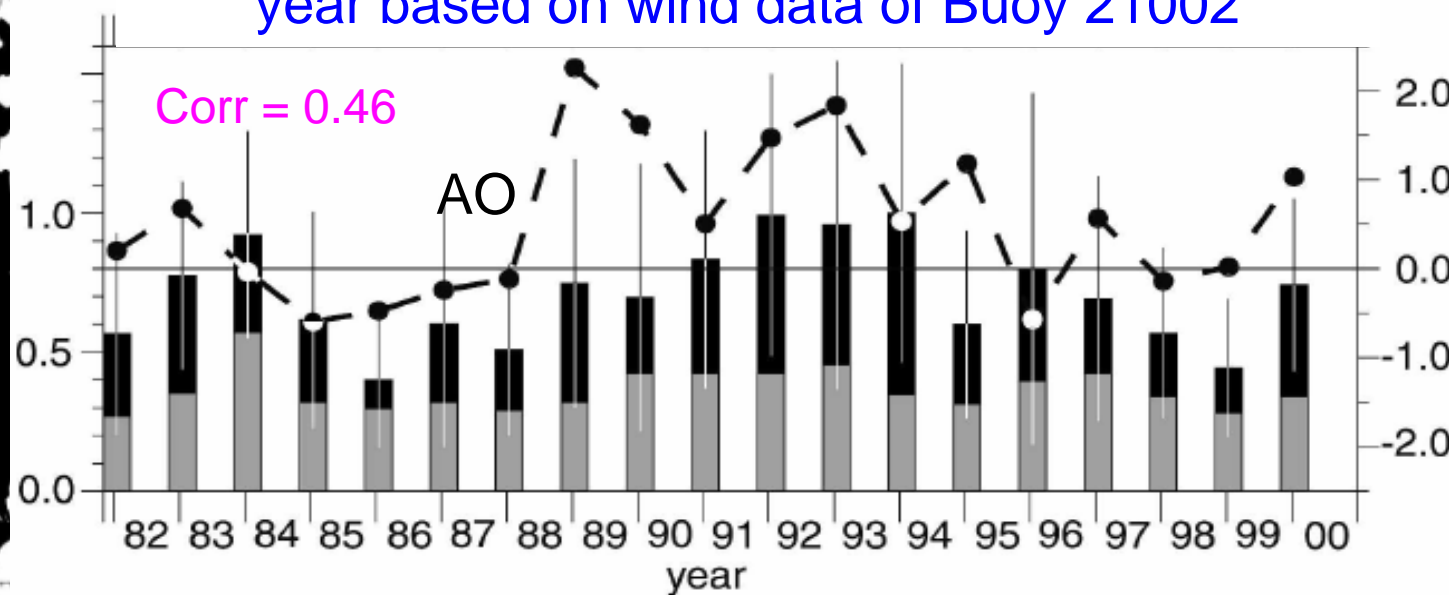
Watanabe et al. (2003)

Long-term variation of wind in Japan Sea



Isobe and Beardsley
(2007)

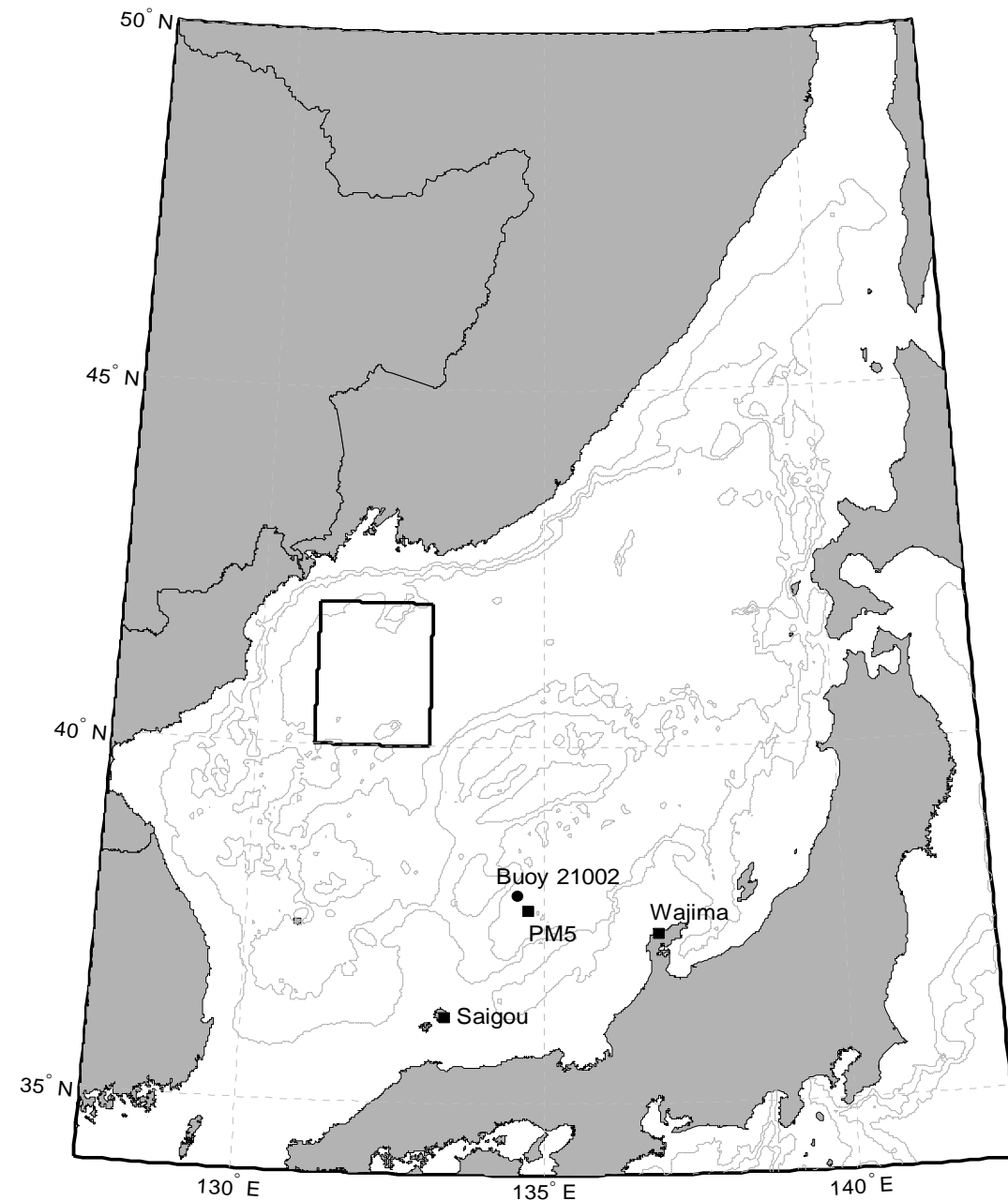
Scale-averaged (5-15days) Wavelet Spectra averaged over time November-March in each year based on wind data of Buoy 21002



Arctic Oscillation (AO):

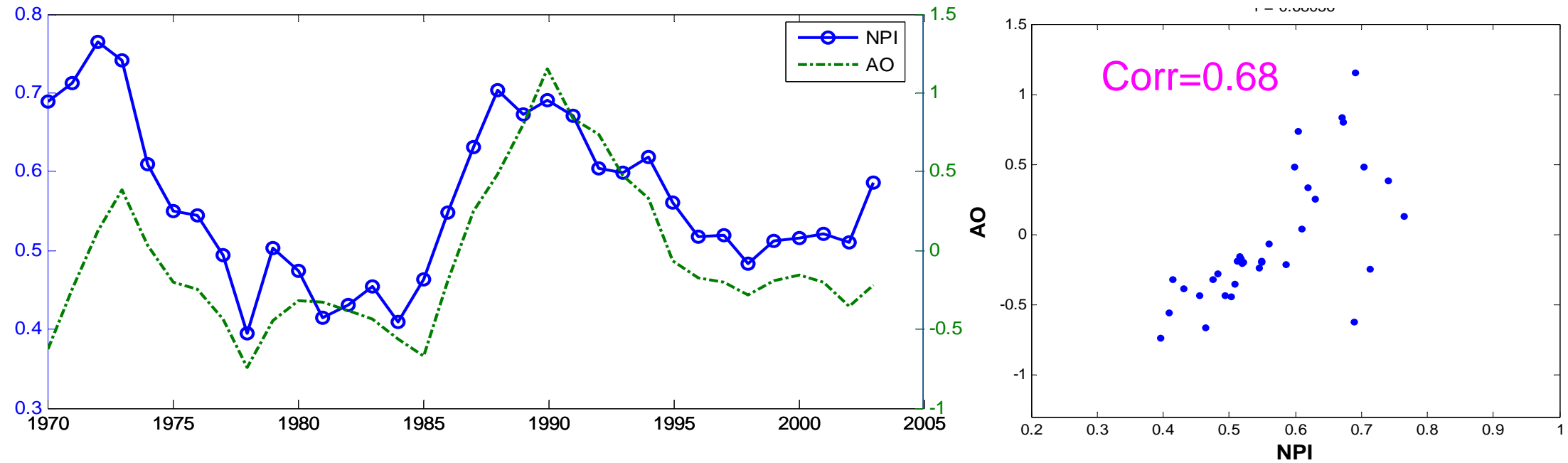
- the first EOF of Northern Hemisphere (20-90°N) winter SLP data.
- +AO → Weak Aleutian Low

Data



- SST (Minobe et al., 2004)
 - DO (PM5)
 - Wind (JMA Sta. & Buoy21002)
 - AO Index (NOAA)
 - NPI (NASA)
- Winter: Dec, Jan, Feb
- 5-yr running mean

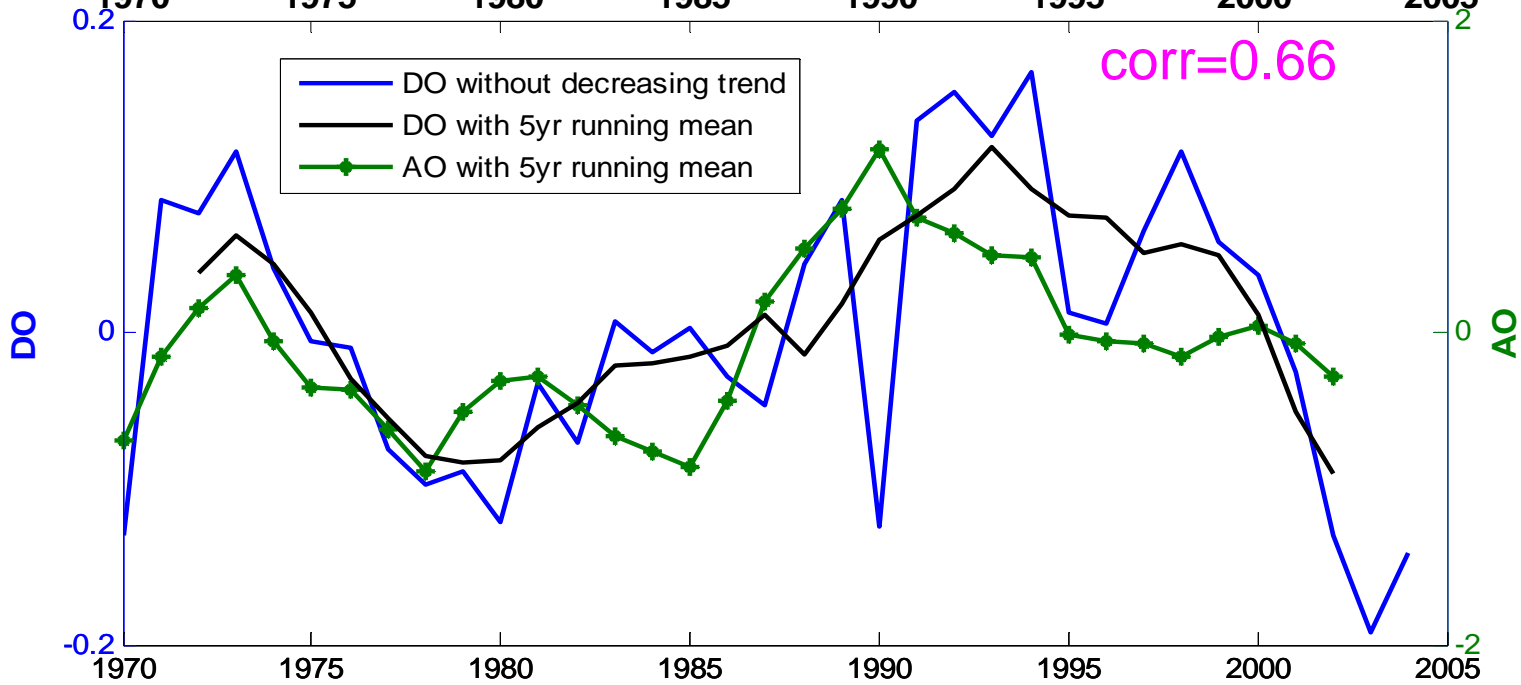
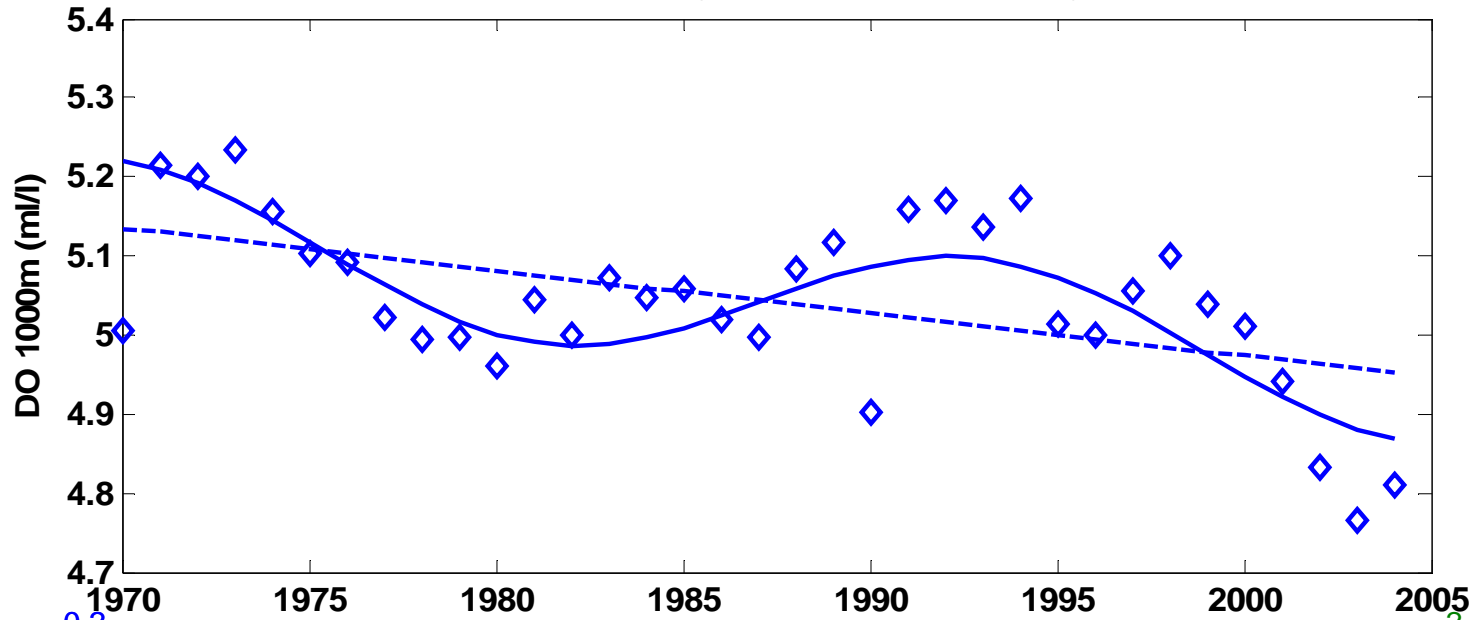
North Pacific Index & Arctic Oscillation



Hereafter, AO will be used only.

AO & DO

Period: 23.3751yr; Rate:-0.0053852ml/l/yr



Wind Sta. Chosen

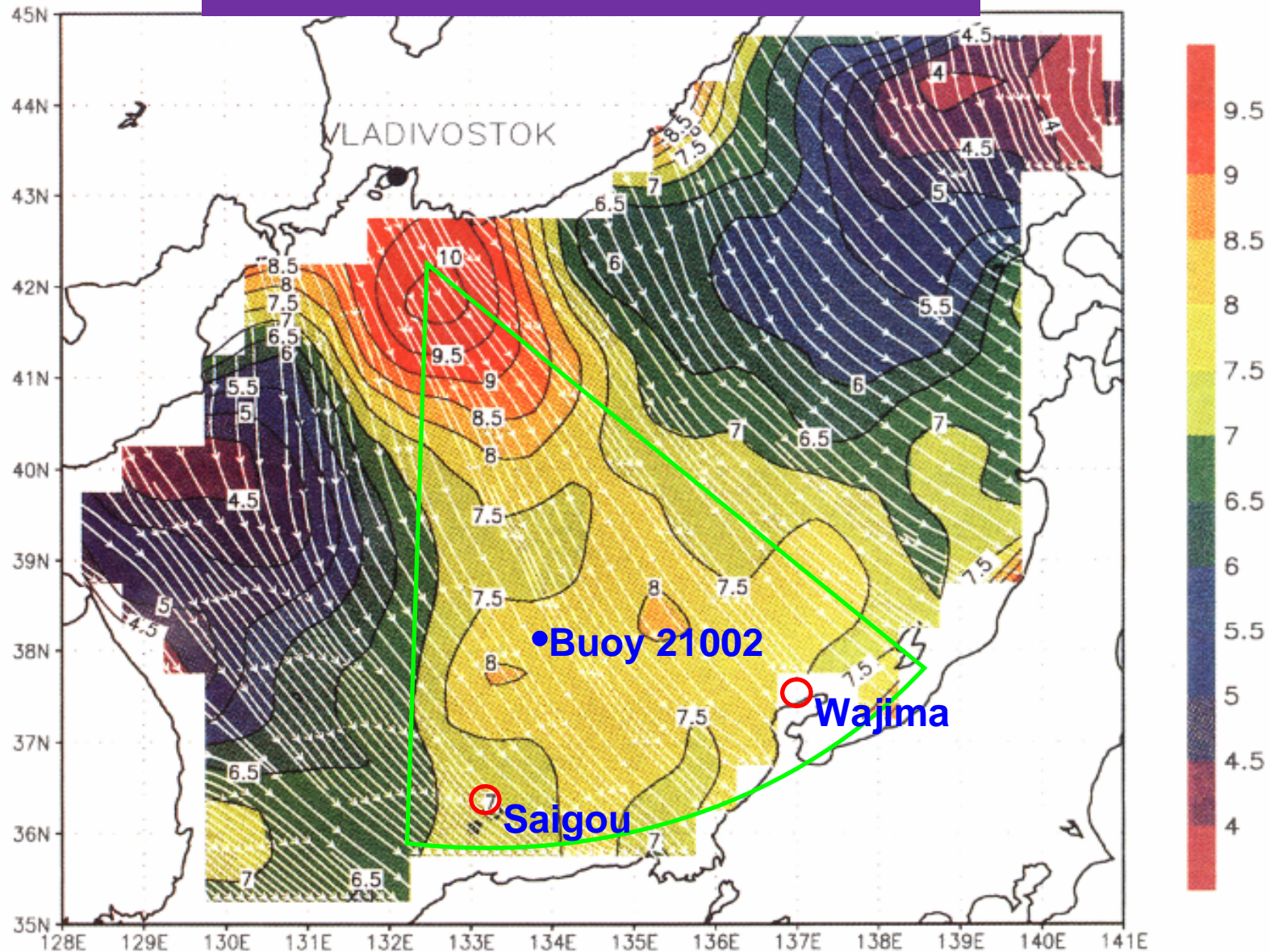
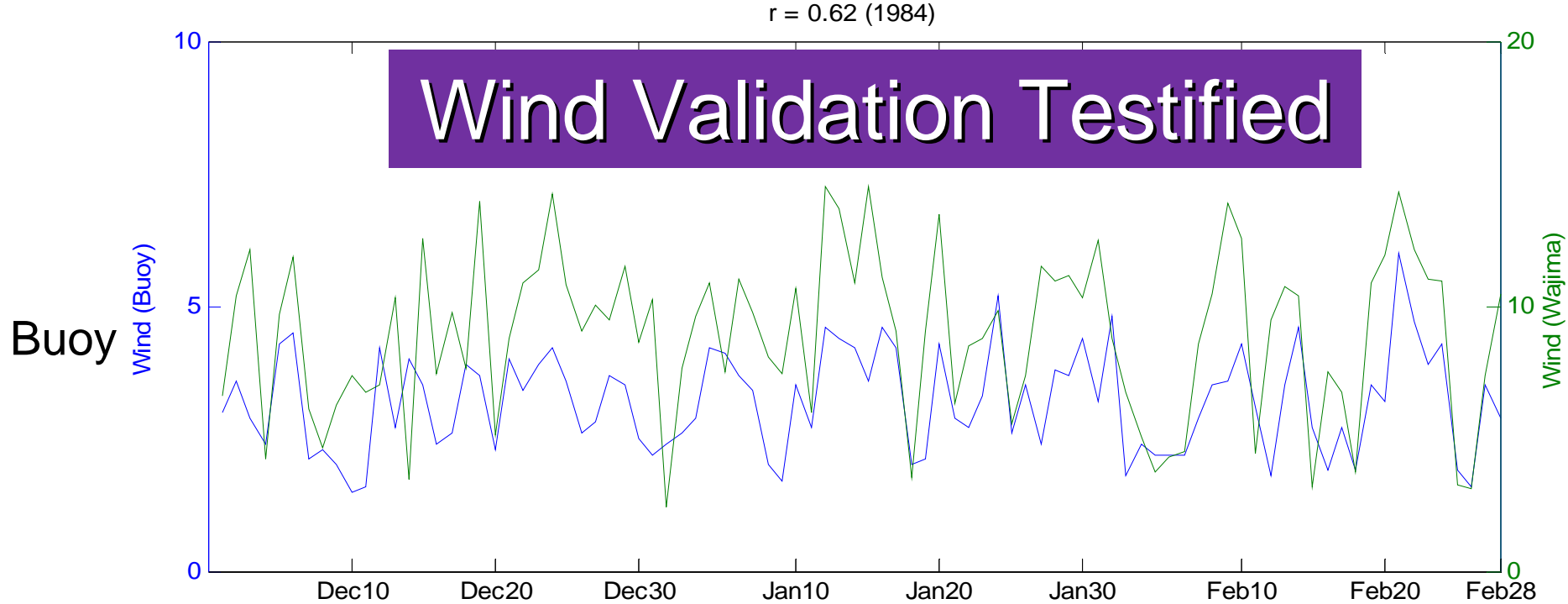


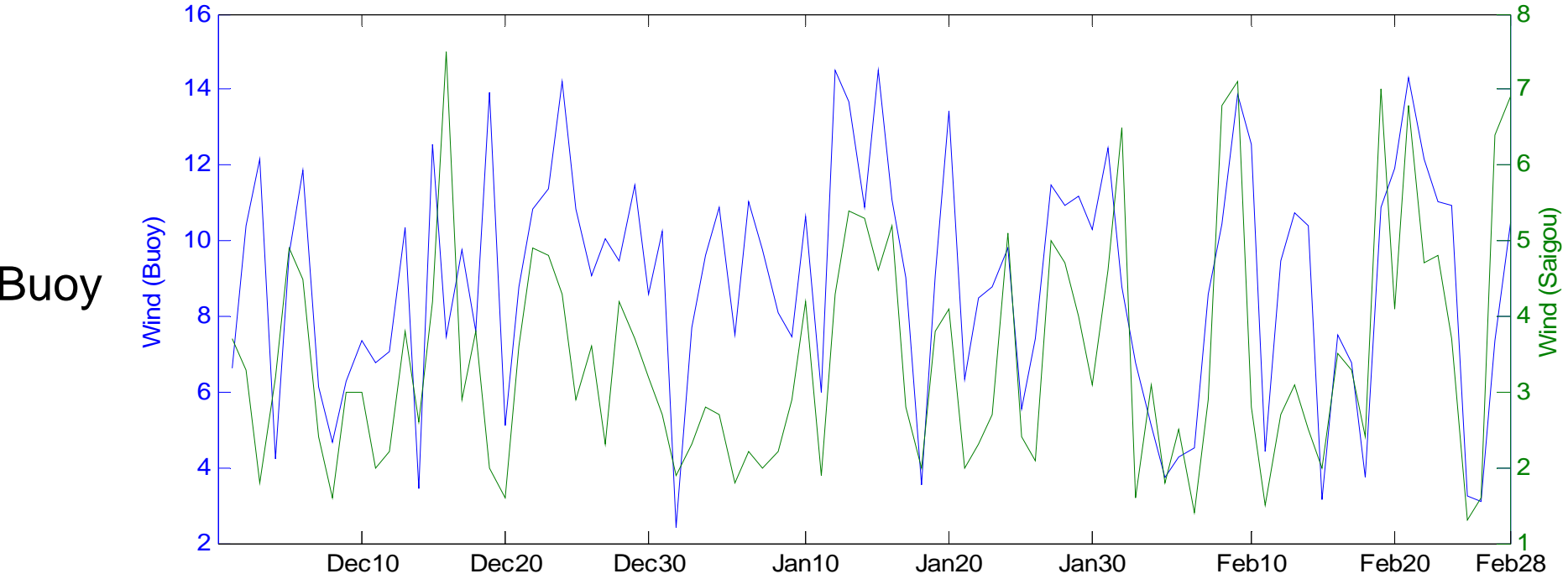
Plate 2. Monthly mean wind field over the Japan Sea in January 1997, in meters per second. Wind speeds are illustrated by color, and white streamlines are superimposed with arrows. The area off Vladivostok with a wind speed of $>9 \text{ m s}^{-1}$ is shown in red.

Kawamura and Wu (1998)



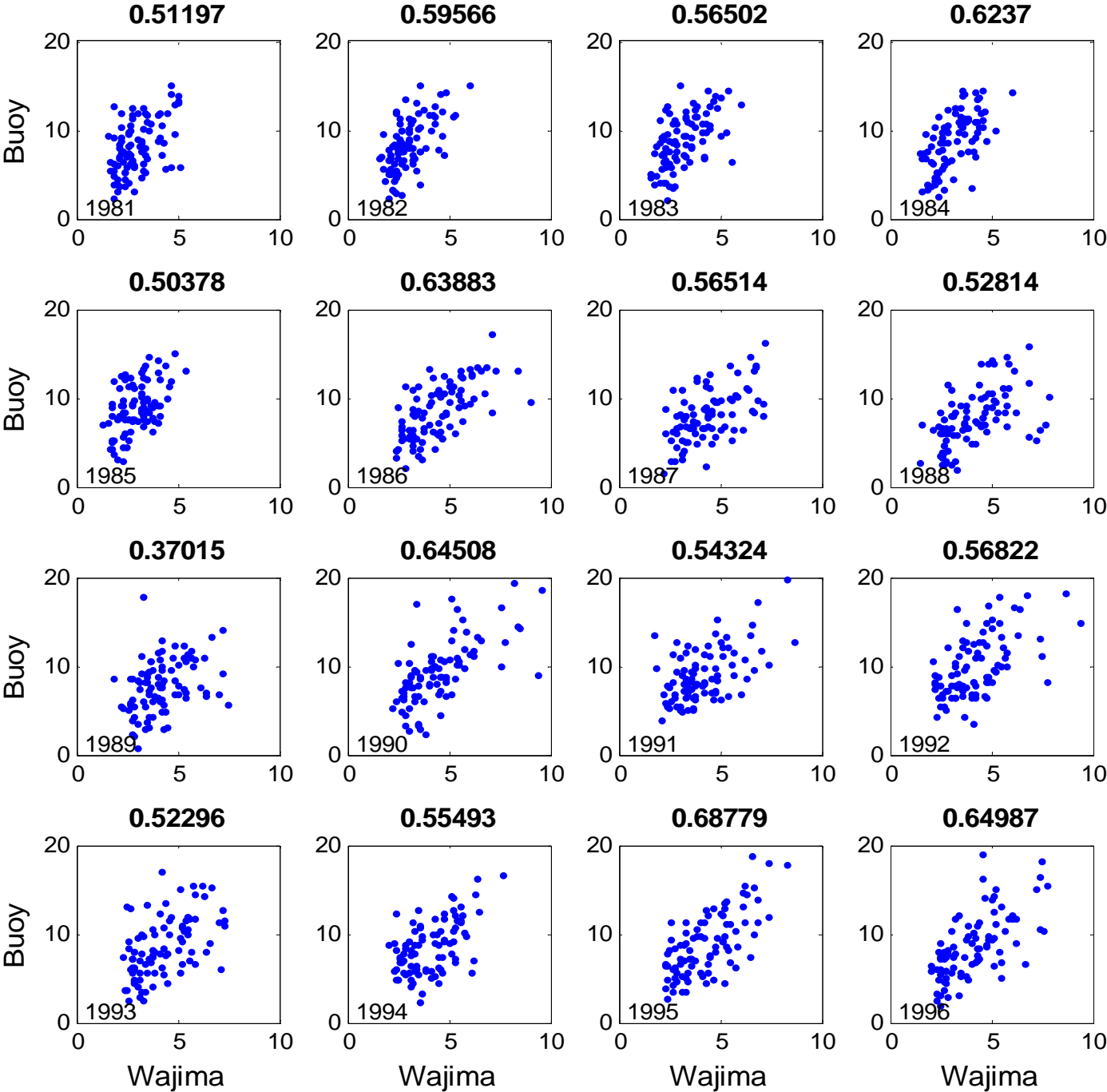
Wajima

Buoy

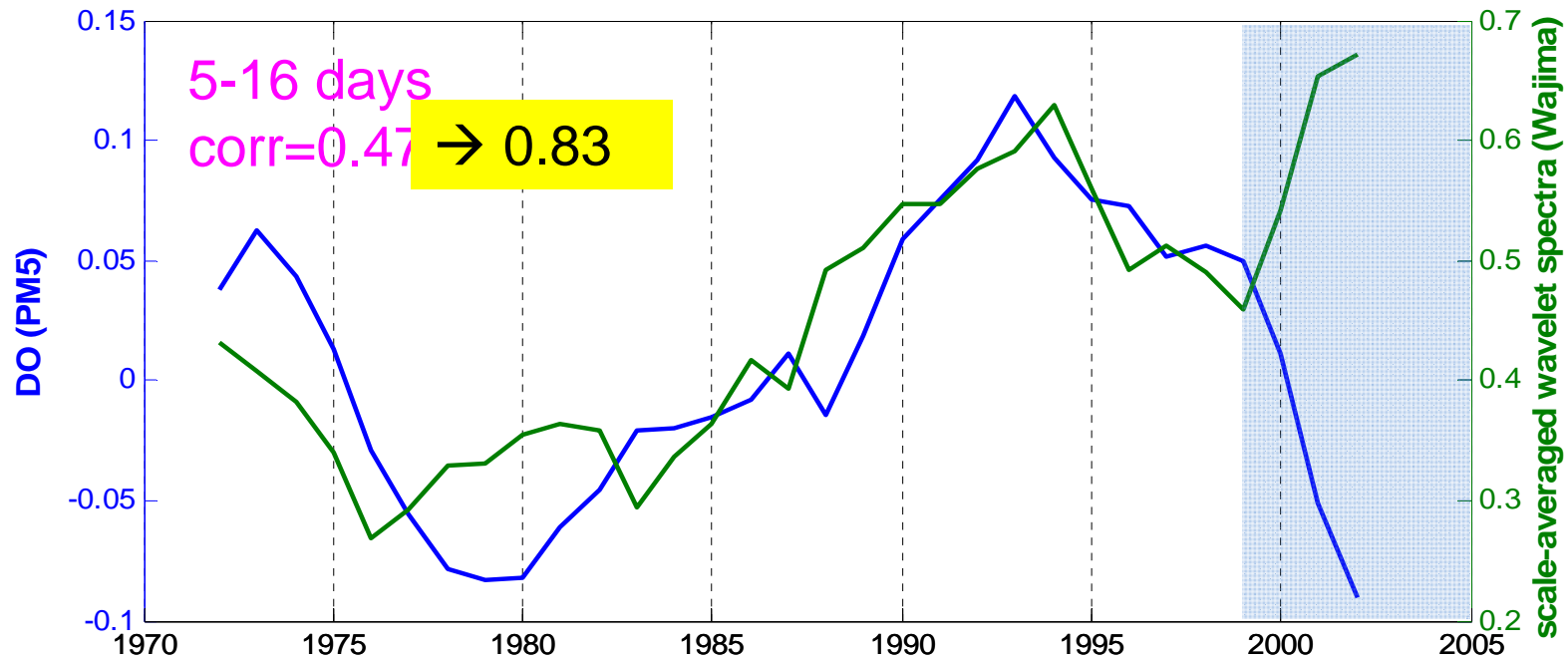
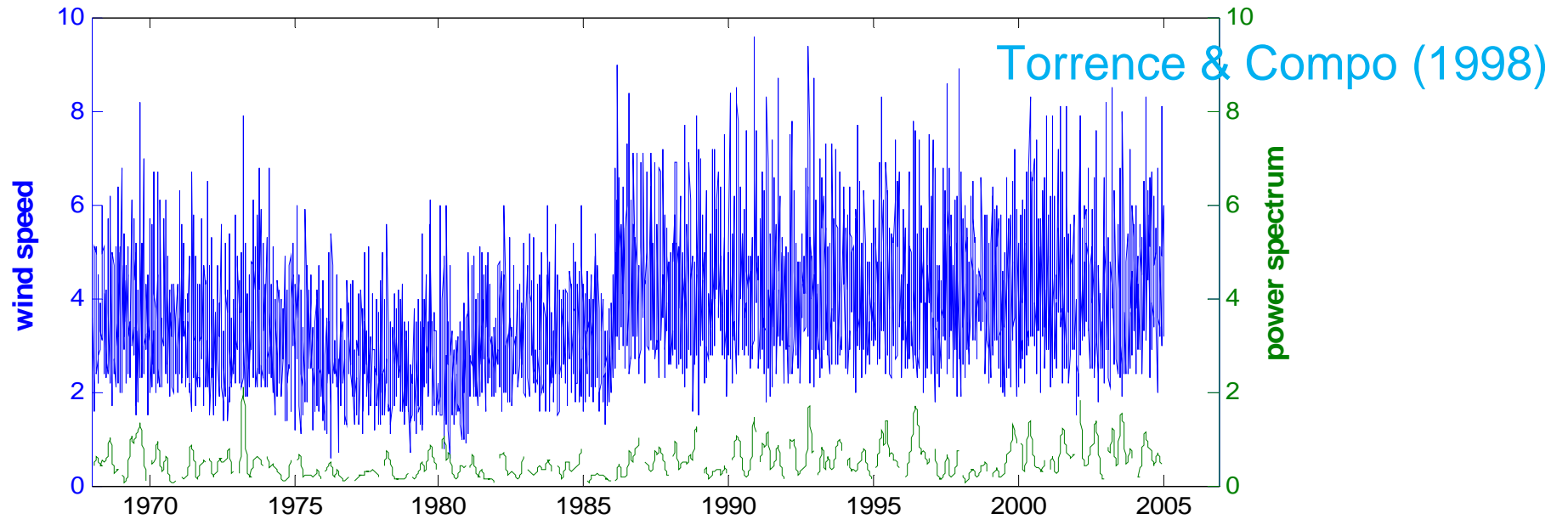


Saigou

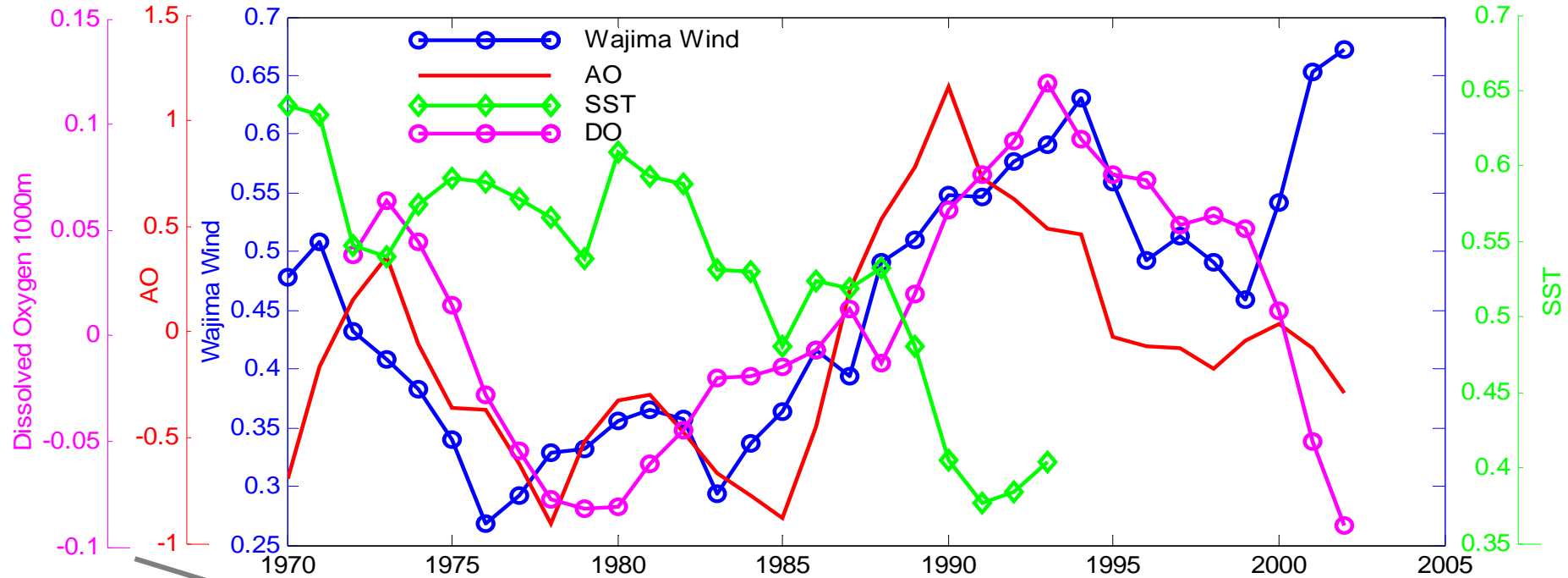
Wind Validation Testified



Wind scale-averaged wavelet spectra



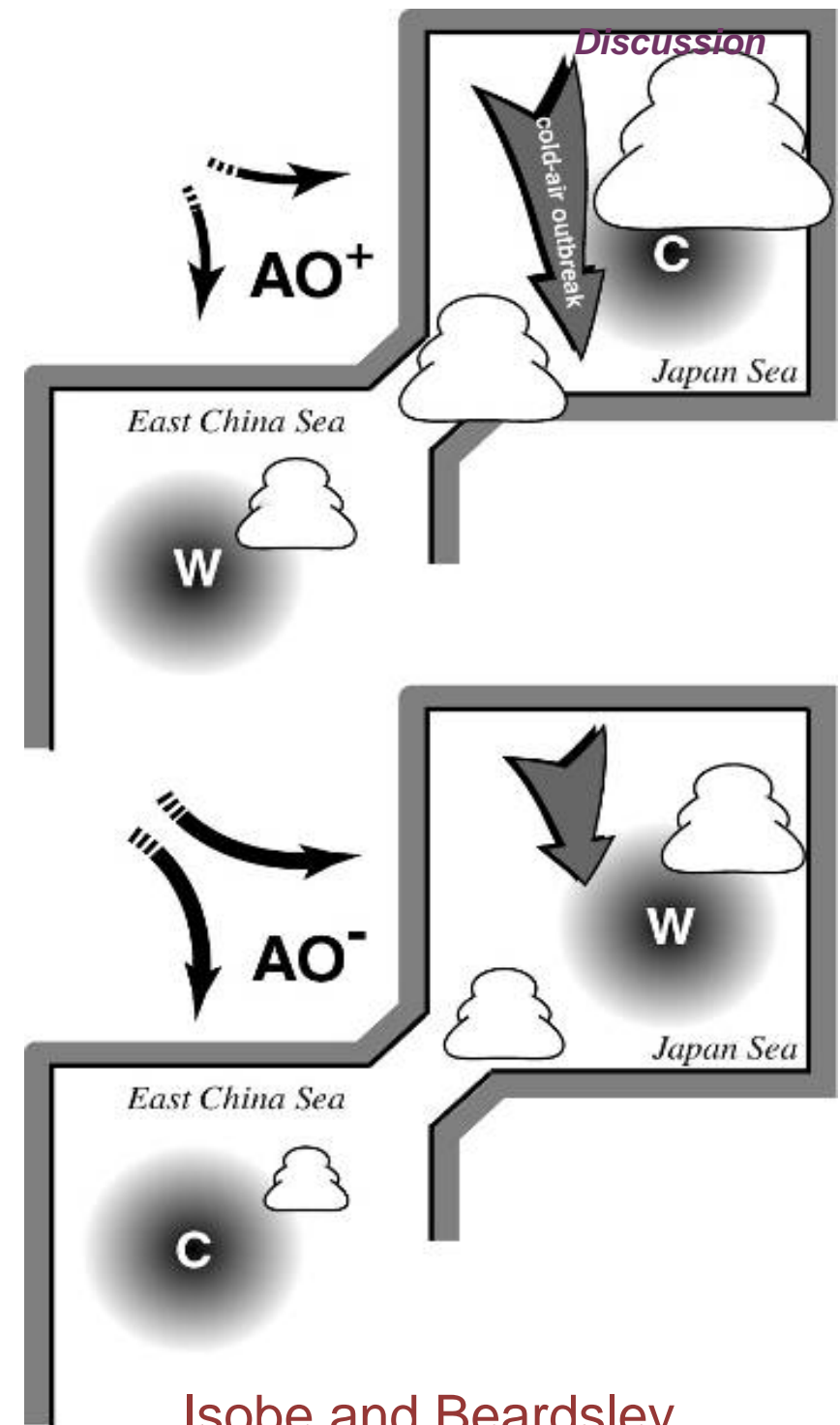
Long-term variations of DO, SST, wind and AO



	AO	SST	DO	Wind
AO		-0.66	0.66	0.61
SST	-0.66		-0.74	-0.62
DO	0.66	-0.74		0.47
Wind	0.61	-0.62	0.47	

Ocean-Atmosphere interaction of Asian marginal sea influenced by AO

- Positive AO:
- low pressure developed on the warm East China Sea advances toward the northern Japan islands, the resultant enhanced atmospheric disturbances would lead to more intense cold-air outbreak.
- vice versa.



Isobe and Beardsley
(2007)

Conclusion

Conclusion

- +AO phase lead to more intense cold-air outbreaks over Japan Sea which could decrease SST largely in the JSPW formation area; Together with the strong wind stirring effect, the dense surface water sinks to deeper part forming the new JSPW.
- Decadal-scale changes of AO could accompany significant changes in the hydrological cycle of Japan Sea, here represented by interdecadal oscillation of JSPW formation.
- Long time series wind data of Japan Sea might be established using data from