

# Lake-land circulations in the Taihu Catchment



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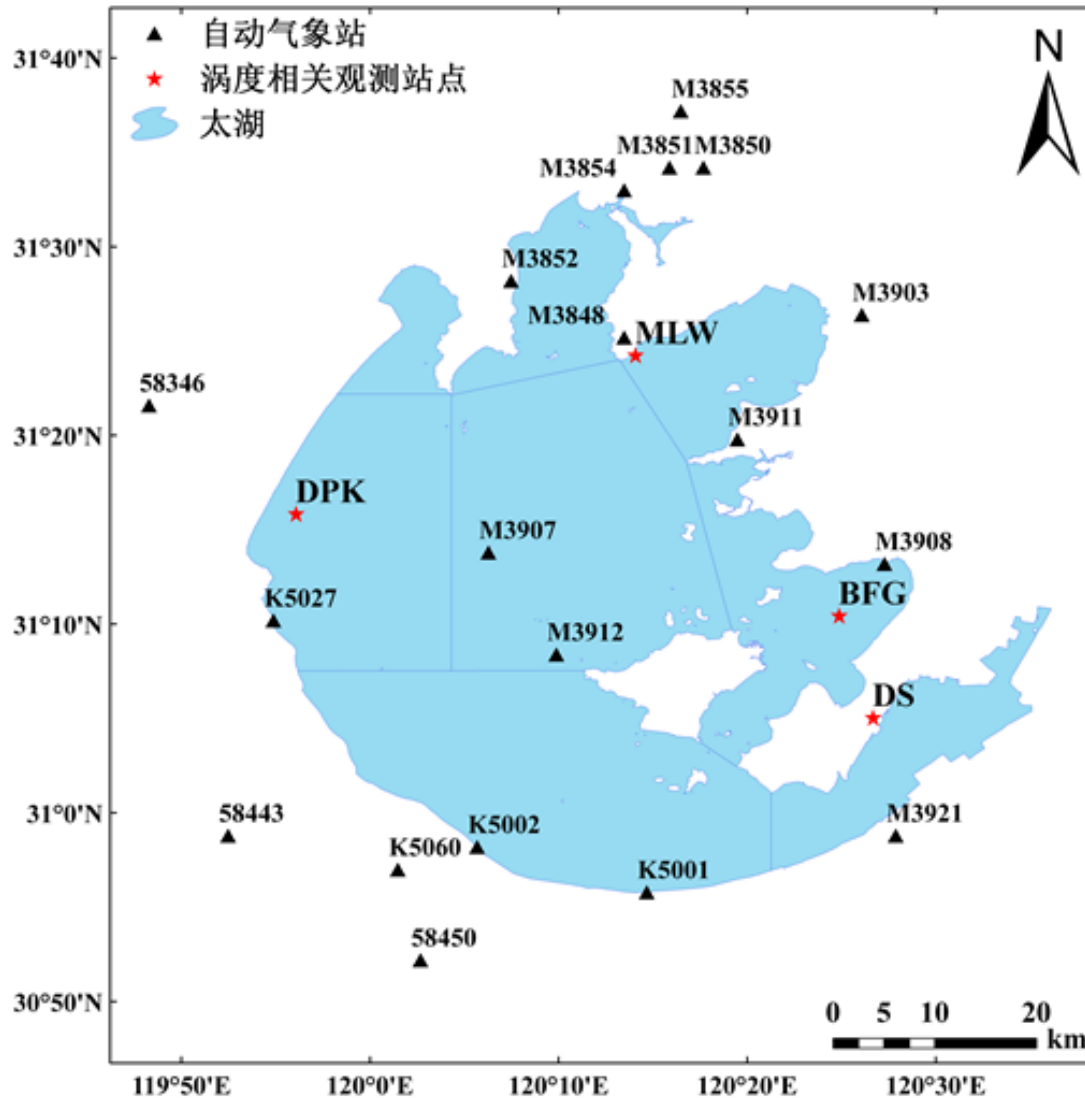
# ◆Outline

- Background
- Methods and Materials
- Basic character of the Lake Taihu breeze
- Impact factors of the lake Taihu breeze
- Conclusion

# ◆ Background

- Studies of Lake Taihu breeze are of great scientific and environmental interest due to its impact on climate, air quality and human health, all of which calls for measures aimed at reducing air pollution.
- Recent study are mainly focus on the sea breeze and the deep lake(Mean depth of the lake is over 6m), there're few study of the shallow lake.

# ◆ Location of the meteorological station and flux station



# ◆ Identification of lake breezes in observational data

- $T_{\text{land}} - T_{\text{lake}}$ : The temperature different between land and lake  $\Delta T$  should be over  $0.6^{\circ}\text{C}$ .
- $V_g$ :  $WS < 3.8 \text{ m/s}$  where  $V_g$  is the geostrophic wind and WS is the 1500m wind speed at the specified time. This filter is there to exclude days with a too strong synoptic wind speed.
- WD: An abrupt shift in WD which cannot be attributed to synoptic flow and a secondary increase in WS.
- Temperature: An abrupt decrease in the diurnal air temperature curve.

# ◆ Frequency of the Lake Taihu Breeze

	J	F	M	A	M	J	J	A	S	O	N	D	ave <sup>+</sup>
East	13.3	13.8	12.9	10	13.3	26.7	12.9	22.6	16.7	9.7	6.7	3.2	13.5 <sup>+</sup>
West	10	10.9	9.7	6.7	9.7	32.3	9.7	25.8	16.7	6.5	3.3	0	11.7 <sup>+</sup>
South	13.3	17.2	9.7	13.3	13.3	30	12.9	25.8	20	16.1	6.7	3.2	15.1 <sup>+</sup>
North	16.7	17.2	12.9	10	16.7	40	9.7	29	16.7	19.4	6.7	6.5	16.8 <sup>+</sup>

Table 1 Frequency of the Lake Taihu breeze of each shore

# ◆ Onset and Cessation

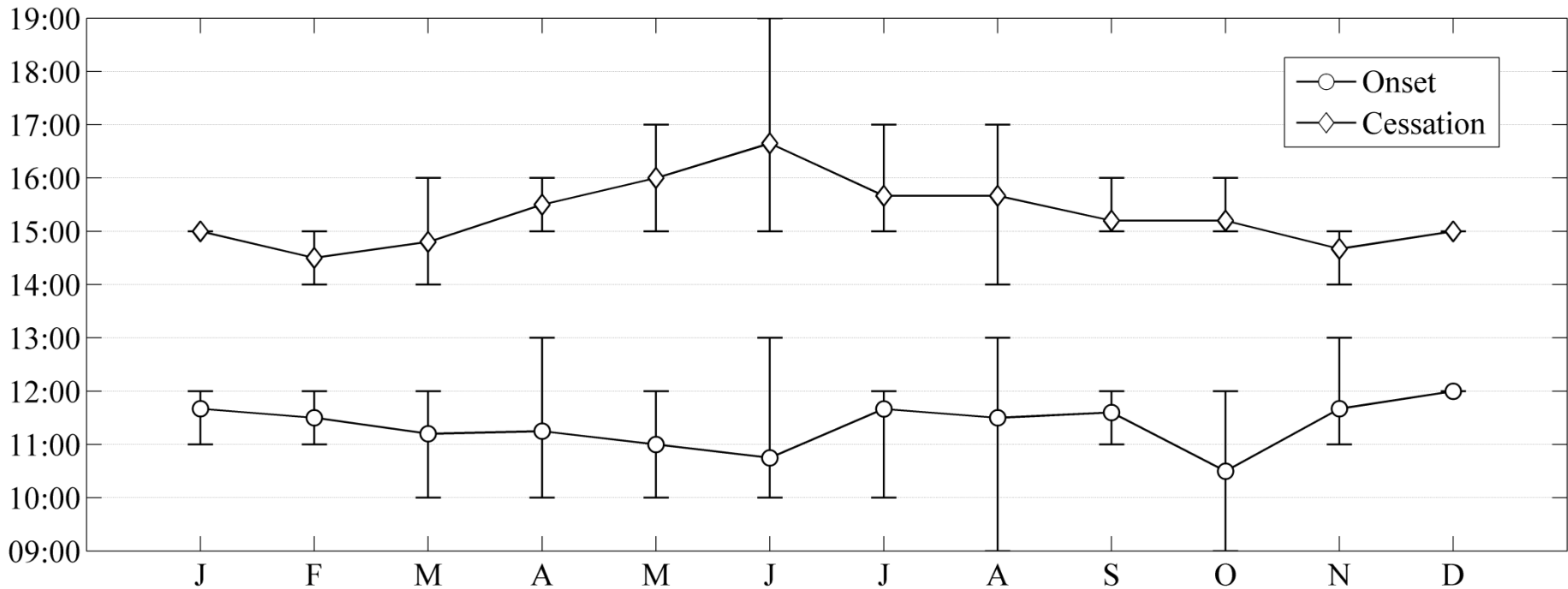


Fig.2 Monthly mean Onset and Cessation time of the Lake breeze



# ◆ Wind speed of the East、South and north shore

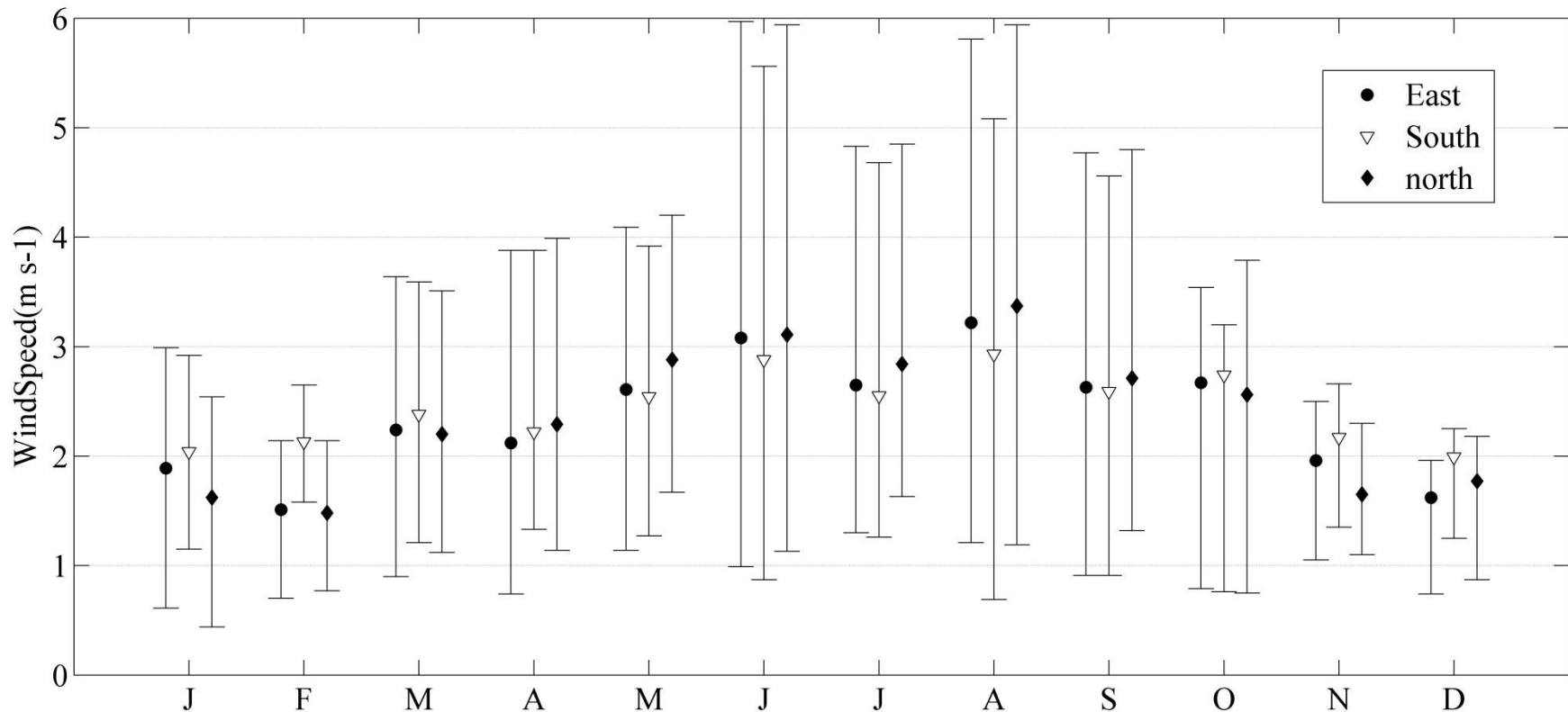


Fig.3 Mean hourly wind speed by month averaged, The wind speed of the east (M3908) and north shore (M3848) was higher than south (K5001) from May to September, while opposited in other months.



# ◆ Construction between sea breeze and The Great Lake breeze in summer

Lake/sea	frequency	mean wind speed	duration	period of the sea/lake breeze day
Taihu	34%	3.3m/s	5.9h	9:00—19:00
Huron	84%	/	9h	10:00—20:00
Michigan	36%	4.1m/s	/	8:00—20:00
Alicante	25.8%	>4m/s	12h	9:00—21:00
Sardinia	40%	5.2m/s	8.7h	8:00—19:00

# ◆ Construction between several small lake

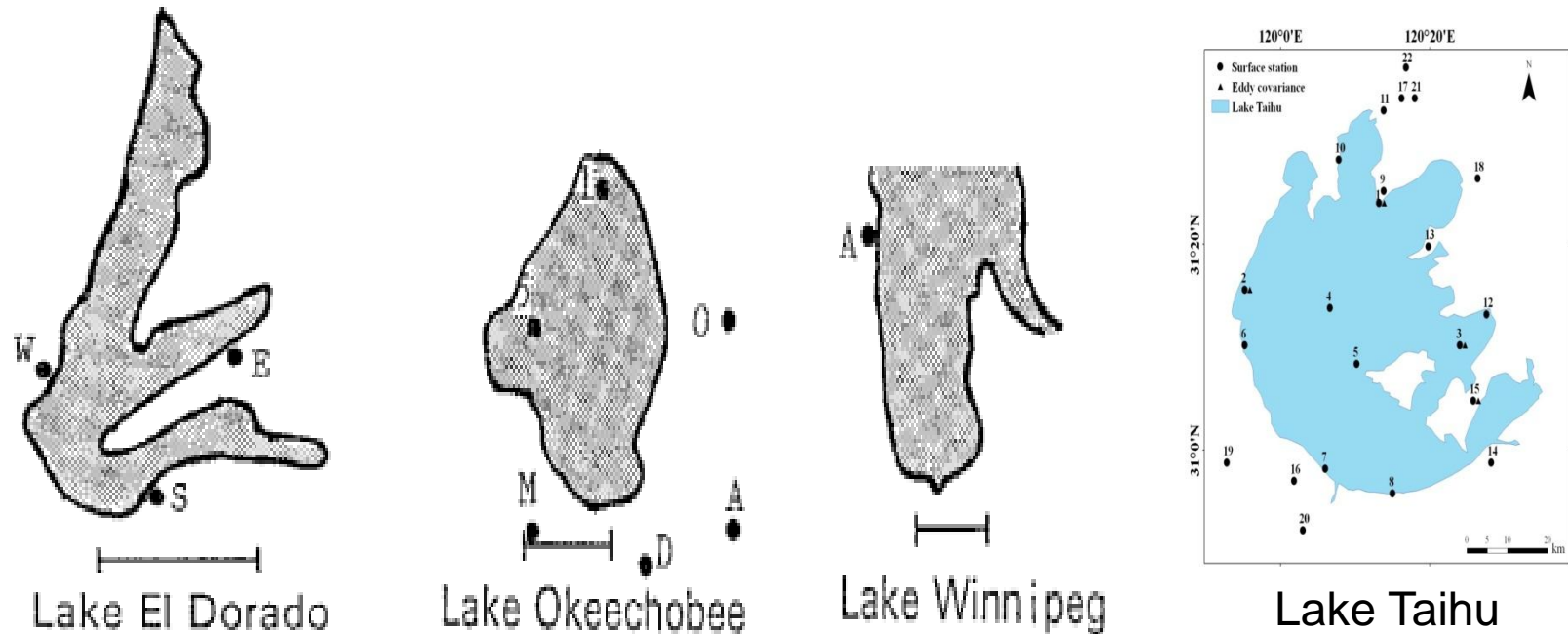


Fig.4 Map illustration of several lakes ,The distance scale is 20 km except for 3 km for Lake El Dorado.

Lake	Onshore distance (km)	# of fair weather days	# of onshore flow days	Land-scape	# of days with LB	Period of the day (LST)	Possible range of LB speed <sup>a</sup> (m s <sup>-1</sup> )
Lake El Dorado, KS, South Site (S)	0.2	13	7	D	7	1000–1800	2–4 <sup>a</sup>
Lake El Dorado, KS, East Site (E)	0.5	15	5	D	5	1000–1700	2–5 <sup>a</sup>
Lake El Dorado, KS, West Site (W)	0.2	16	6	D	4	1000–1700	2–3 <sup>a</sup>
Lake Eufala, OK (E)	3	26	10	V	9	1200–1700	1–3 <sup>a</sup>
Lake Okeechobee, FL, Osce. <sup>b</sup> (O)	15	43	19	V	19	1100–1500	2–4
Lake Okeechobee, FL, Atla. (A)	25	52	20	V	19	1100–1500	2–4
Lake Okeechobee, FL, Mott. (M)	12	52	28	V	21	1100–1600	2–4
Lake Okeechobee, FL, Duda. <sup>c</sup> (D)	11	29	6	V	6	1100–1500	2–4
Lake Winnipeg, Canada, Arnes (A)	0.3	—	—	S	10	1000–1600	2–5
Lake TaiHu	40	—	—	P		0900-1700	2-5

# ◆ Monthly mean Land-lake temperature difference

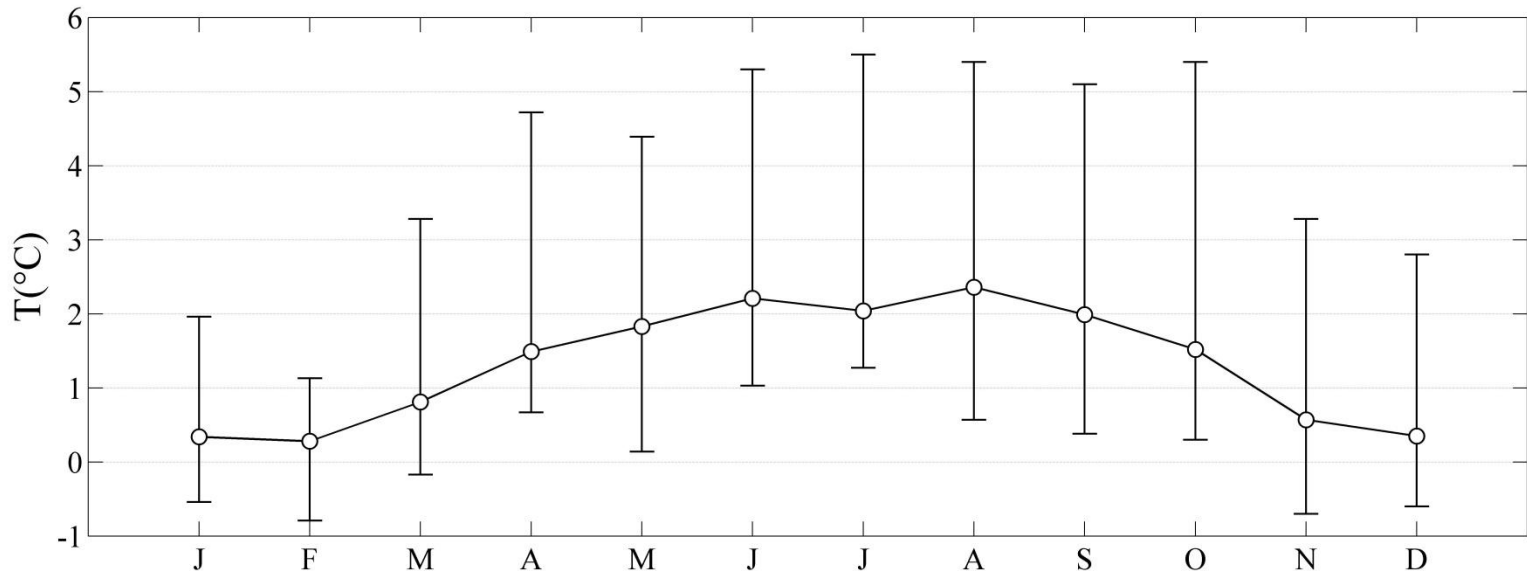
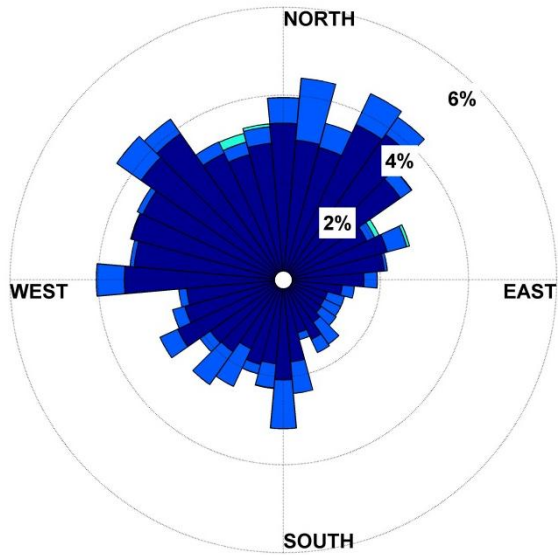


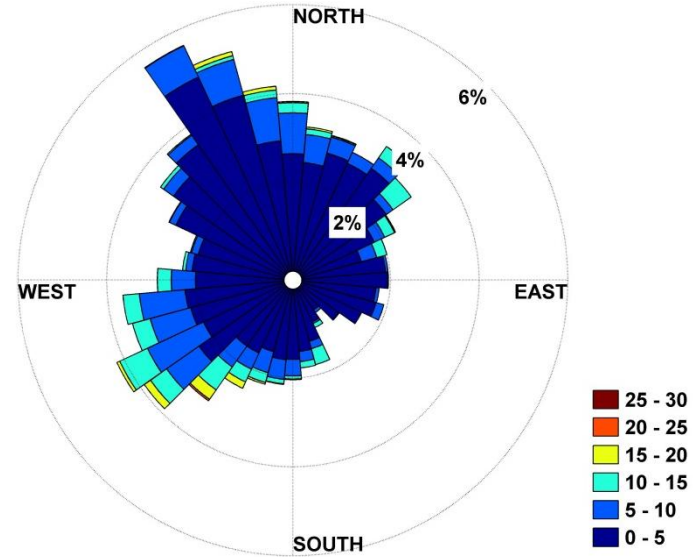
Figure 5. Land–Lake temperature difference by month averaged over all stations.  $T_{\text{land}}$  is the mean monthly daytime air temperature over land and  $T_{\text{Lake}}$  is the mean monthly Lake air temperature over the four flux station

# The synoptic wind

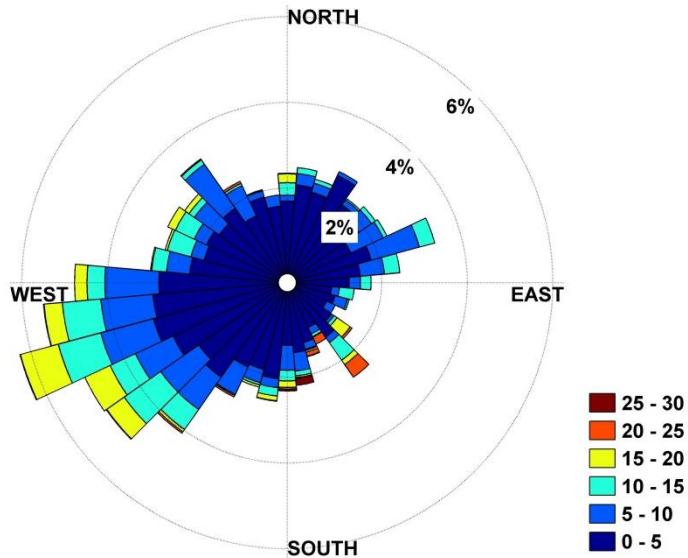
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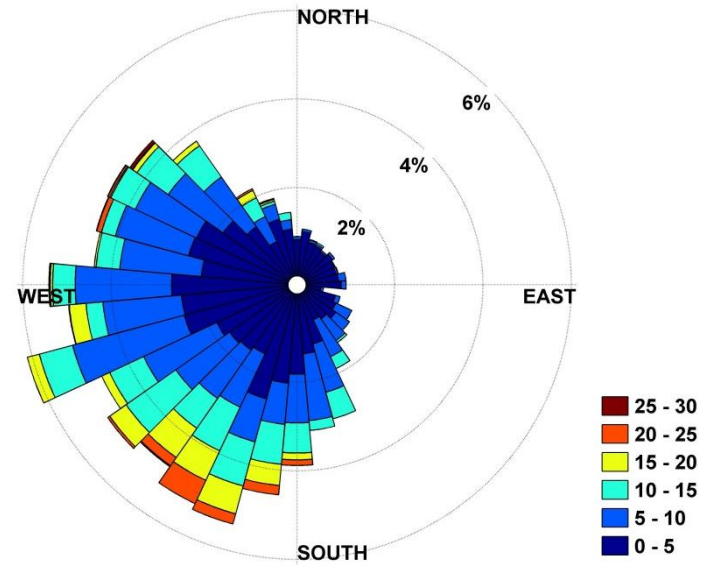
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Mar

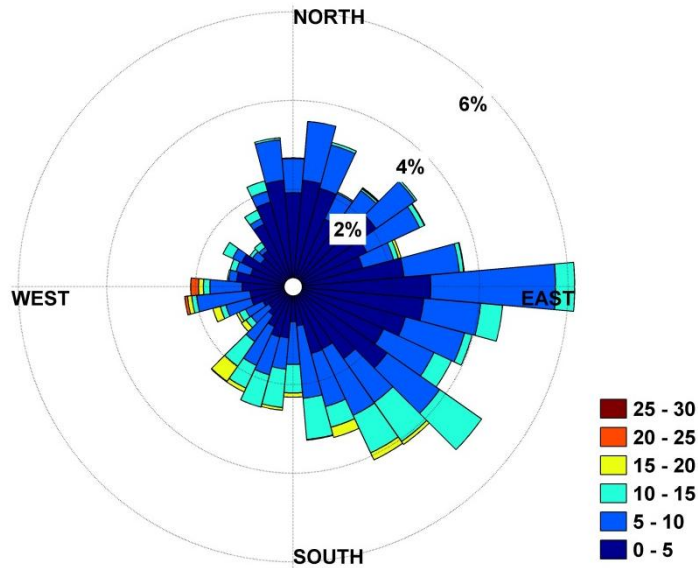


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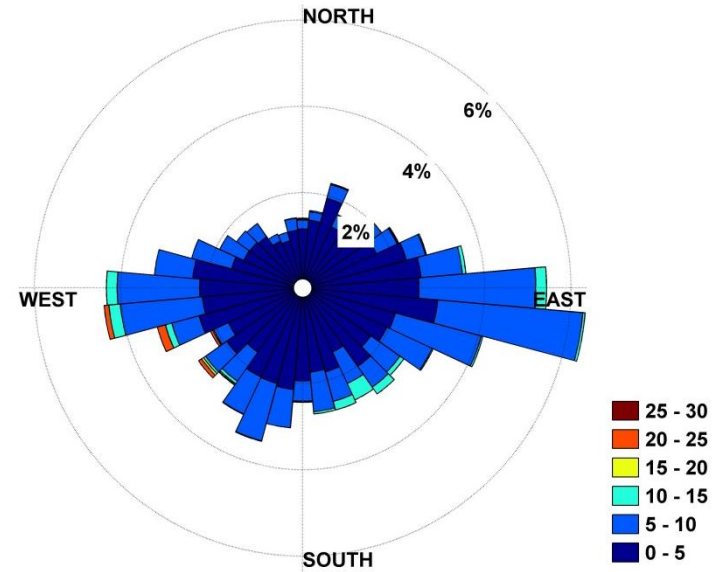


# The synoptic wind

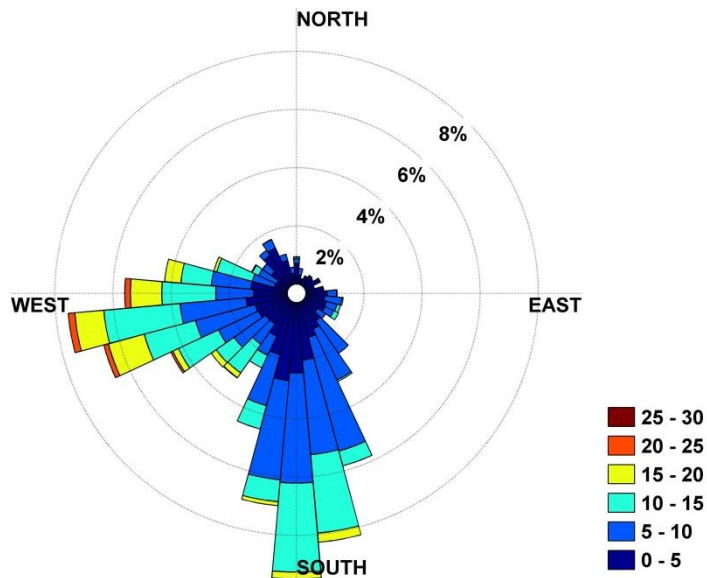
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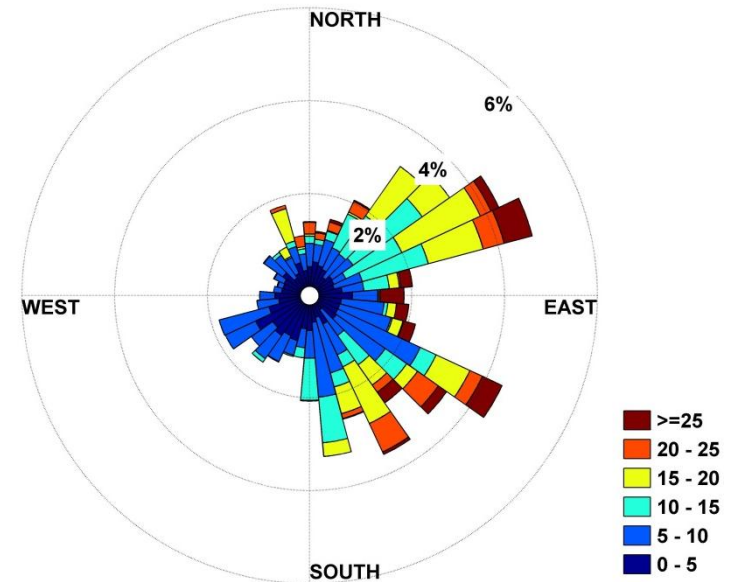
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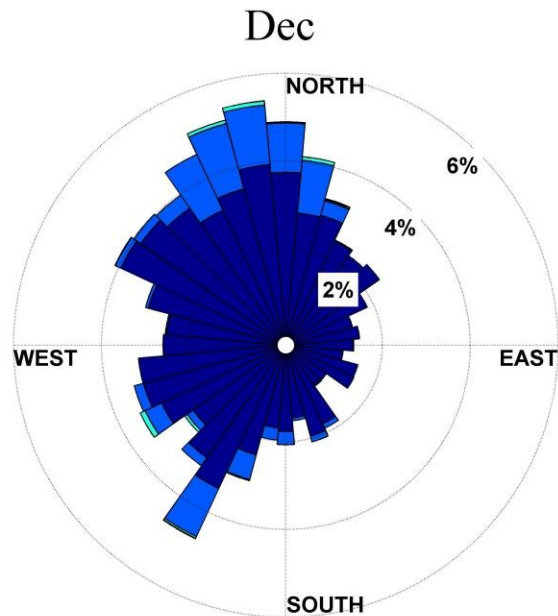
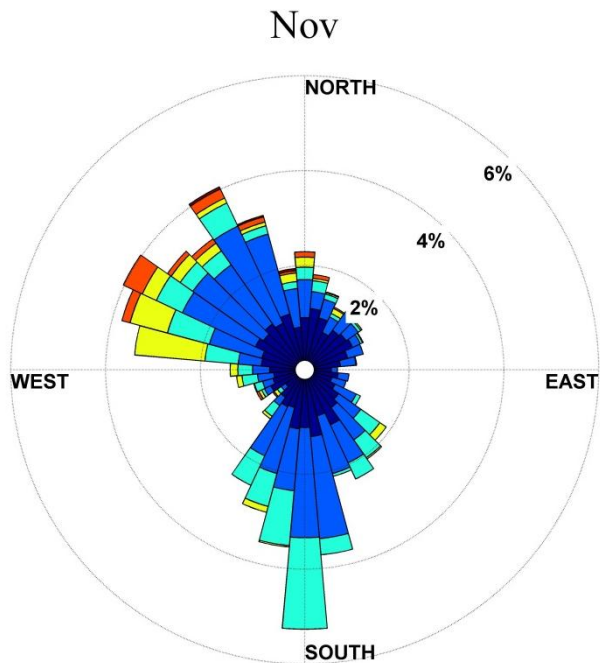
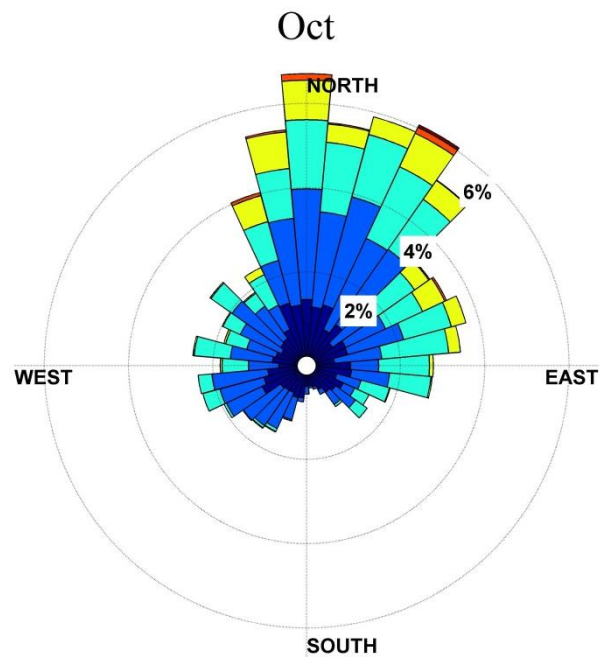
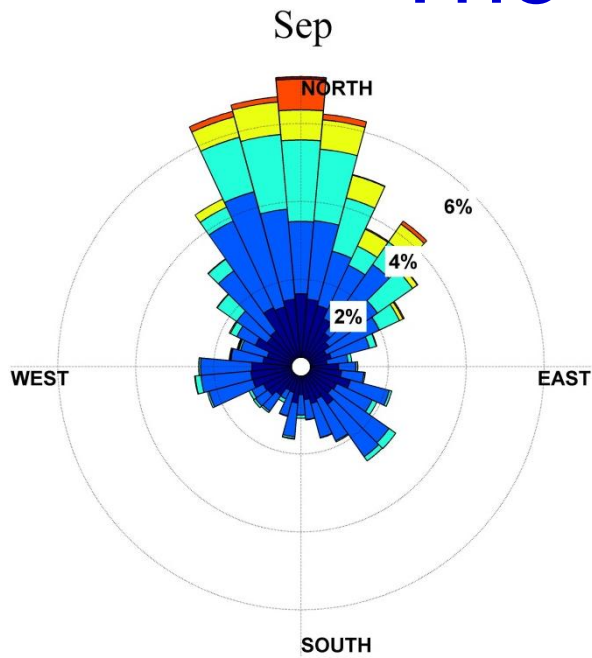
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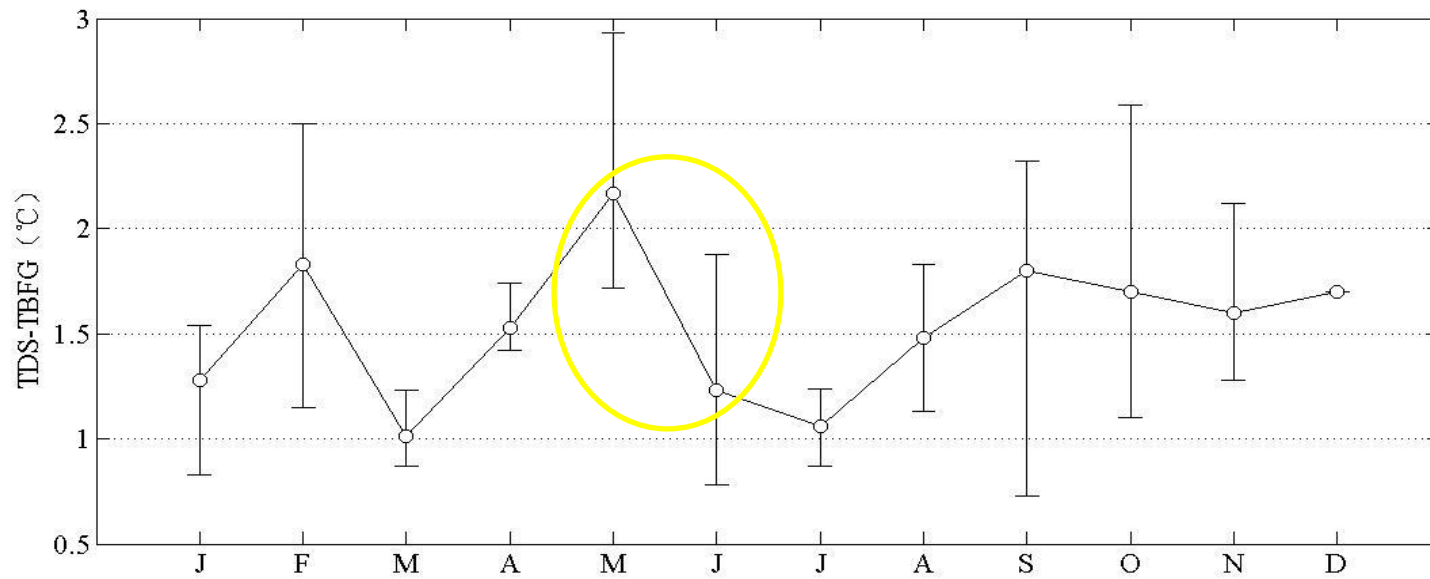
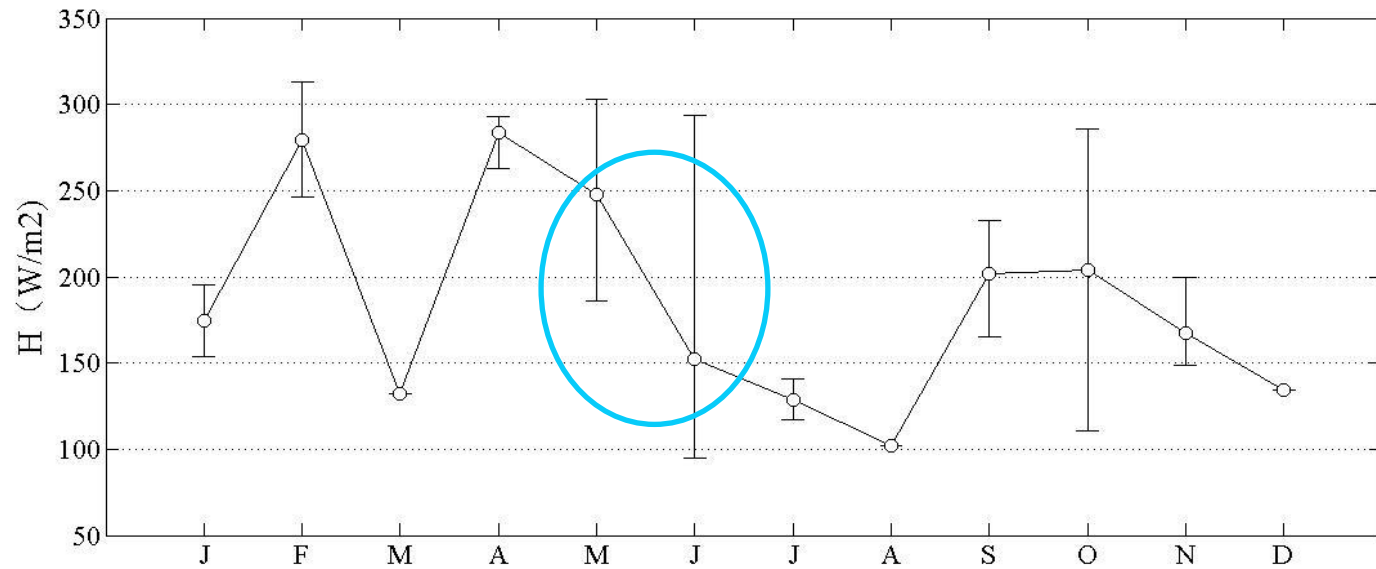


# The synoptic wind





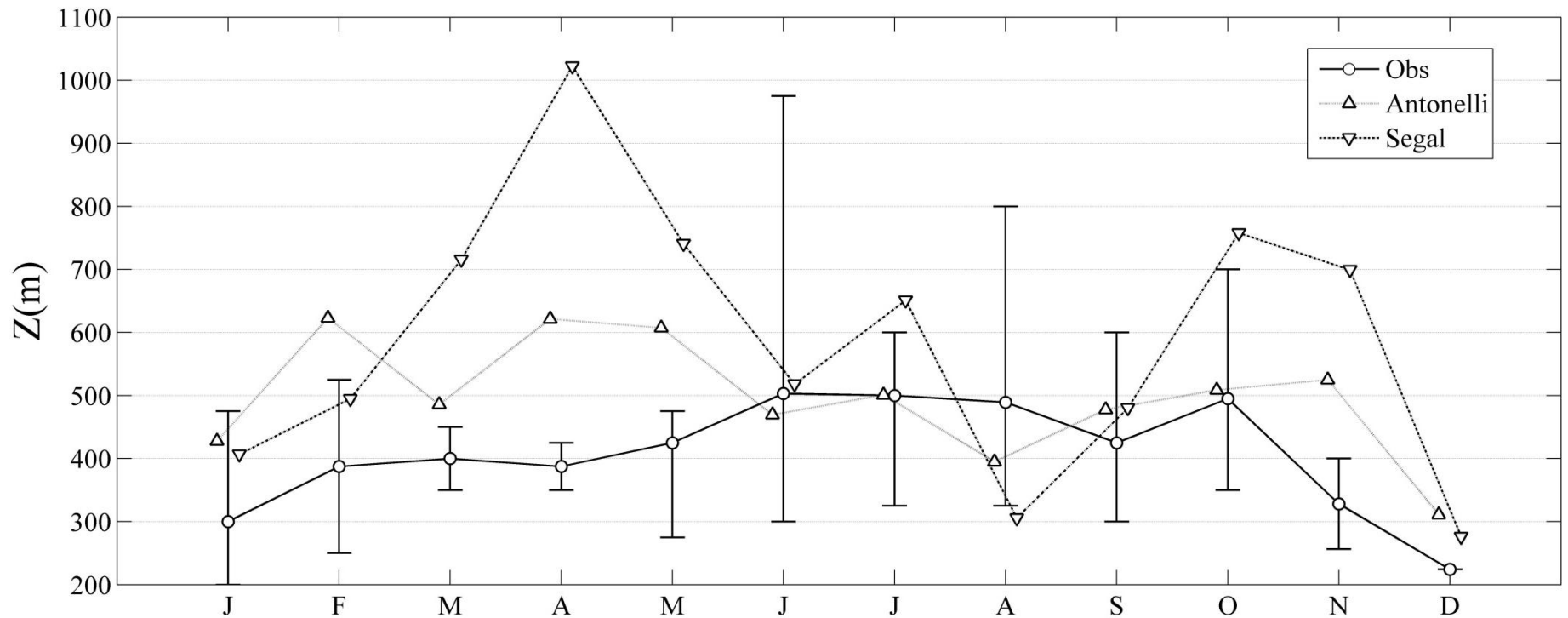
# $\Delta H$ and $\Delta T$



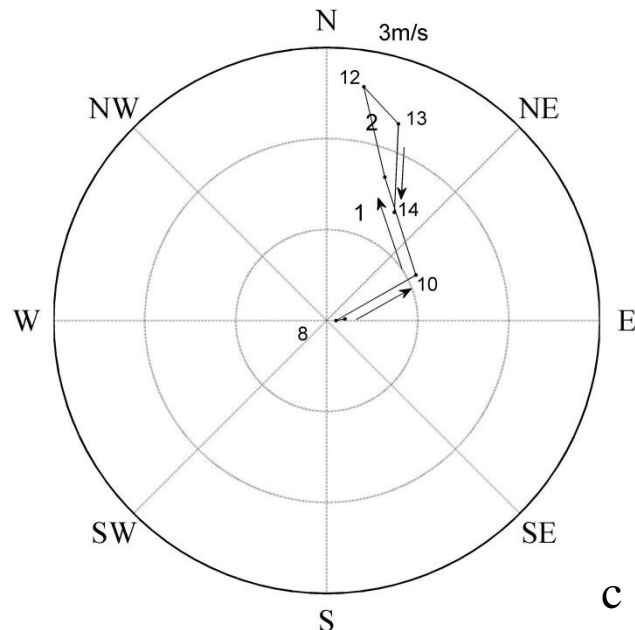
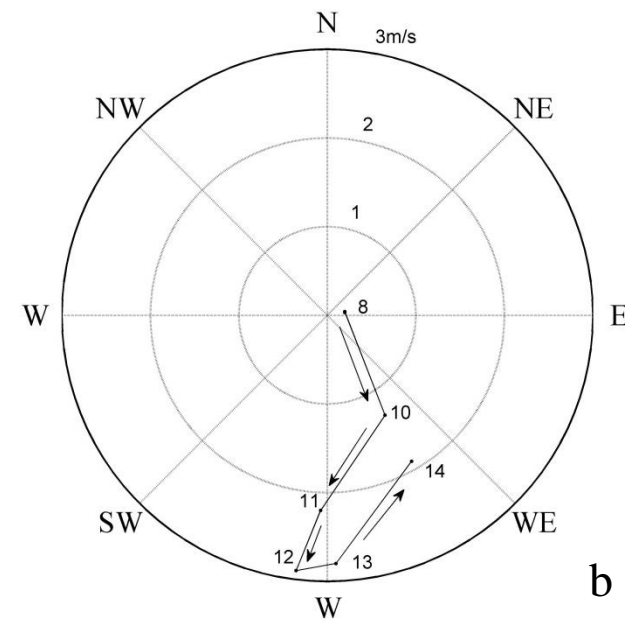
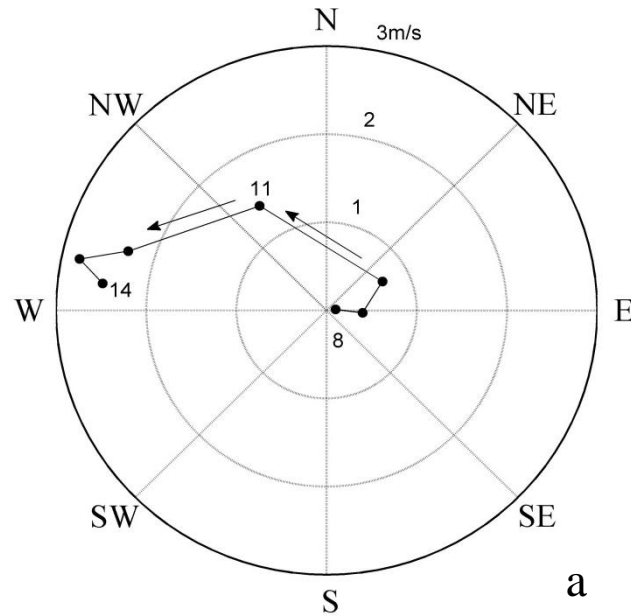
# ◆ $Z_{\text{obs}}$ and $Z_{\text{calculation}}$

Antonelli(2007):  $Z = \frac{\sqrt{Qt}}{N}$        $Q = (g/\theta)(\overline{w'\theta'})$

Segal(1997):  $Z = \frac{H}{\omega \Delta T}$



# Terrain effects



Case study of hourly hodographs  
From 8:00-14:00(LST) on 16  
May 2012 for the east(a)、  
north(b) and south(c) in the  
sample that displayed Lake  
breeze on that day

# ◆ Conclusion

- Lake Taihu breeze is characterized by **lower frequency and less feature** while compared with the sea breeze and The Great Lake breeze.
- The characteristic of the Lake Taihu breeze **is strongly dependent on the season**. The frequency of occurrence, monthly mean onset and cessation time and the wind speed of each shore shows a distinct seasonal change regulation.

Thank you