Yale-NUIST Center on Atmospheric Environment

Effects of the interaction of local circulation on transfer and diffusion at Taihu Lake and surrounding area

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Outline

- Introduction
- Data and model
- Results and discussion
- Next work

Introduction

- Air pollution is getting severer at Taihu lake and surrounding area in recent years. Several studies have analyzed pollutant sources and potential impacts,however, few studie has focused on transfer and diffusion.

- This work adopted WRF/Lake model to simulate the impacts of local circulation around Taihu lake and surrounding area on transfer and diffusion.

Data and method

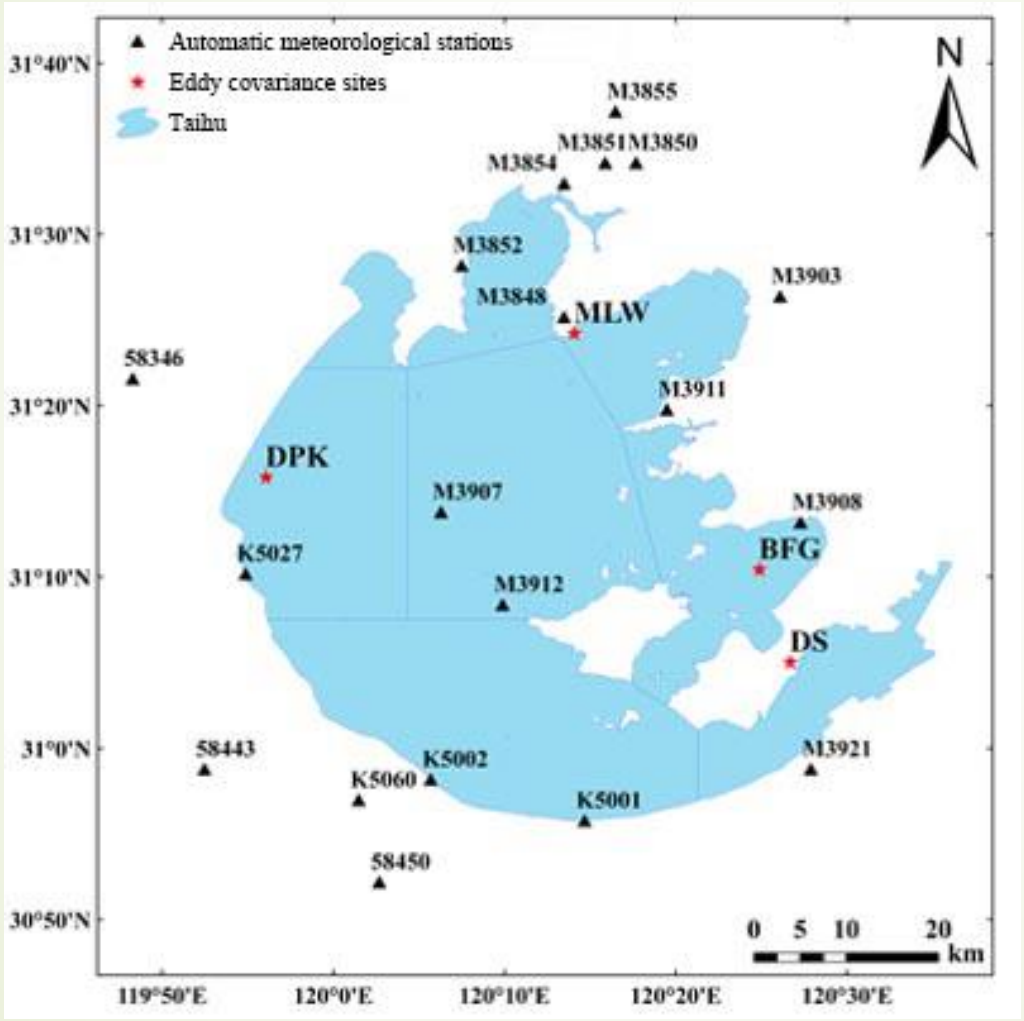

Figure 1. Distribution of observation station

Table 1. Summary of automatic meteorological station

站名	站点位置	经度 (°E)	纬度 (°N)	观测量	观测高度(m)
M3903	苏州望虞河水闸	120．44	31．44	风向、风速、降水、平均气温、湿度	10
M3907	苏州太湖平台山	120．11	31．23	风向、风速、降水、平均气温	10
M3908	苏州胥口海事所	120．46	31．22	风向、风速、降水、平均气温	10
M3911	苏州新区镇湖镇	120．33	31．33	风向、风速、降水、平均气温	10
M3912	苏州太湖捕杆山	120．17	31．14	风向、风速、降水、平均气温	10
M3921	苏州吴江庙港	120．47	30．98	风向、风速、降水、平均气温	10
M3848	无锡市南泉水源厂	120．23	31．42	风向、风速、降水、平均气温	3．4
M3850	无锡市学前街	120．3	31．57	风向、风速、降水、平均气温	10．4
M3851	无锡市中桥	120．27	31．57	风向、风速、降水、平均气温	10．4
M3852	无锡市马山万景	120．13	31．47	风向、风速、降水、平均气温	13．4
M3854	无锡市蠡湖	120．23	31．55	风向、风速、降水、平均气温	10．4
M3855	无锡市黄巷	120．28	31．62	风向、风速、降水、平均气温	10．4
58346	宜兴	119．81	31．36	风向、风速、降水、平均气温、湿度	10
K5001	湖州幻娄	120．25	30．93	风向、风速、降水、平均气温	10
K5002	湖州乐园	120．1	30．97	风向、风速、降水、平均气温	10
K5027	湖州香山	119．92	31．17	风向、风速、降水、平均气温	10
K5060	湖州洪桥	120．03	30．95	风向、风速、降水、平均气温	10
58443	湖州长兴	119．88	30．98	风向、风速、降水、平均气温、湿度	10
58450	湖州	120．05	30．87	风向、风速、降水、平均气温、湿度	10
BFG	太湖东岸	120．22	31．40	风向、风速、降水、平均气温、辐射四分量、湍流通量	10
DPK	太湖西岸	119．92	31．26	风向、风速、降水、平均气温、辐射四分量、湍流通量	10
MLW	太湖北岸	120．40	31．17	风向、风速、降水、平均气温、辐射四分量、湍流通量	10
DS	太湖东南边的小岛	120．43	31．08	风向、风速、降水、平均气温、辐射四分量、湍流通量	10

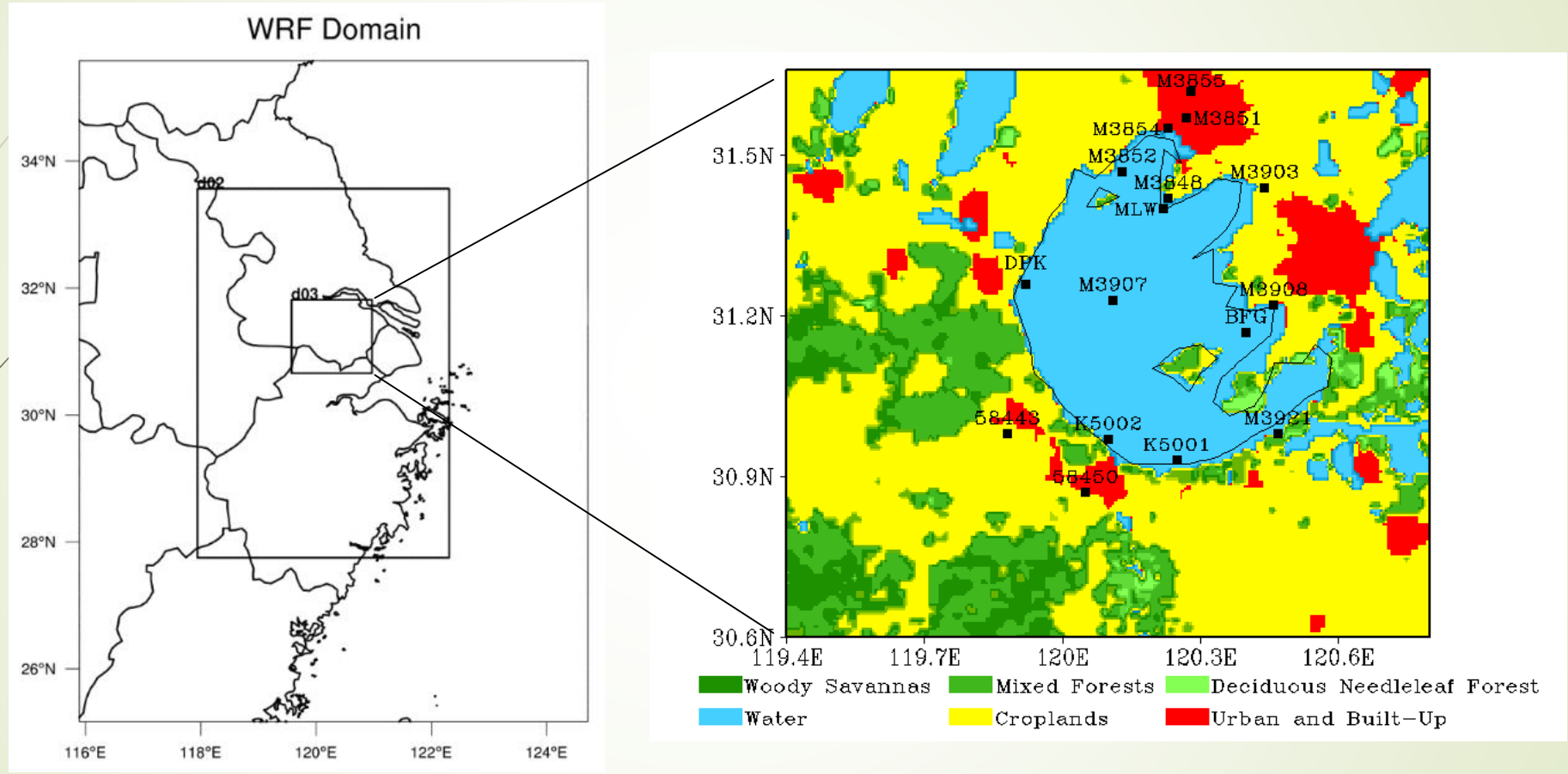

Figure 2. Underlying surface molds

Land surface process model programs in WRF model

- (1) The default NOAH land surface process model program in WRF model;
- (2) CLM4.0 deep lake model program coupled in WRFV3.5.1;
- (3) WRF/Lake model that shallow lake model program CLM4-LISSS coupling WRF/NOAH;
- Case1.Using actual underlying surface data;
- Case2.Replacing Taihu Lake by suburb.

Results and discussion

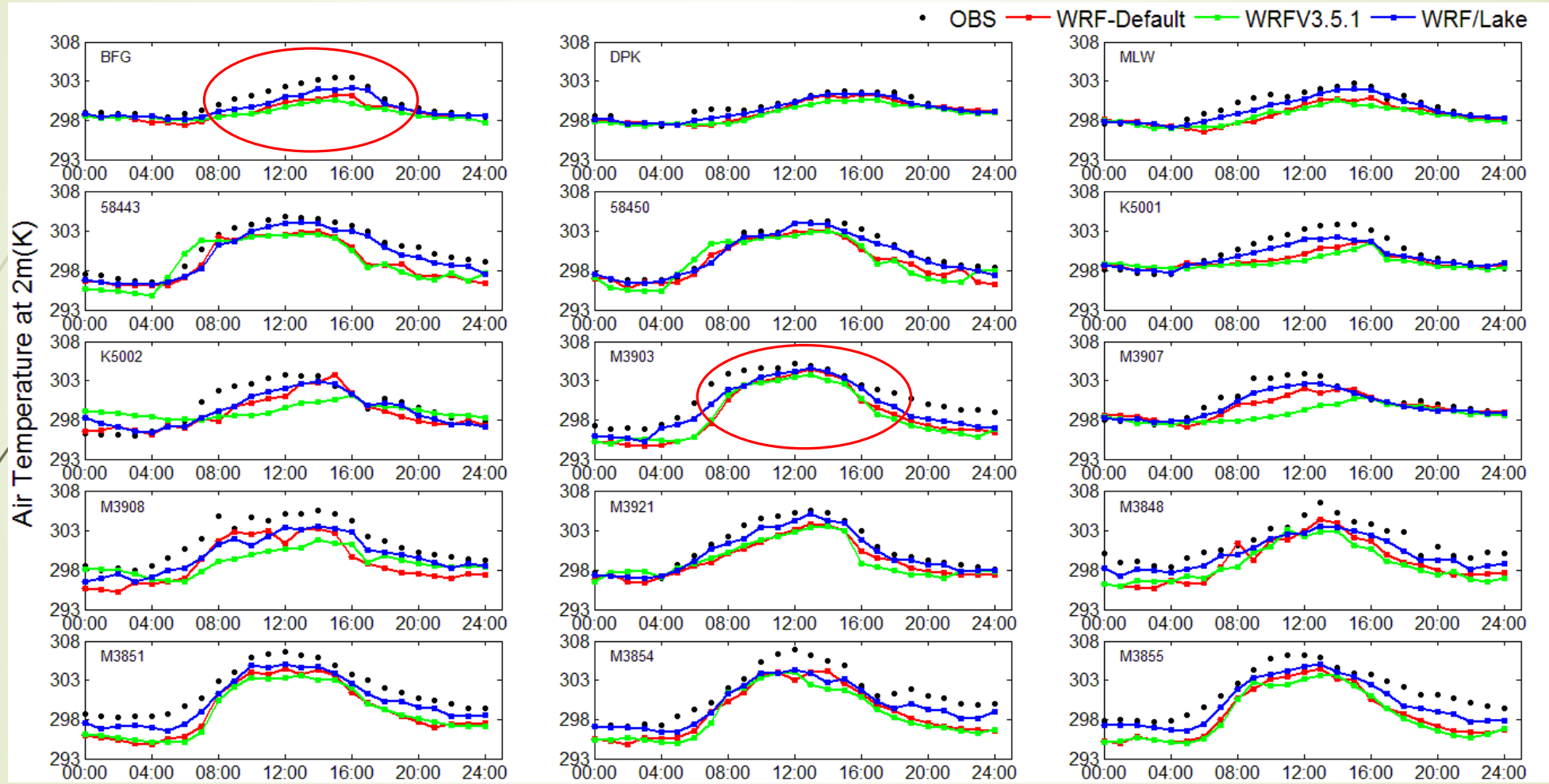

Figure 3. Comparison between observed and modeled air temperature at 2m

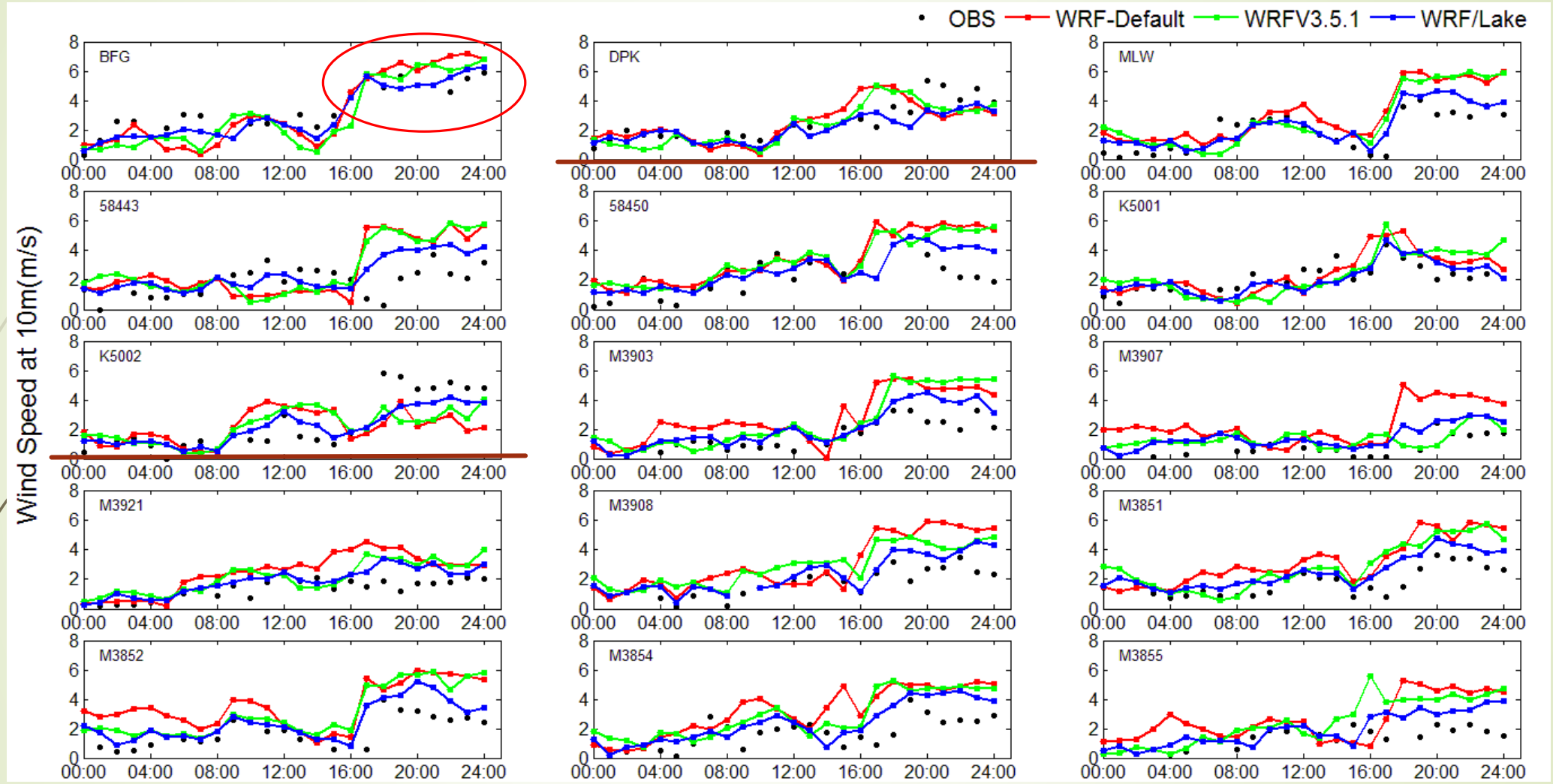

Figure 4. Comparison between observed and modeled wind speed at 10m

Table 2. The RMSE of air temperature at 2m

Air temperature at 2m	Model	RMSE（°C）
Average	WRF-Default	2.0
	WRFV3.5.1	2.2
	WRF/Lake	1.1

Table 3. The RMSE of wind speed at 10m

Wind speed at 10m	Model	RMSE（$m \cdot s^{-1}$）
Average	WRF-Default	1.7
	WRFV3.5.1	1.5
	WRF/Lake	0.9

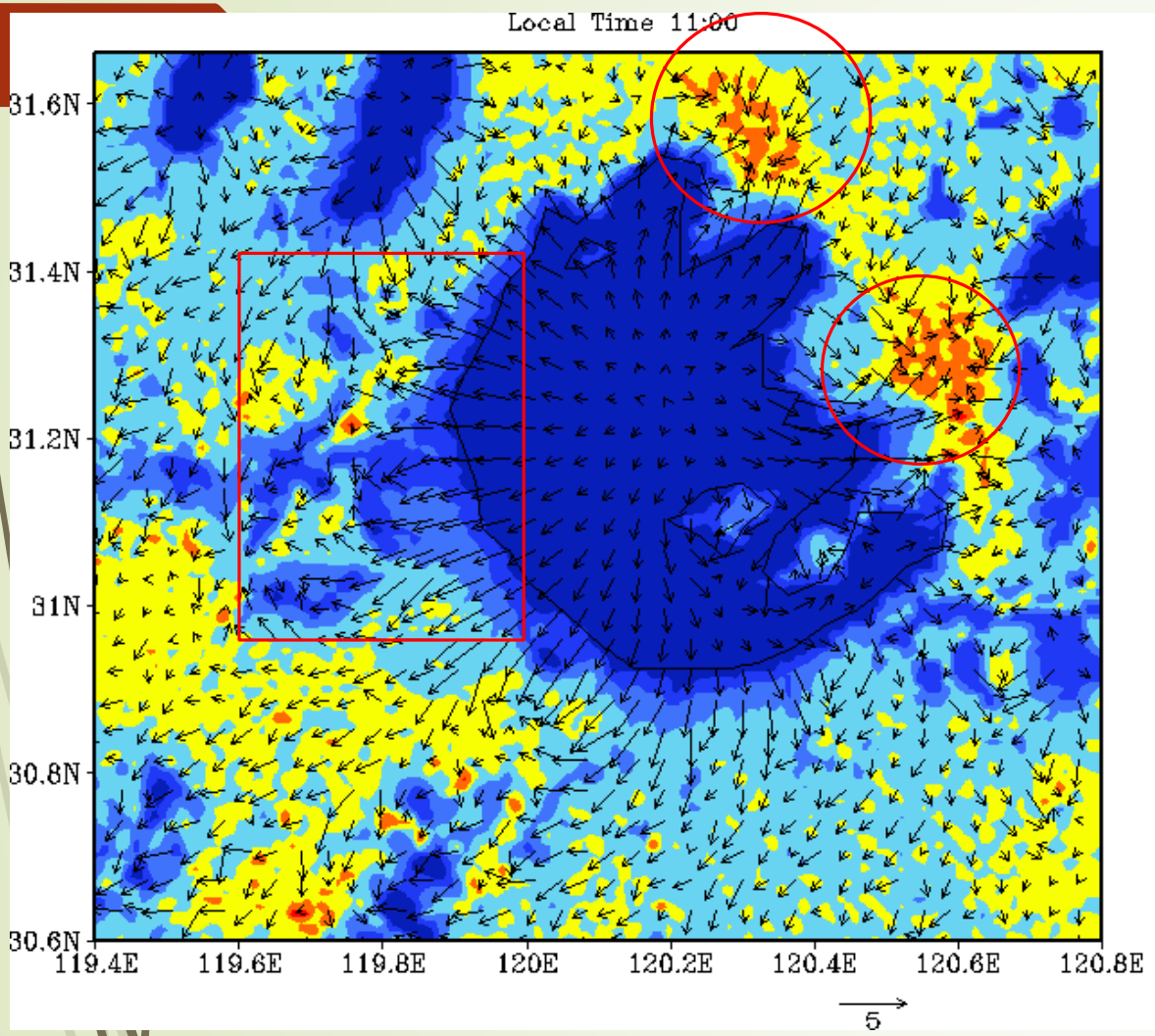

Figure 5. Surface horizontal velocity ($m \cdot s^{-1}$) and temperature(K) modeled by WRF/Lake at 11:00, 08/30/2012

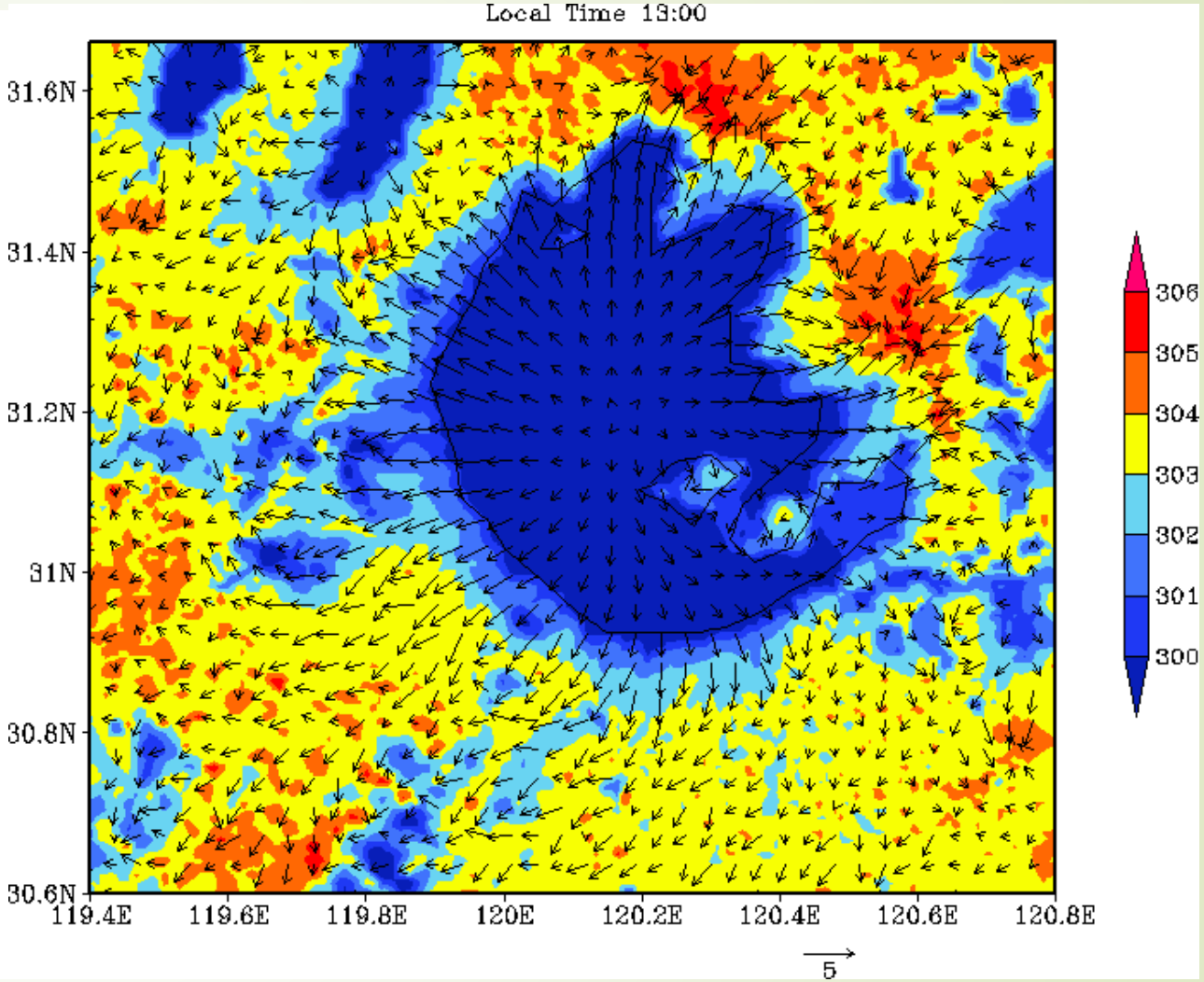

Figure 6. Surface horizontal velocity ($m \cdot s^{-1}$) and temperature(K) modeled by WRF/Lake at 13:00, 08/30/2012

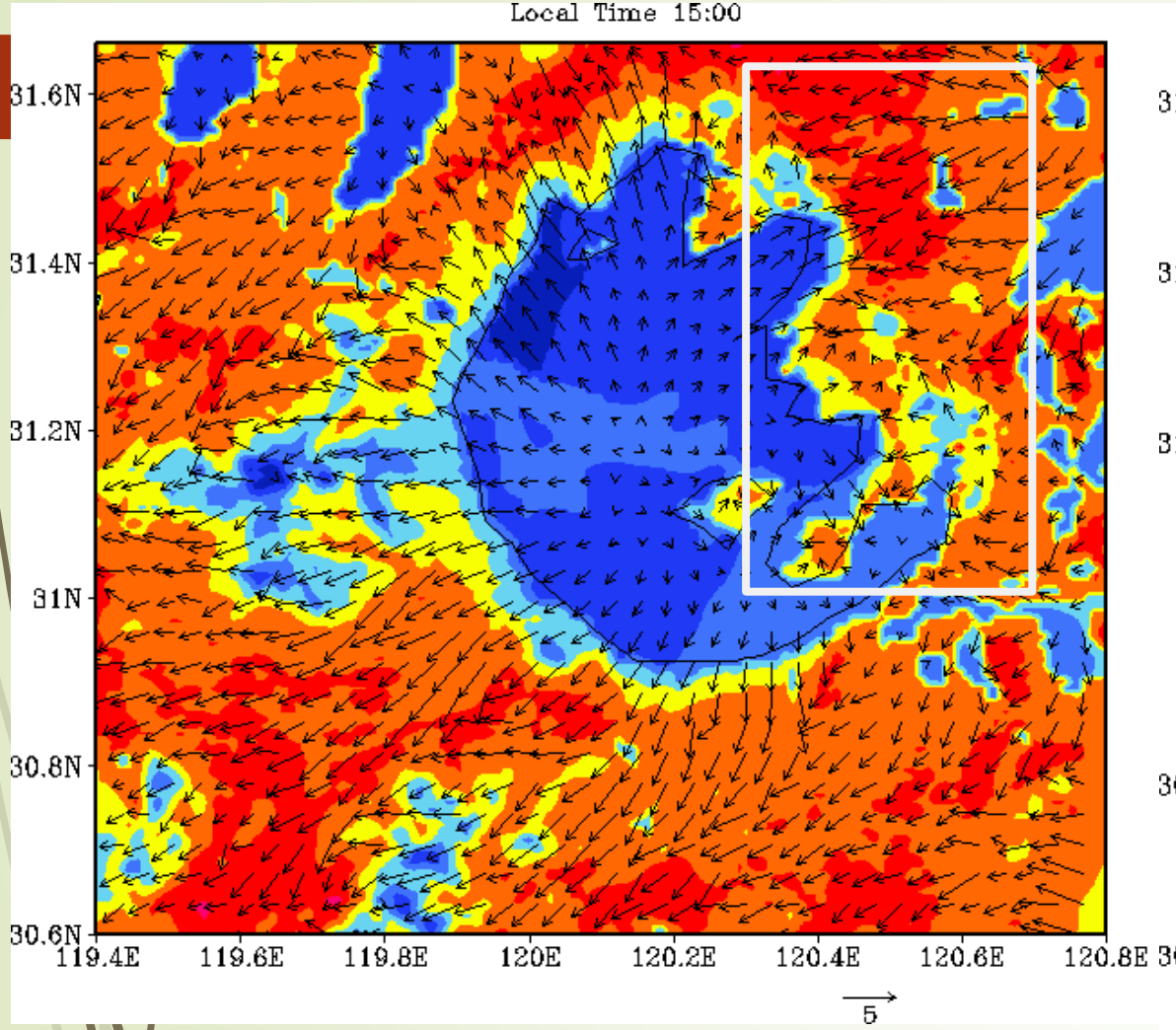

Figure 7. Surface horizontal velocity ($m \cdot s^{-1}$) and temperature(K) modeled by WRF/Lake at 15:00, 08/30/2012

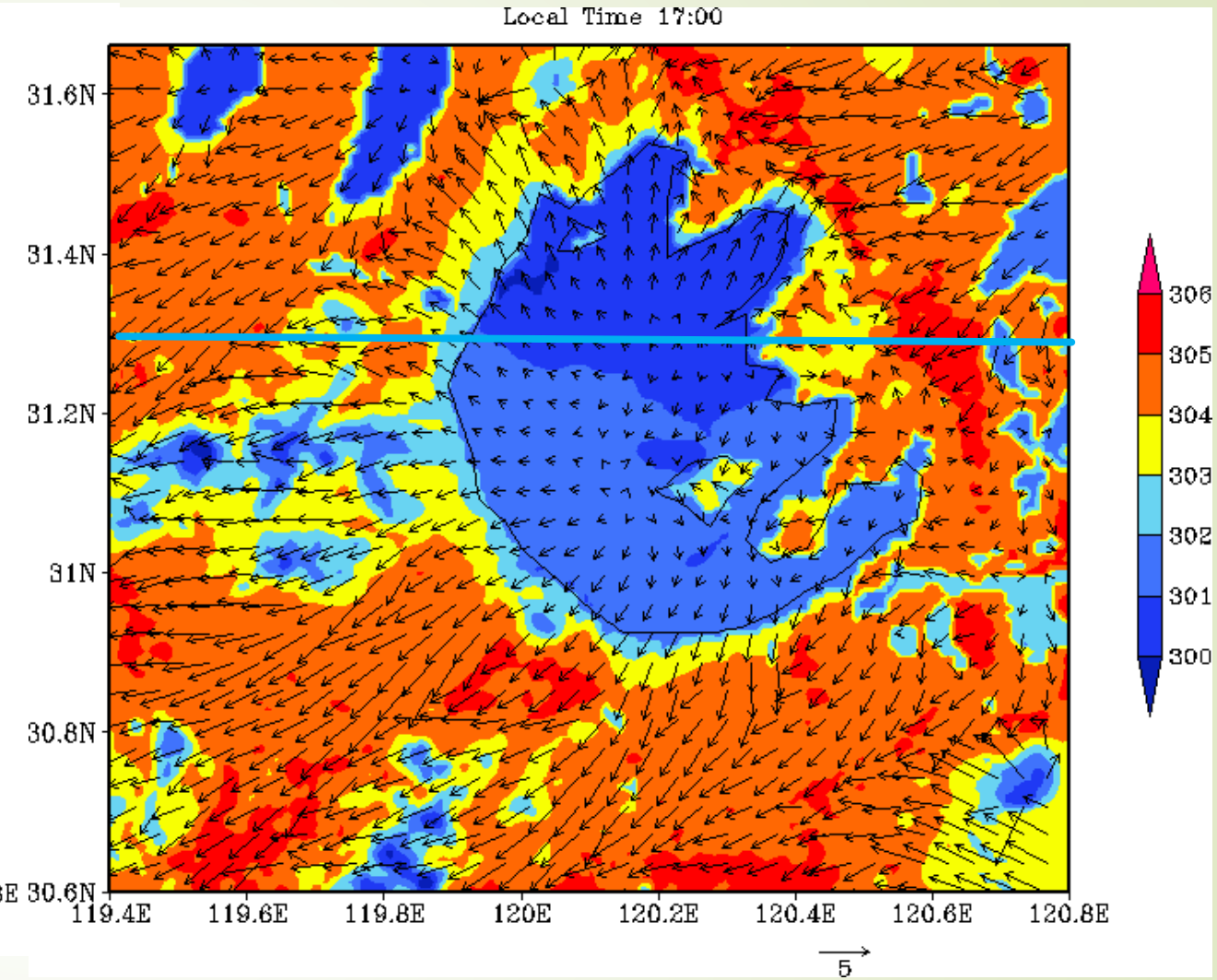

Figure 8. Surface horizontal velocity ($m \cdot s^{-1}$) and temperature(K) modeled by WRF/Lake at 17:00, 08/30/2012

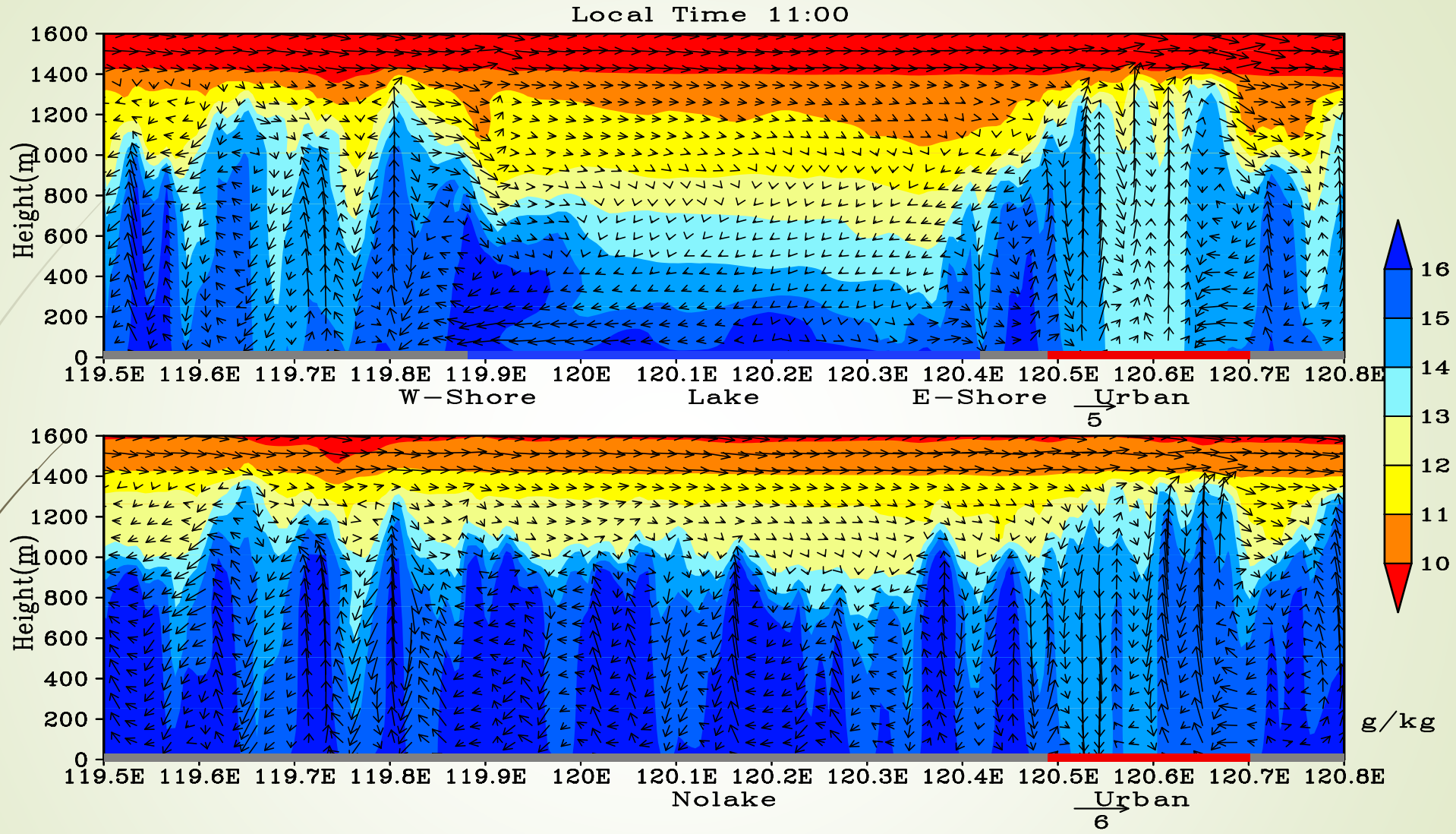

Figure 9. Overlay of vertical velocity ($m \cdot s^{-1}$) and vapor-liquid ratio ($g \cdot kg^{-1}$) at 11:00, 08/30/2012. Comparison between case1 (top) and case 2 (bottom).

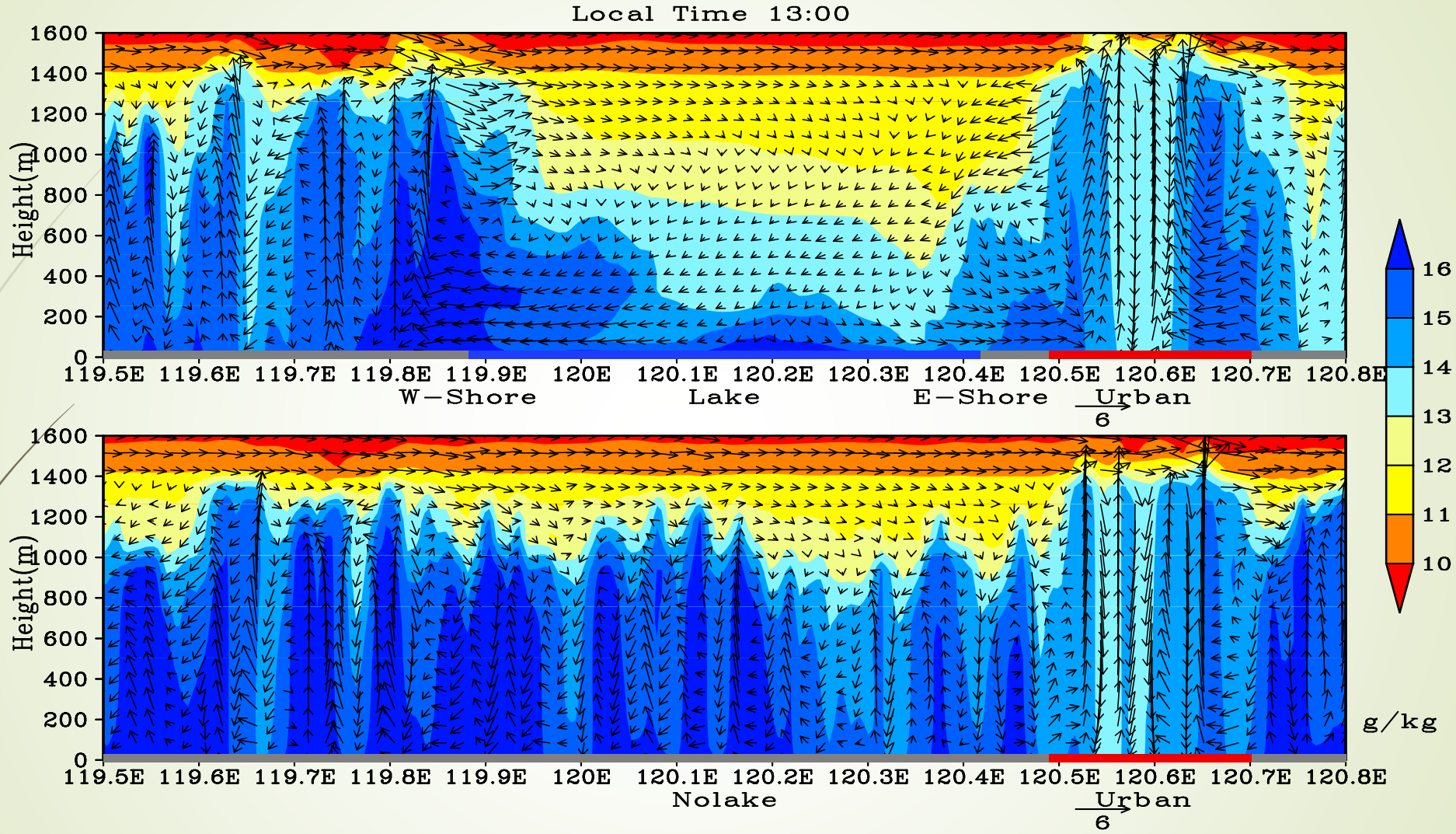

Figure 10. Overlay of vertical velocity ($m \cdot s^{-1}$) and vapor-liquid ratio ($g \cdot kg^{-1}$) at 13:00, 08/30/2012. Comparison between case1 (top) and case 2 (bottom).

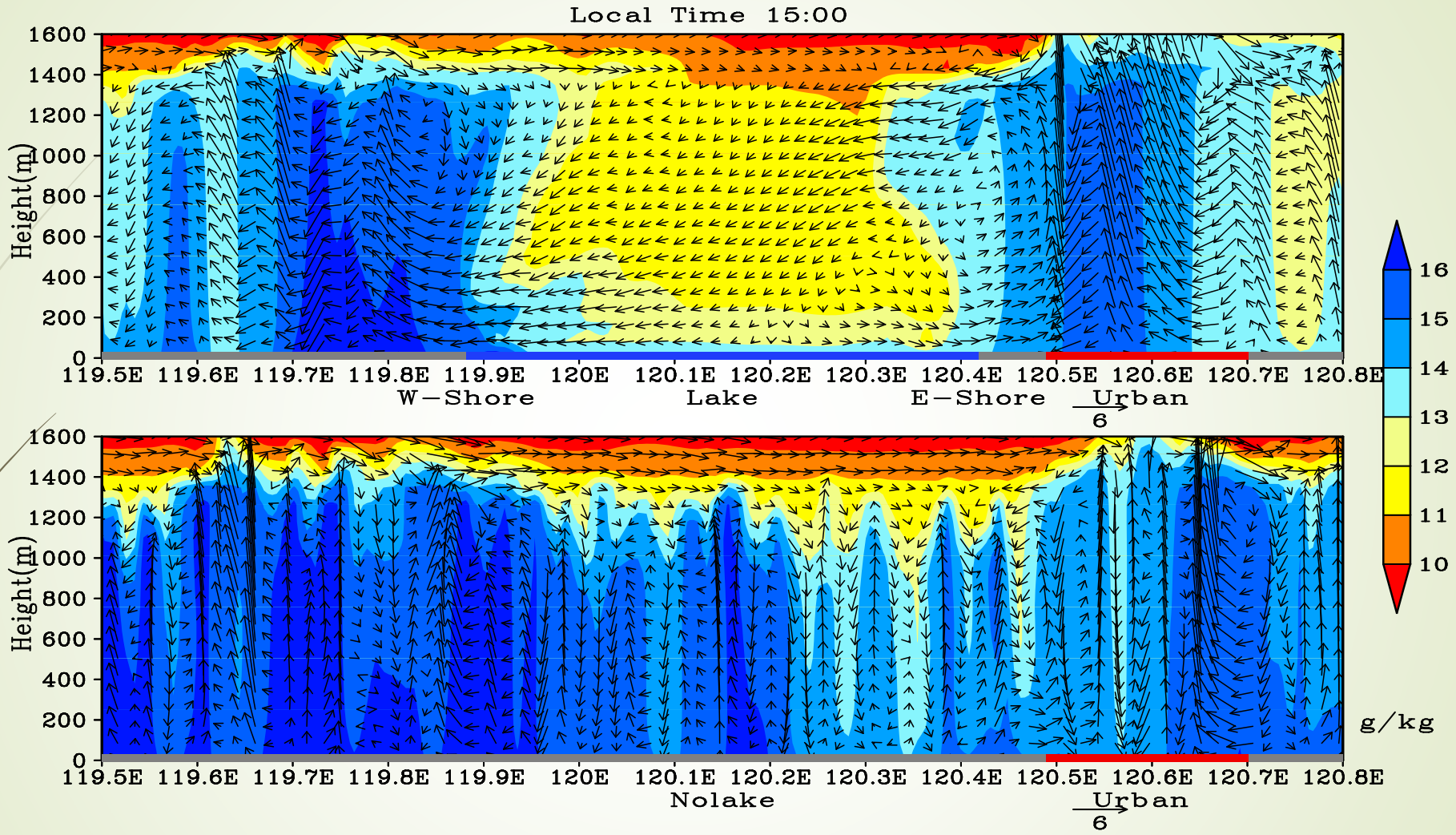

Figure 11. Overlay of vertical velocity ($m \cdot s^{-1}$) and vapor-liquid ratio ($g \cdot kg^{-1}$) at 15:00, 08/30/2012. Comparison between case1 (top) and case 2 (bottom).

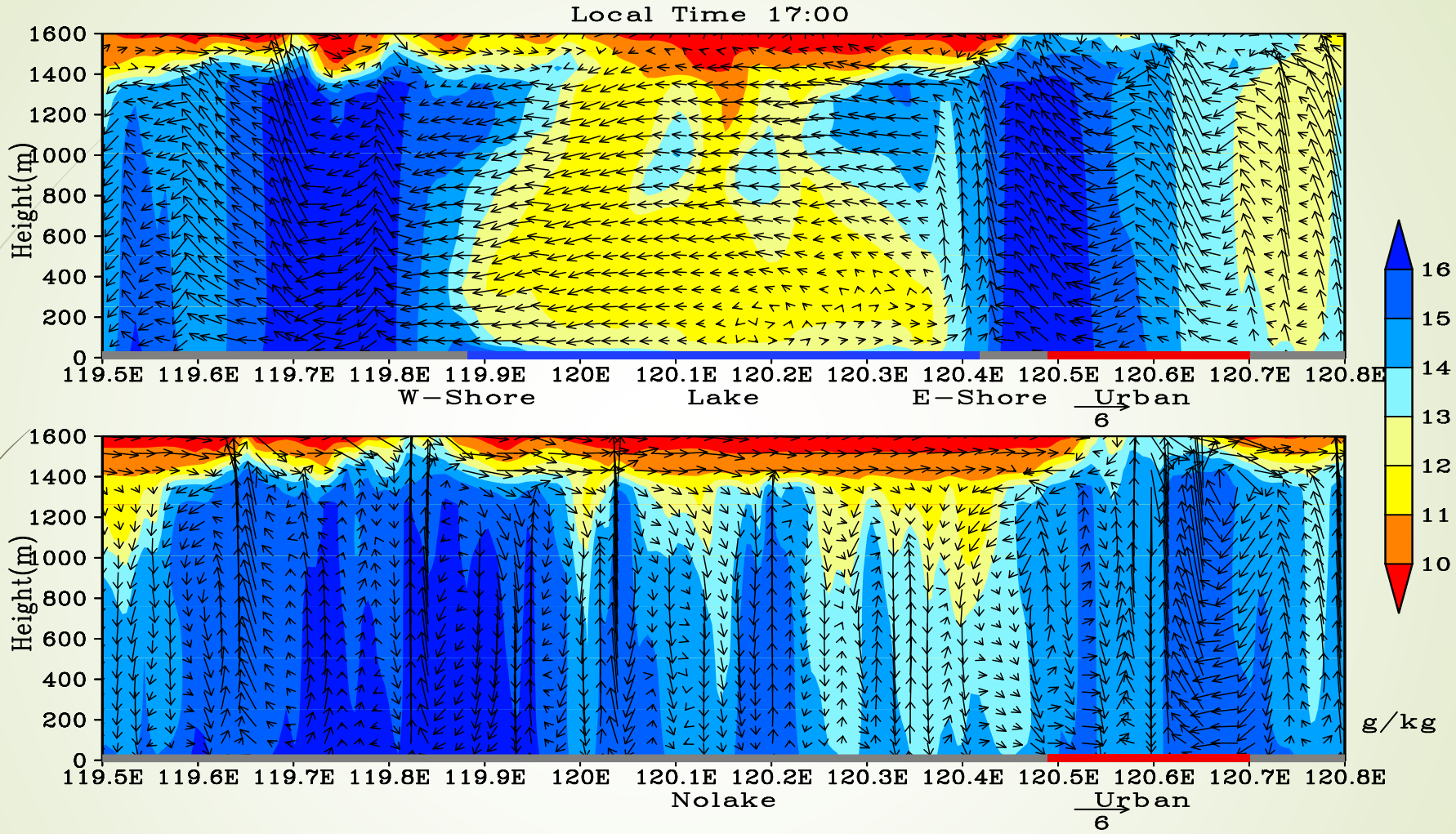

Figure 12. Overlay of vertical velocity ($m \cdot s^{-1}$) and vapor-liquid ratio ($g \cdot kg^{-1}$) at 17:00, 08/30/2012. Comparison between case1 (top) and case 2 (bottom).

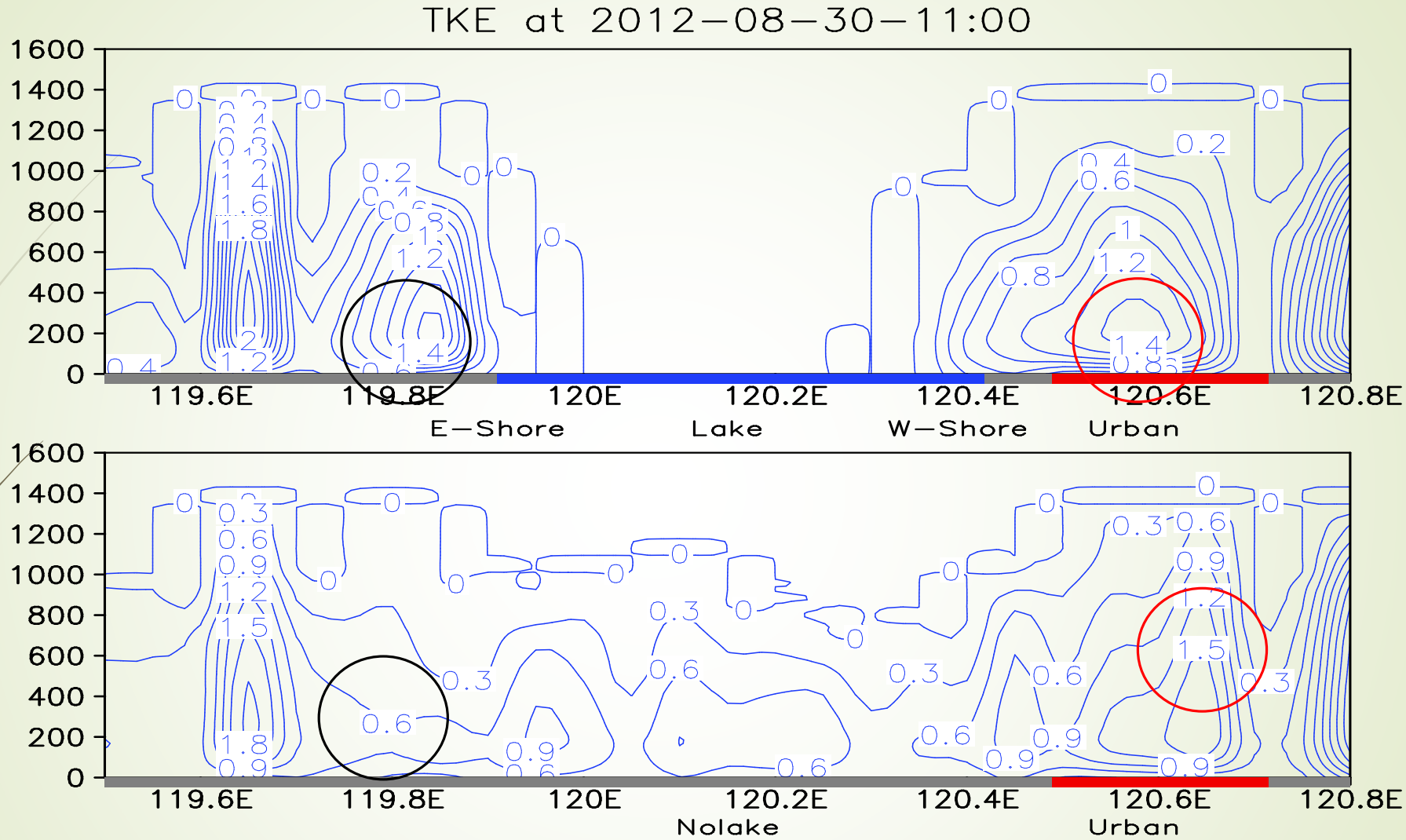

Figure 13. Turbulence kinetic energy ($m^2 \cdot s^2$) at 11:00, 08/30/2012. Comparison between case 1 (top) and case 2 (bottom)

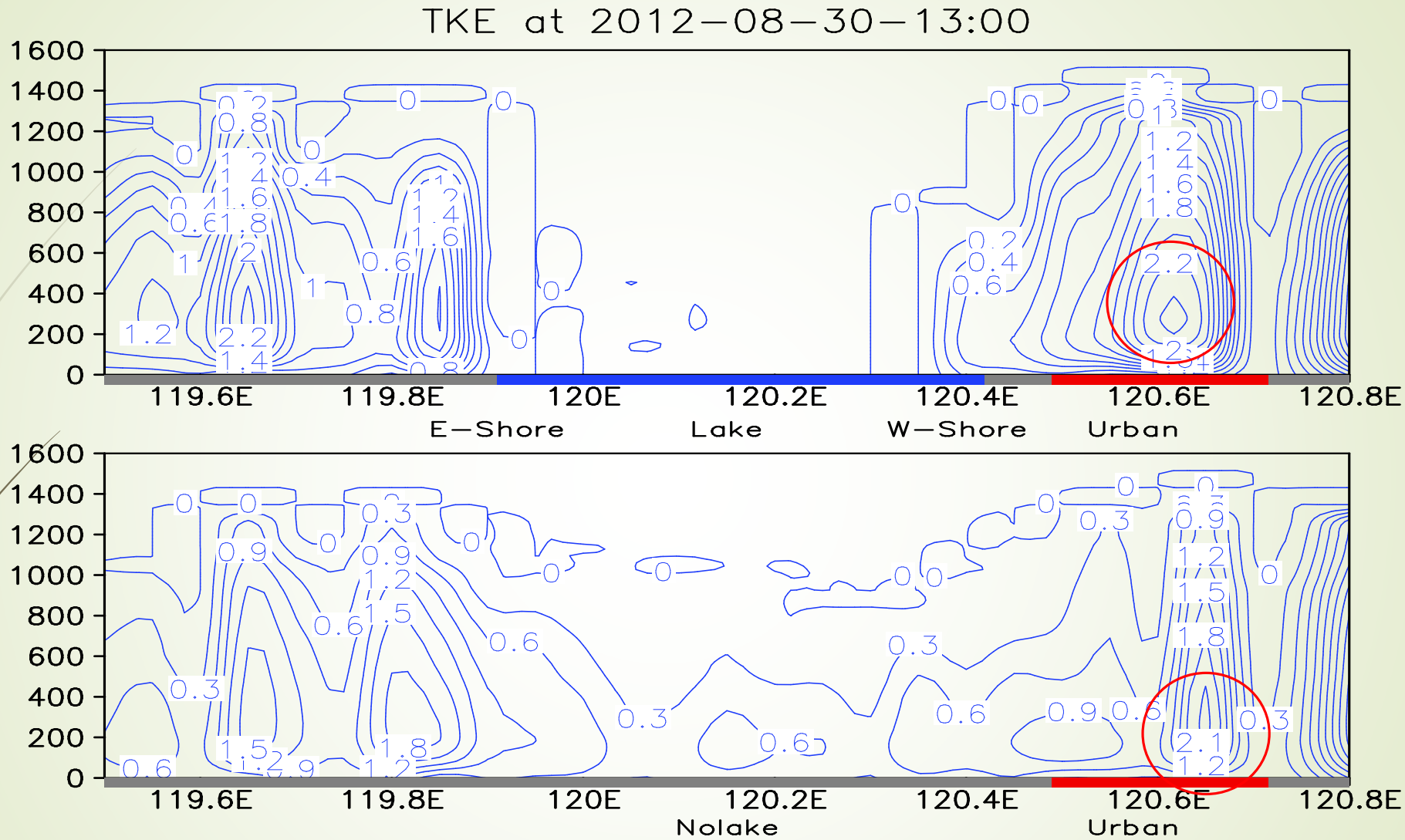

Figure 14. Turbulence kinetic energy ($m^2 \cdot s^2$) at 13:00, 08/30/2012. Comparison between case 1 (top) and case 2 (bottom)

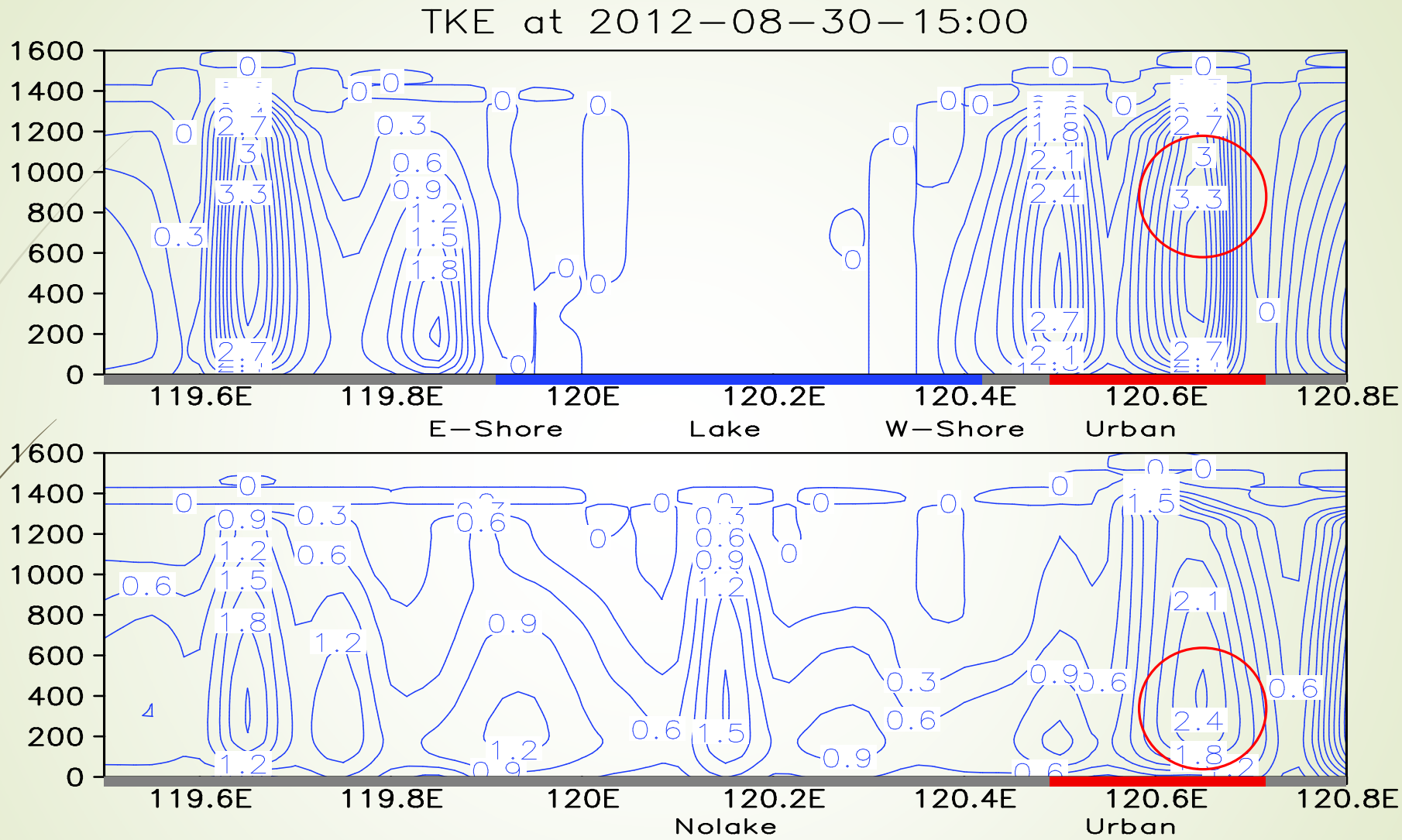

Figure 15. Turbulence kinetic energy ($m^2 \cdot s^2$) at 15:00, 08/30/2012. Comparison between case 1 (top) and case 2 (bottom)

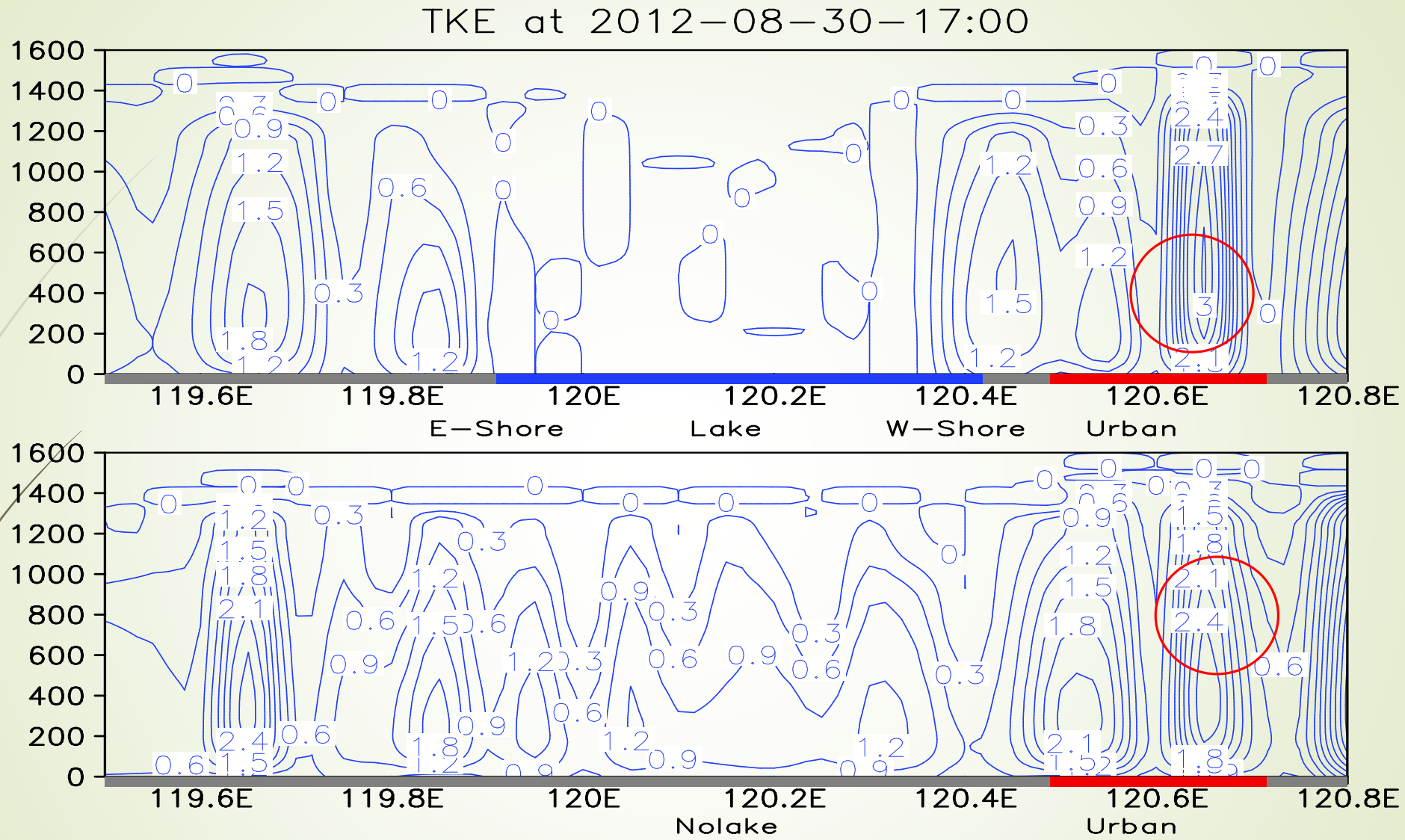

Figure 16. Turbulence kinetic energy ($m^2 \cdot s^2$) at 17:00, 08/30/2012. Comparison between case 1 (top) and case 2 (bottom)

Next work

- Expand research area of Taihu lake, including more suburb area
- Integrate CMAQ model to analyze the effects of interaction of local circulation on transfer and diffusion

Thank you