

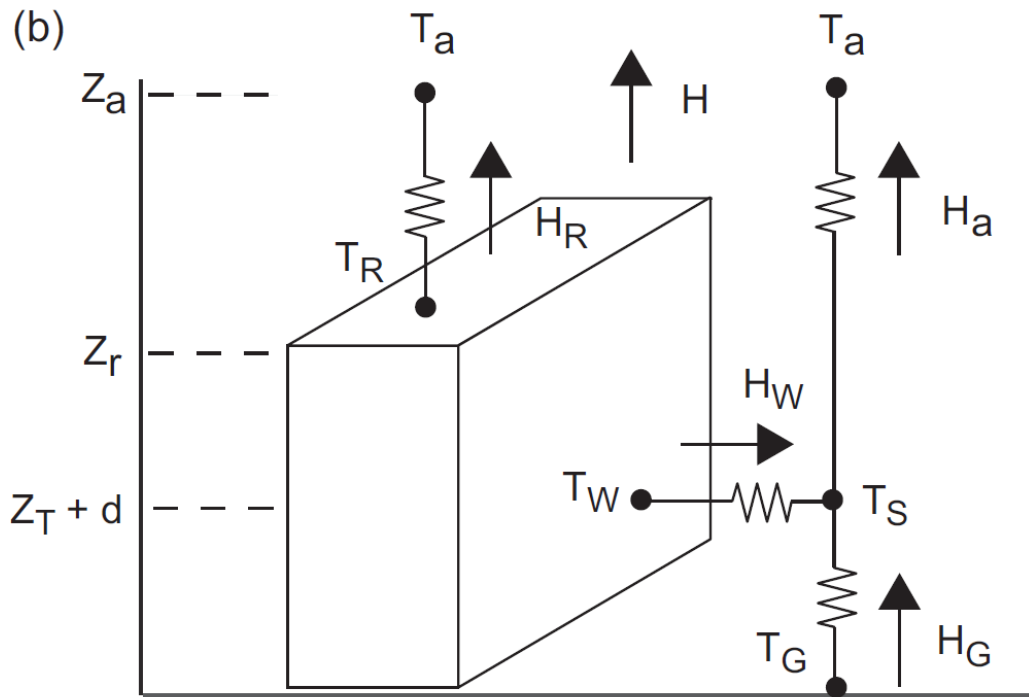
Urban Canopy Model對 高解析度模式預報影響之探討

林伯勳、洪景山

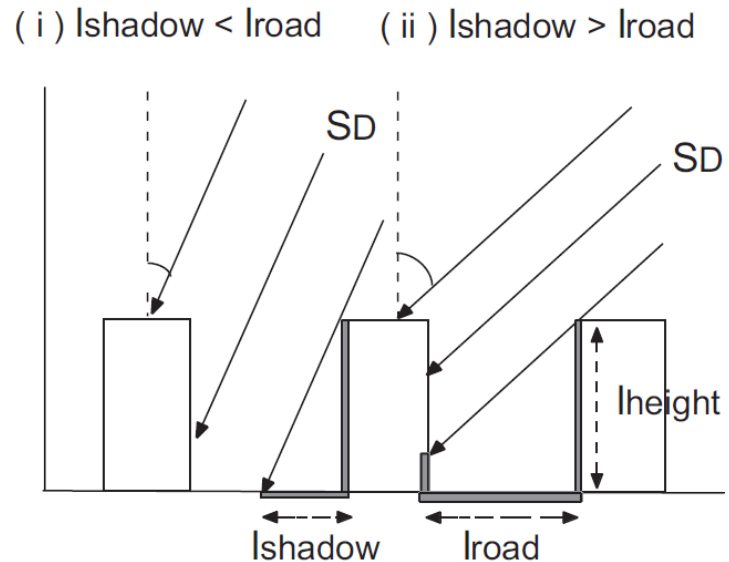
2017.09.13



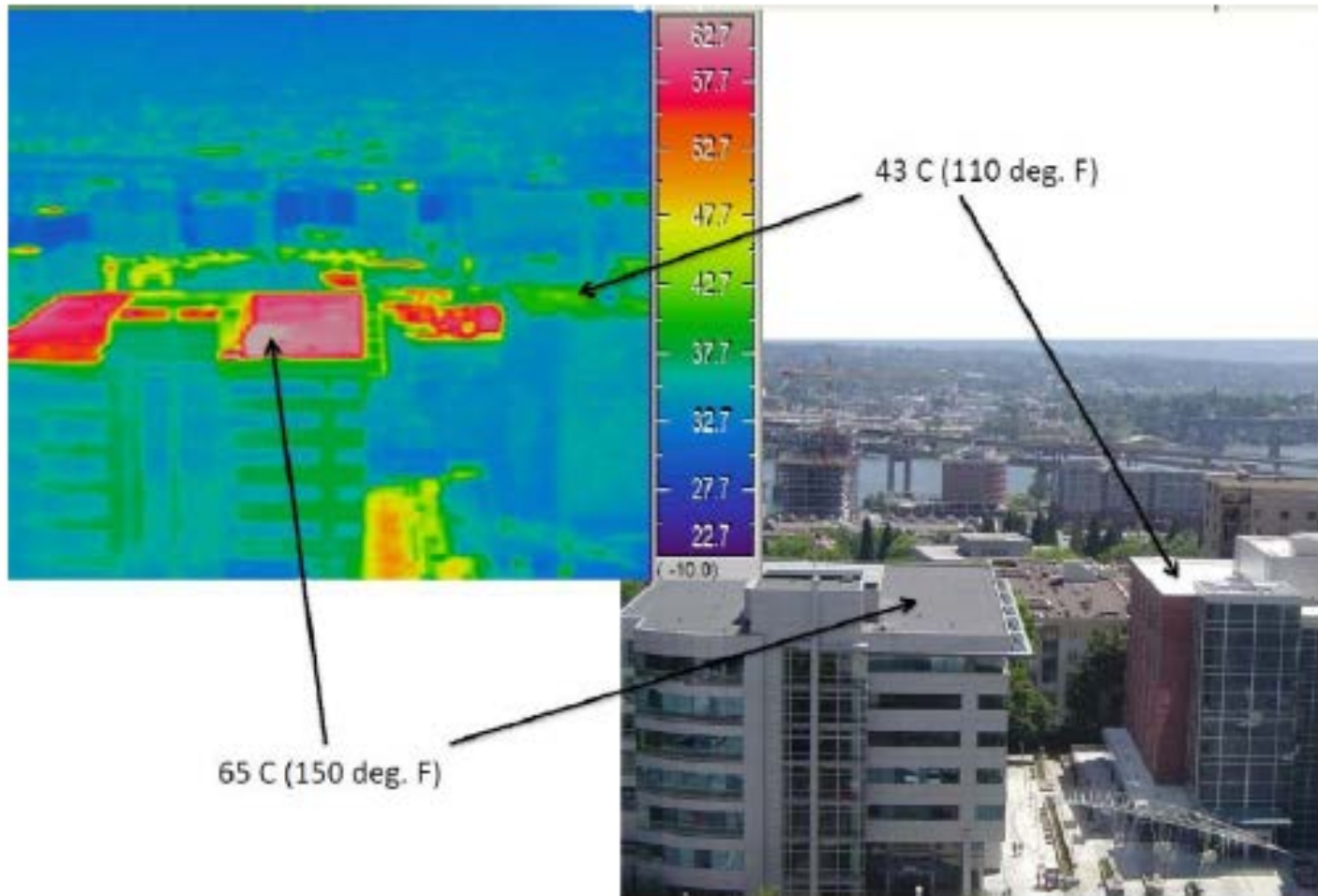
隨著本局區域作業模式(WRF)解析度提高，都市熱島效應對模式預報的影響越來越重要。因此，本研究將探討**使用Urban Canopy Model對模式預報的影響**。



(b) Schematic of the single-layer urban canopy model. T_a is the air temperature at reference height z_a , T_R the building roof temperature, T_W the building wall temperature, T_G the road temperature, and T_S the temperature defined at Z_{T+d} . H is the sensible heat exchange at the reference height. H_a is the sensible heat flux from the canyon space to the atmosphere, similarly, H_W is that from wall to the canyon space, H_G that from road to the canyon space, and H_R that from roof to the atmosphere.



Radiation of the single-layer urban canopy model. SD is the direct solar radiation incident on a horizontal surface. I_{road} is the normalized road width and h_c is the normalized building height ($I_{roof} + I_{road} = 1$). I_{shadow} is the normalized shadow length on the road.



(Chuan-Yao Lin, 2015)

2015.06.14 台北市午後大雨，公館時雨量131毫米最多

午後暴雨 台北公館地區多處積水

2015-06-14 16:28

讚 21

A+

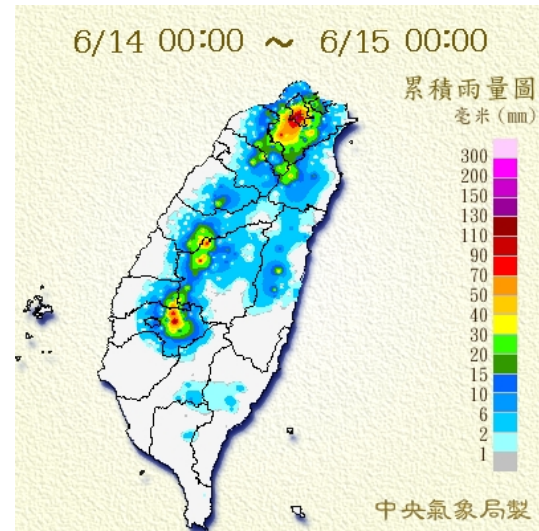


午後暴雨，台北公館地區已成汪洋一片。（讀者提供）

〔記者甘芝萸／台北報導〕因午後對流發展旺盛，氣象局表示台北市的中正區、大安區及松山區有較大雨勢發生並有冰雹發生的機率；目前時雨量最大的地區是在台北公館，已達**62.5毫米**，日雨量累積也有**187.5毫米**，該地也傳出淹水災情，汽車、機車及行人都泡在水中。

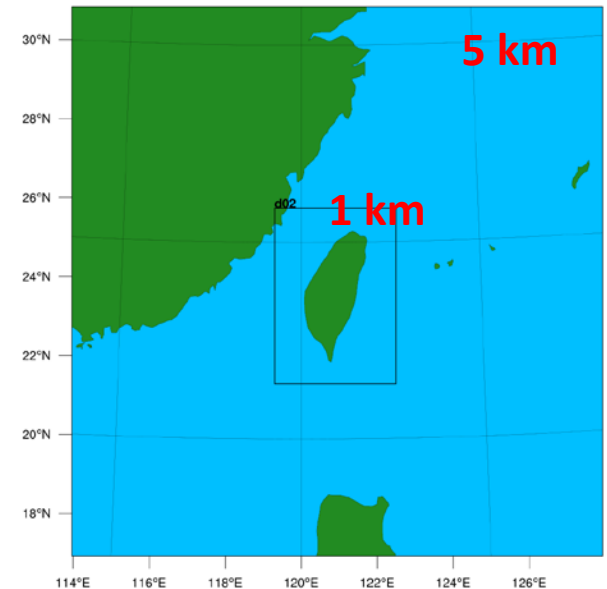


台北市14日下午下起傾盆大雨，造成文山區興隆路四段多處淹水，居民們苦不堪言，車輛也沒法通行。（劉宗龍攝）



實驗設計

- Model version : WRF V3.8.1
- Initial time : 2015.06.13 12 UTC
- IC and BC : NCEP GFS 0.5°
- Forecast time : 36 hours
- Data assimilation : No Data assimilation
- Landuse : MODIS 15-arc second



實驗設計

	CTRL	WUCMAH200	WUCMAH100
Albedo	0.18	0.20	0.20
Emission	0.88	0.9 (roof) 0.9 (wall) 0.95 (road)	0.9 (roof) 0.9 (wall) 0.95 (road)
Heat Capacity [$\text{J m}^{-3} \text{K}^{-1}$]	1.89E6	1.0E6 (roof) 1.0E6 (wall) 1.4E6 (road)	1.0E6 (roof) 1.0E6 (wall) 1.4E6 (road)
Anthropogenic Heat [W m^{-2}]	NO	200*W (Lin et., 2008)	100*W
Anthropogenic Latent Heat [W m^{-2}]	NO	25*W	25*W
Fraction of the urban landscape	0.95	0.95	0.95

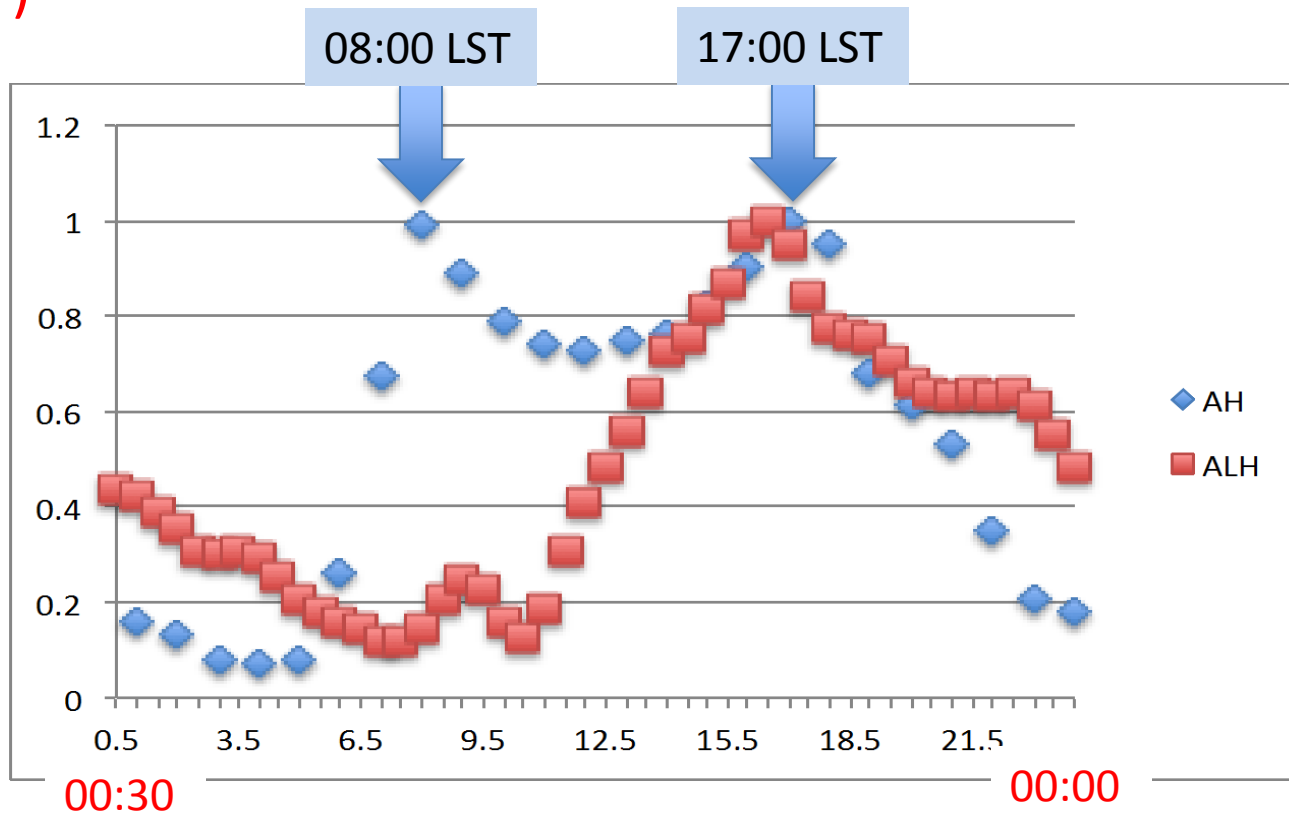
Anthropogenic Heat (AH)

人為加熱效應



Weighting Number (W)

- Anthropogenic Heat (per hour ; 01~24 LST) and
- Anthropogenic Latent Heat (Every half hour ; 00:30~24:00 LST)



地表温度

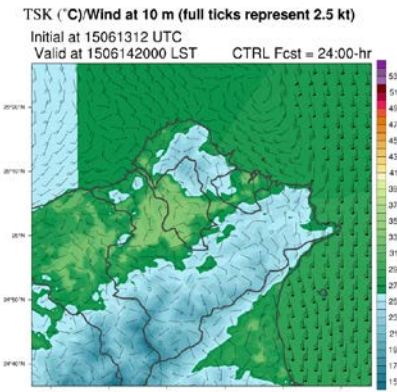
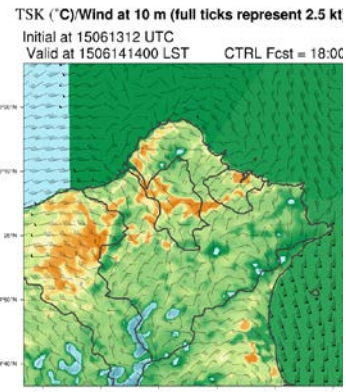
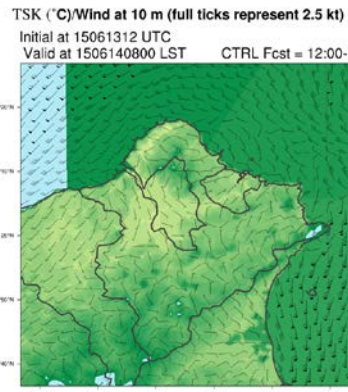
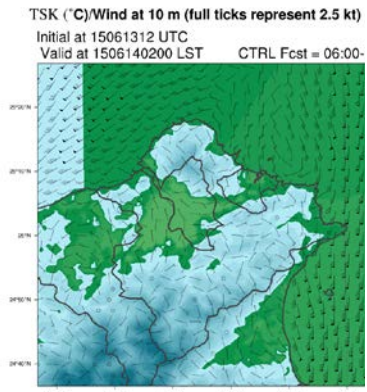
2015.06.14 02:00

2015.06.14 08:00

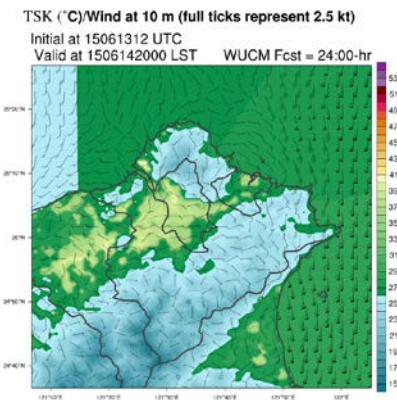
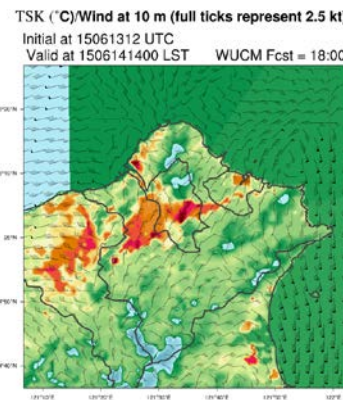
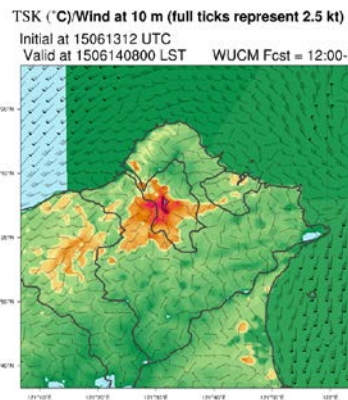
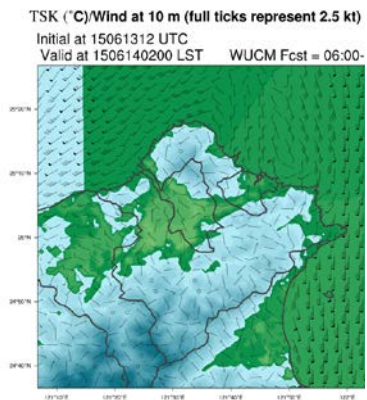
2015.06.14 14:00

2015.06.14 20:00

CTRL



WUCM
AH200



兩米溫度

2015.06.14 02:00

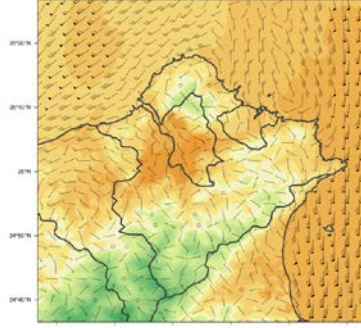
2015.06.14 08:00

2015.06.14 14:00

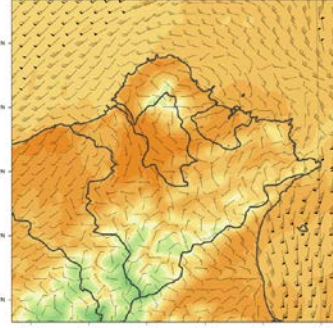
2015.06.14 20:00

CTRL

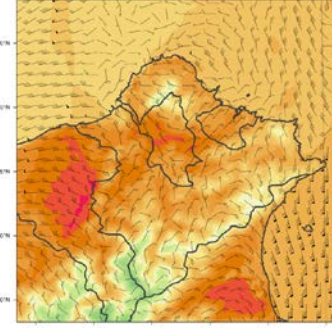
T2 (°C)/Wind at 10 m (full ticks represent 2.5 kt)
Initial at 15061312 UTC
Valid at 1506140200 LST WUCM Fcst = 06:00-



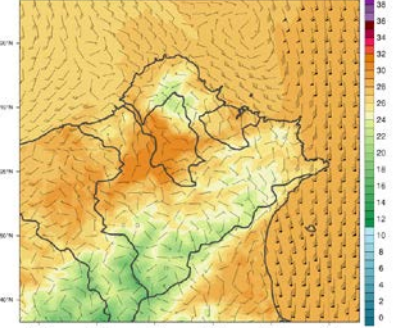
T2 (°C)/Wind at 10 m (full ticks represent 2.5 kt)
Initial at 15061312 UTC
Valid at 1506140800 LST CTRL Fcst = 12:00-



T2 (°C)/Wind at 10 m (full ticks represent 2.5 kt)
Initial at 15061312 UTC
Valid at 1506141400 LST CTRL Fcst = 18:00-

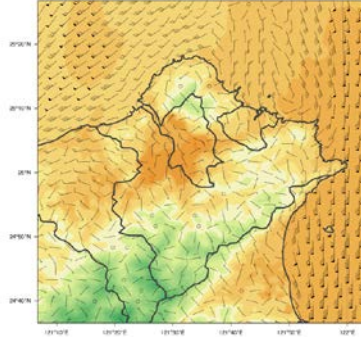


T2 (°C)/Wind at 10 m (full ticks represent 2.5 kt)
Initial at 15061312 UTC
Valid at 1506142000 LST CTRL Fcst = 24:00-hr

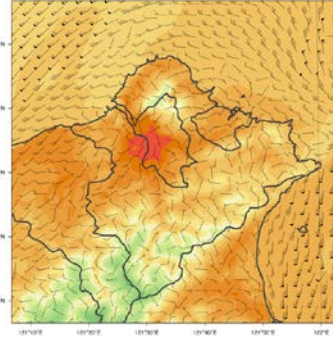


WUCM
AH200

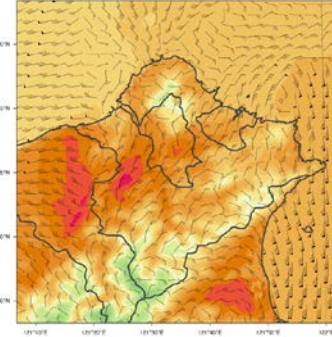
T2 (°C)/Wind at 10 m (full ticks represent 2.5 kt)
Initial at 15061312 UTC
Valid at 1506140200 LST WUCM Fcst = 06:00-



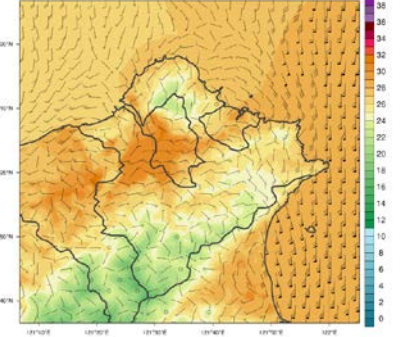
T2 (°C)/Wind at 10 m (full ticks represent 2.5 kt)
Initial at 15061312 UTC
Valid at 1506140800 LST WUCM Fcst = 12:00-



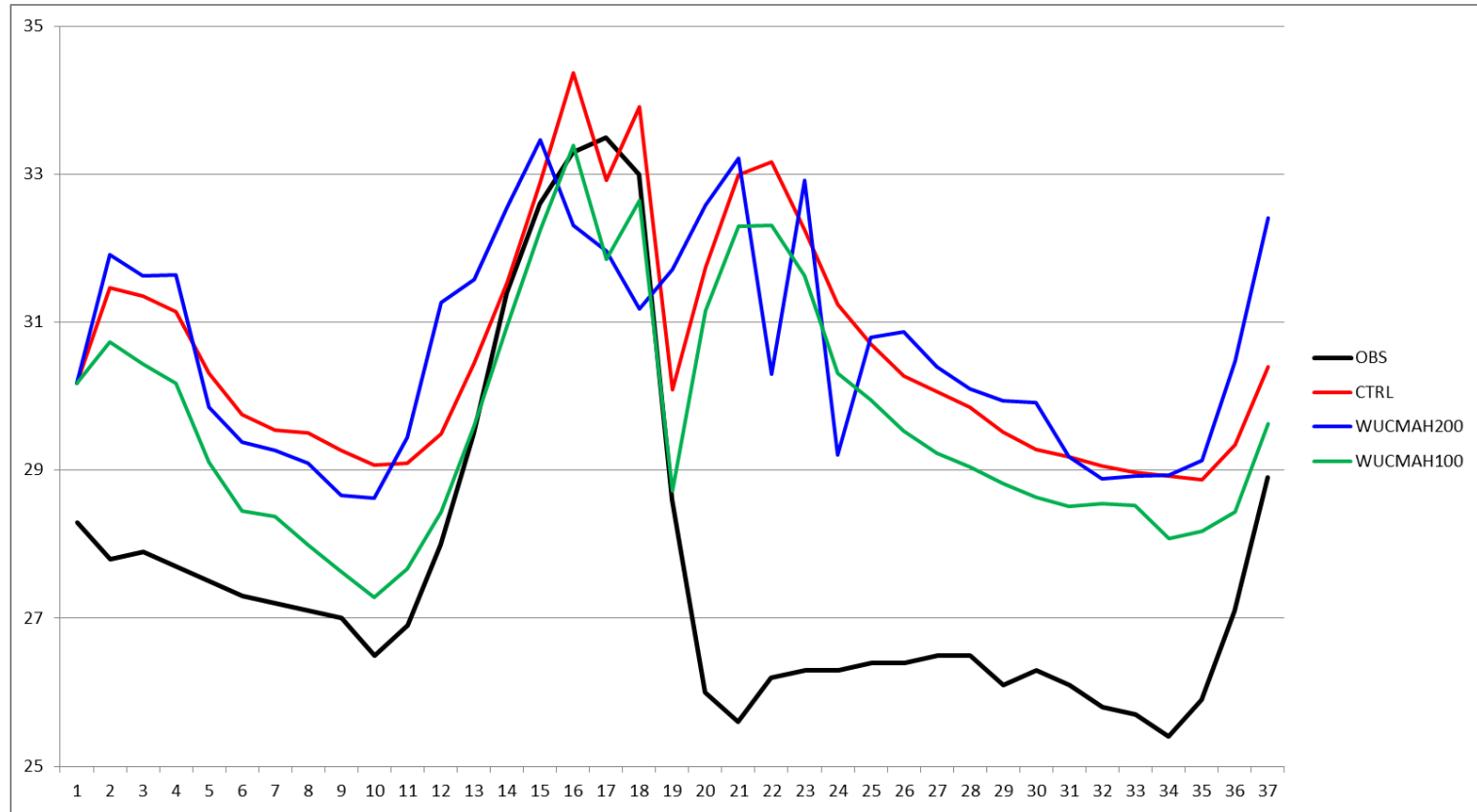
T2 (°C)/Wind at 10 m (full ticks represent 2.5 kt)
Initial at 15061312 UTC
Valid at 1506141400 LST WUCM Fcst = 18:00-



T2 (°C)/Wind at 10 m (full ticks represent 2.5 kt)
Initial at 15061312 UTC
Valid at 1506142000 LST WUCM Fcst = 24:00-hr



台北站 V.S. 模式預報 (兩米溫度)



AH對於地面溫度預報的影響相當大

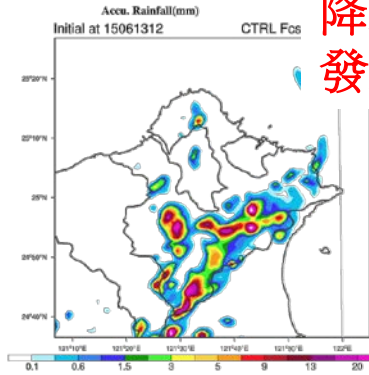
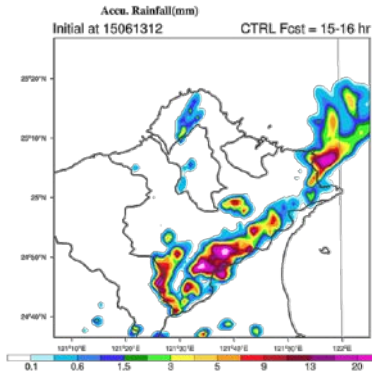
2015.06.14
11:00 – 12:00

2015.06.14
12:00 – 13:00

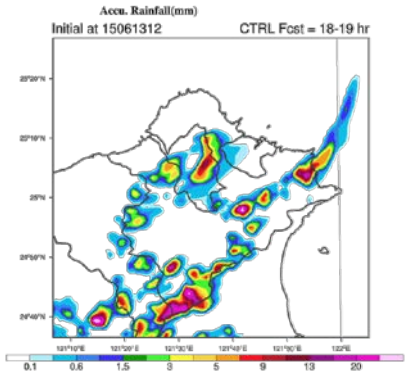
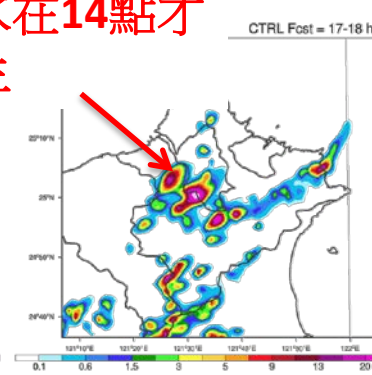
2015.06.14
13:00 – 14:00

2015.06.14
14:00 – 15:00

CTRL

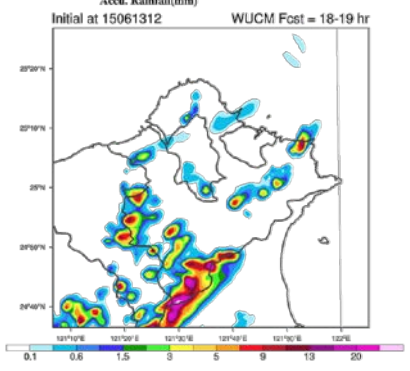
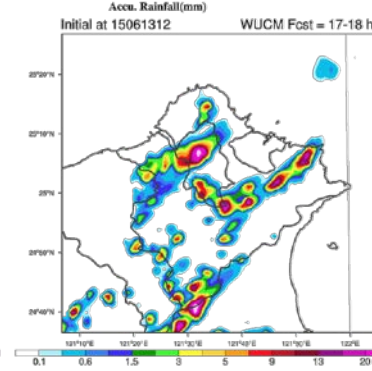
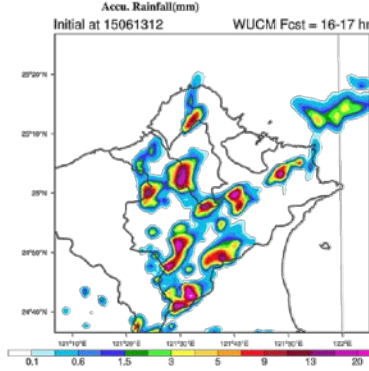
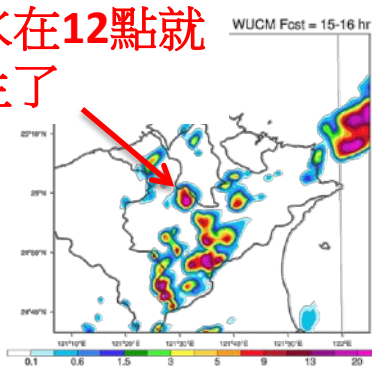


降水在14點才
發生



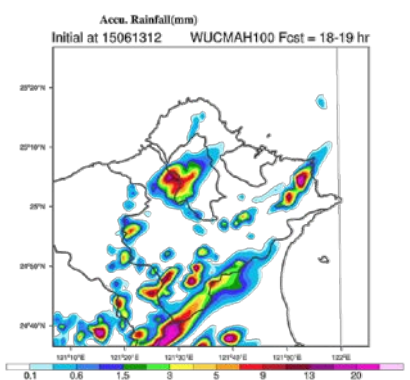
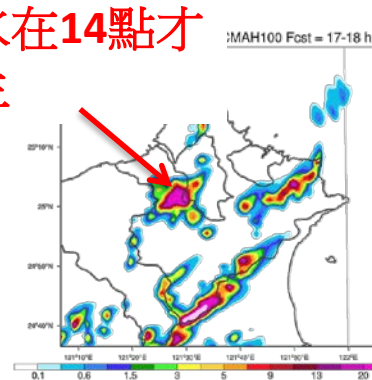
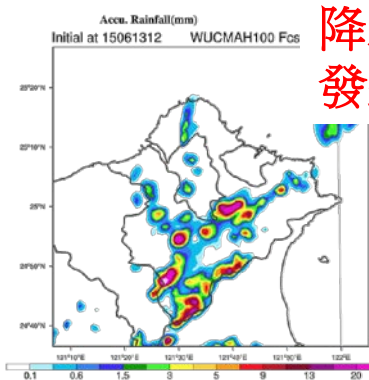
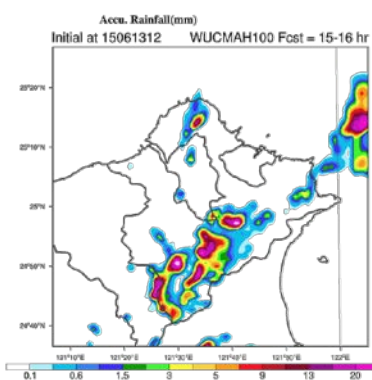
降水在12點就
發生了

WUCM
AH200



降水在14點才
發生

WUCM
AH100



2015.06.14 11:00

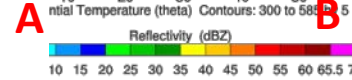
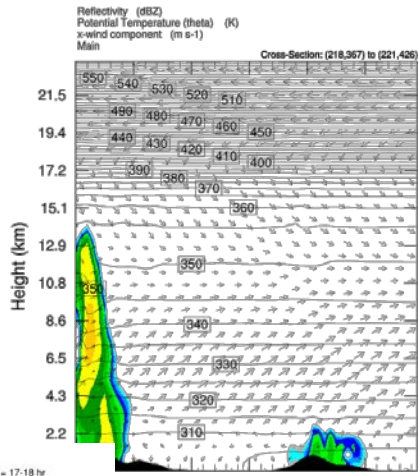
2015.06.14 12:00

2015.06.14 13:00

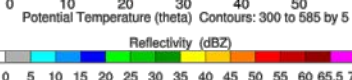
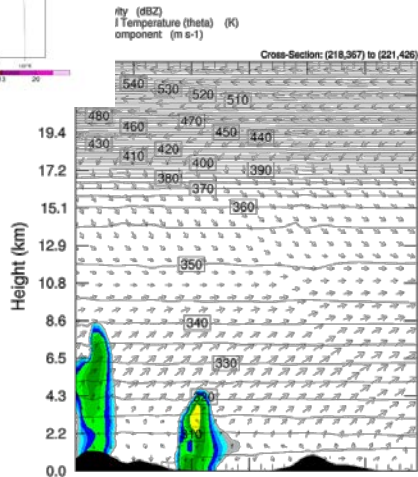
2015.06.14 14:00

CTRL

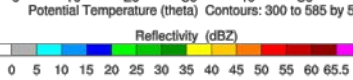
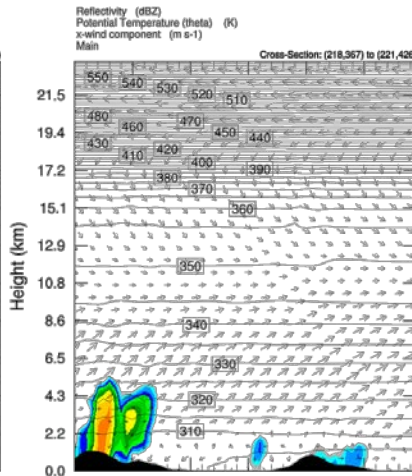
REAL-TIME WRF
Init: 2015-06-13 12:00:00
Valid: 2015-06-14 03:00:00



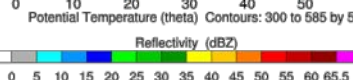
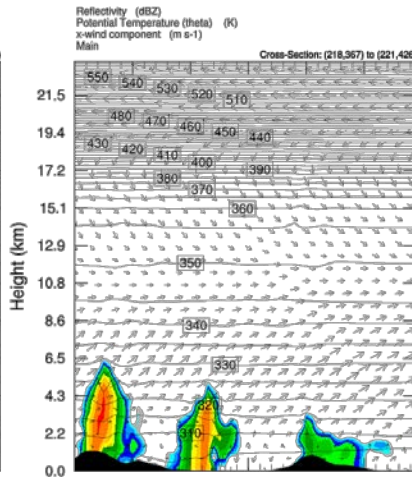
REAL-TIME WRF
Init: 2015-06-13 12:00:00
Valid: 2015-06-14 03:00:00



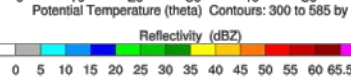
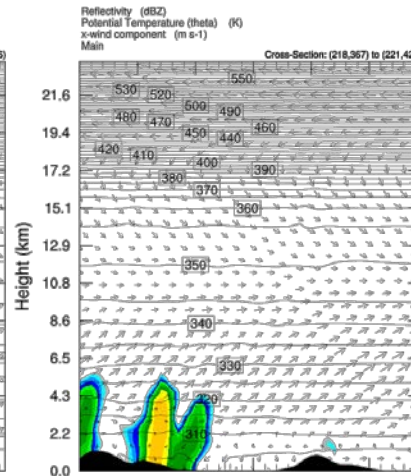
REAL-TIME WRF
Init: 2015-06-13 12:00:00
Valid: 2015-06-14 04:00:00



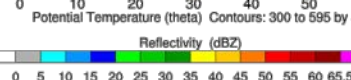
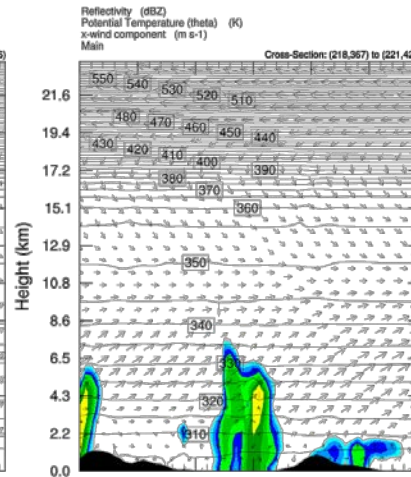
REAL-TIME WRF
Init: 2015-06-13 12:00:00
Valid: 2015-06-14 04:00:00



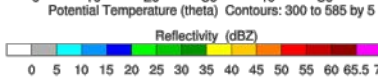
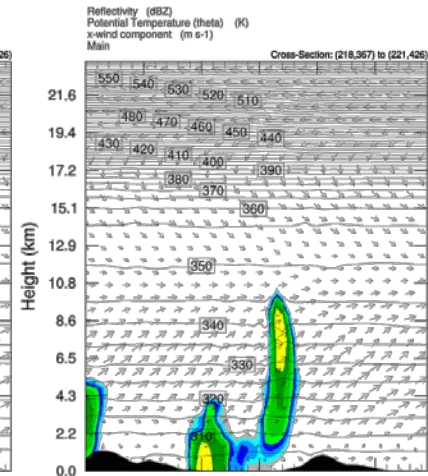
REAL-TIME WRF
Init: 2015-06-13 12:00:00
Valid: 2015-06-14 05:00:00



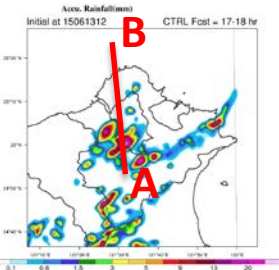
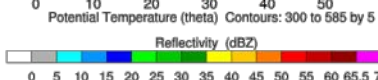
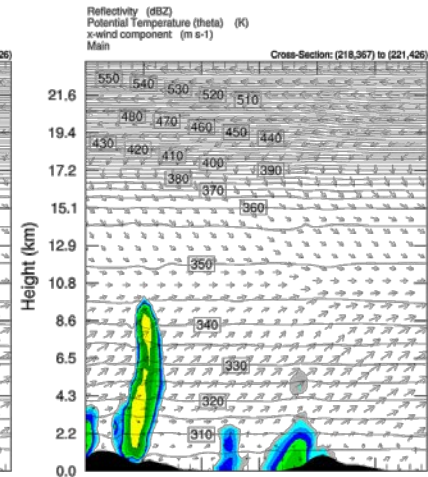
REAL-TIME WRF
Init: 2015-06-13 12:00:00
Valid: 2015-06-14 05:00:00



REAL-TIME WRF
Init: 2015-06-13 12:00:00
Valid: 2015-06-14 06:00:00



REAL-TIME WRF
Init: 2015-06-13 12:00:00
Valid: 2015-06-14 06:00:00



WUCM
AH200

2015.06.14 11:00

2015.06.14 12:00

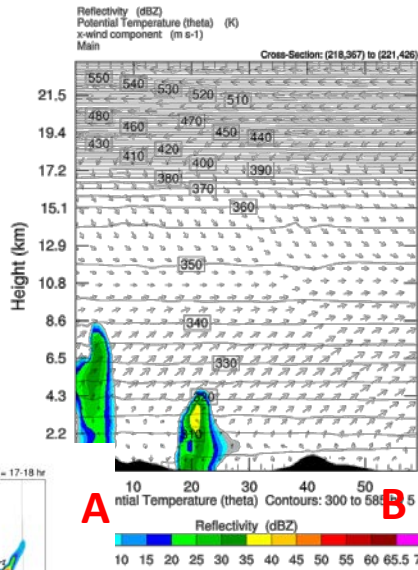
2015.06.14 13:00

2015.06.14 14:00

WUCM
AH200

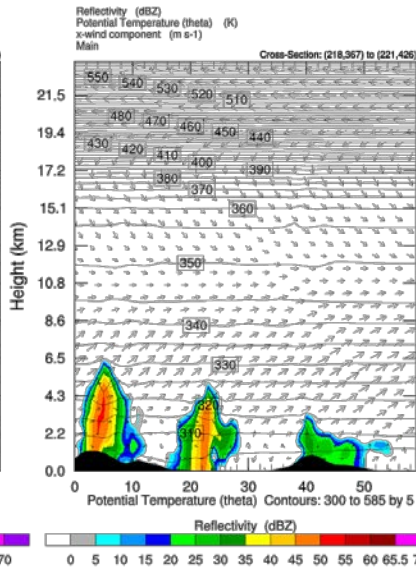
REAL-TIME WRF

Init: 2015-06-13_12:00:00
Valid: 2015-06-14_03:00:00



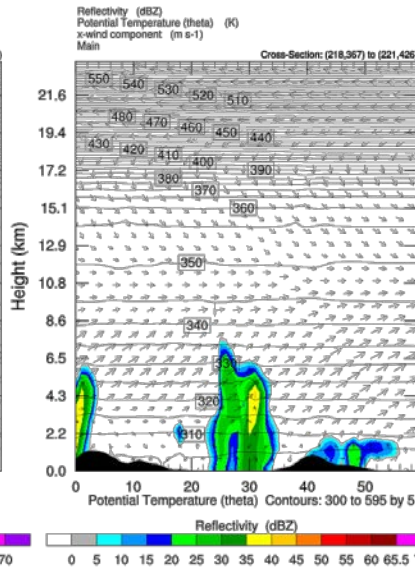
REAL-TIME WRF

Init: 2015-06-13_12:00:00
Valid: 2015-06-14_04:00:00



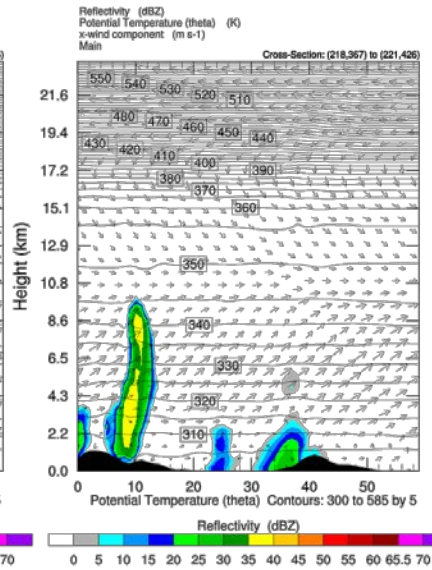
REAL-TIME WRF

Init: 2015-06-13_12:00:00
Valid: 2015-06-14_05:00:00



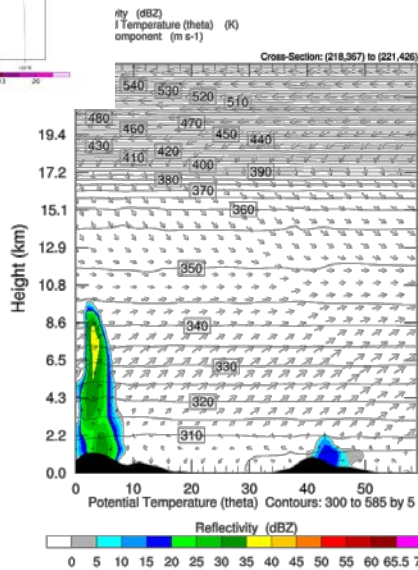
REAL-TIME WRF

Init: 2015-06-13_12:00:00
Valid: 2015-06-14_06:00:00



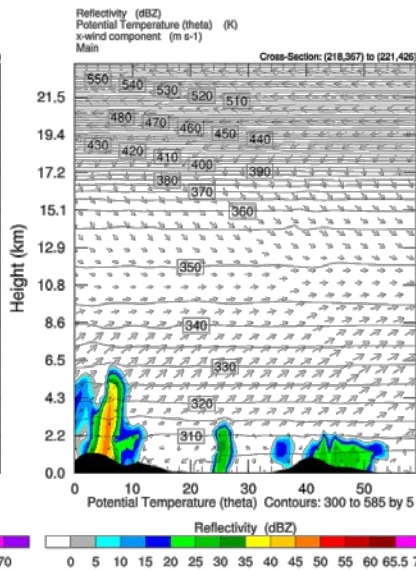
REAL-TIME WRF

Init: 2015-06-13_12:00:00
Valid: 2015-06-14_03:00:00



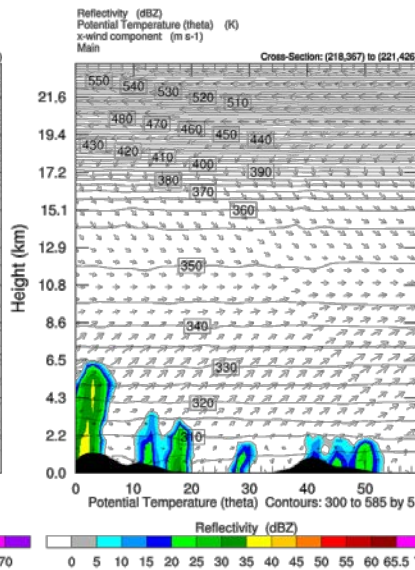
REAL-TIME WRF

Init: 2015-06-13_12:00:00
Valid: 2015-06-14_04:00:00



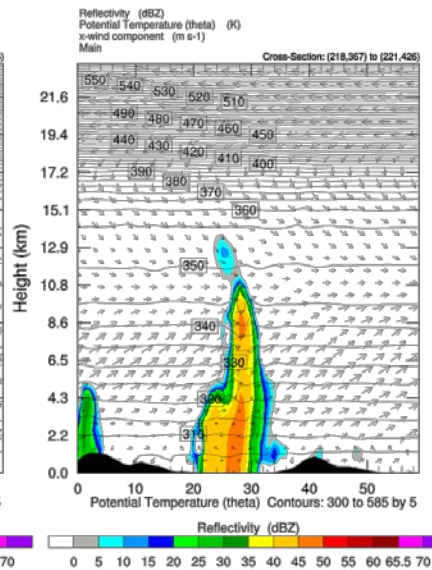
REAL-TIME WRF

Init: 2015-06-13_12:00:00
Valid: 2015-06-14_05:00:00

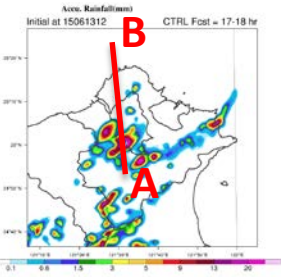


REAL-TIME WRF

Init: 2015-06-13_12:00:00
Valid: 2015-06-14_06:00:00



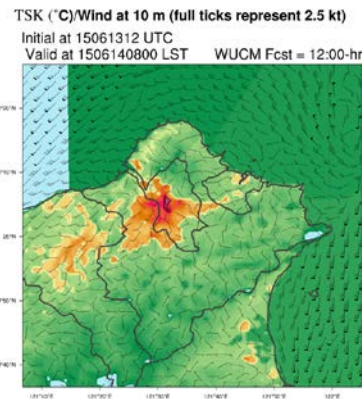
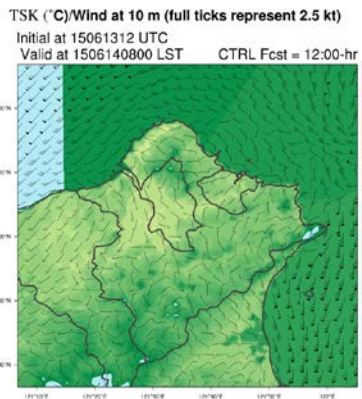
WUCM
AH100



結論

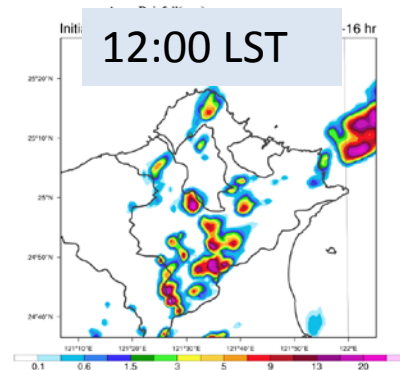
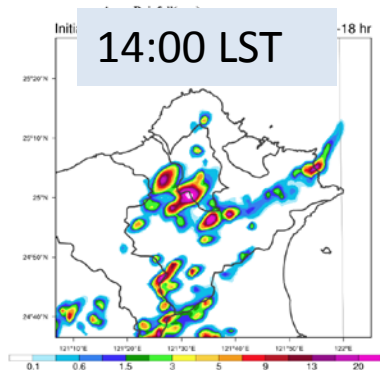
- 由本實驗結果可以看到 **Urban Canopy Model** 對都市地區的地面溫度、對流生成時間、位置、強度及降水皆有顯著影響。

- AH 在人為而影
- 未來模式改進



色，透過AH可以使模式地表溫度的改變，並進

Jrban Canopy Model對el的各種參數，希望能

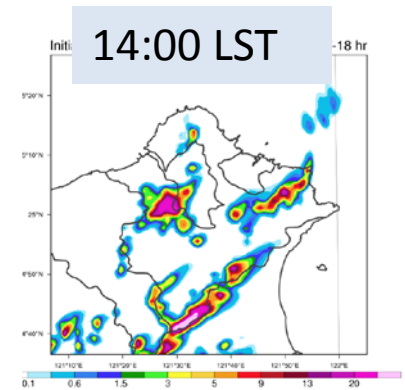
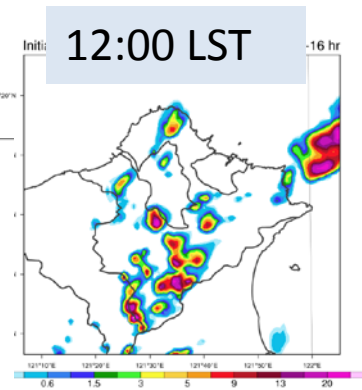
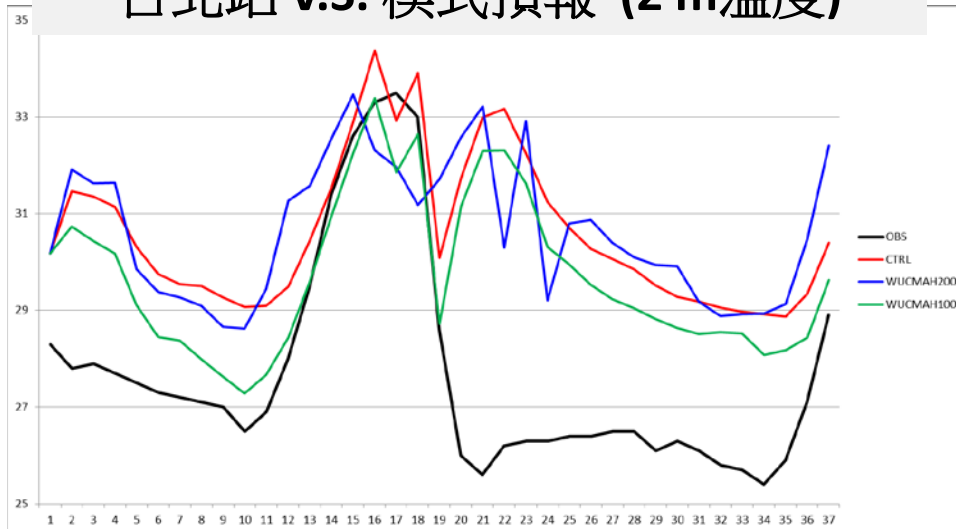


結論

- 由本實驗結果可以看到Urban Canopy Model對都市地區的地面溫度、對流生成時間、對流生成位置及降水皆有顯著影響。
- AH在Urban Canopy Model裡面扮演很重要的角色，透過AH可以使模式人為加熱效應。**AH的變化會直接造成都市地區地表溫度的改變，並進而影響局部環流及降水。**

未來會持續進行不同個案的分析

台北站 V.S. 模式預報 (2 m溫度)



結論

- 由本實驗結果可以看到**Urban Canopy Model**對都市地區的地面溫度、對流生成時間、對流生成位置及降水皆有顯著影響。
- AH在Urban Canopy Model裡面扮演很重要的角色，透過AH可以使模式人為加熱效應。**AH**的變化會直接造成都市地區地表溫度的改變，並進而影響局部環流及降水。
- 未來會持續進行不同個案的分析，以了解使用**Urban Canopy Model**對模式系統性的影響。並調整**Urban Canopy Model**的各種參數，希望能改進模式對都市熱島效應的預報能力。

THANK YOU !!

