Supplement of Geosci. Model Dev., 13, 3489–3505, 2020
https://doi.org/10.5194/gmd-13-3489-2020-supplement

Geoscientific Model Development
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EGU

Supplement of

Concentration Trajectory Route of Air pollution with an Integrated Lagrangian model (C-TRAIL Model v1.0) derived from the Community Multiscale Air Quality Model (CMAQ Model v5.2)

Arman Pouyaei et al.

Correspondence to: Yunsoo Choi (ychoi6@uh.edu)

Table S1: Convective transport modeling in WRF, CMAQ, and C-TRAIL

Models	**WRF v3.8**		**CMAQ v5.2**		**C-TRAIL v1.0**	
Convection Scheme	Kain-Fritch (2004)		ACM		ACM modified	
Scales	Resolved	Sub-grid	Resolved	Sub-grid	Resolved	Sub-grid
Availabilty	✓	✓	✓	✓	✓	×

Table S2: U wind and V wind WRF predictions compared with surface measurements for May 2016 (255 ground stations)

	IOA	Correlation	RMSE	MAE
U wind velocity	0.7632	0.6927	2.1952	1.7536
V wind velocity	0.6922	0.5663	2.1924	1.7282

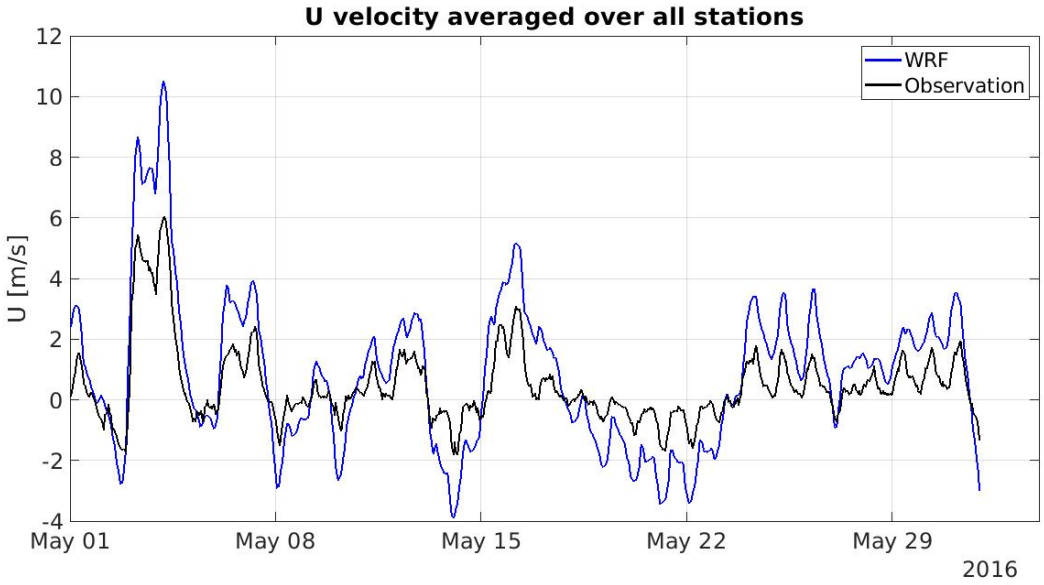

Figure S1: U wind averaged over all stations from WRF compared with ground observation during May 2016.

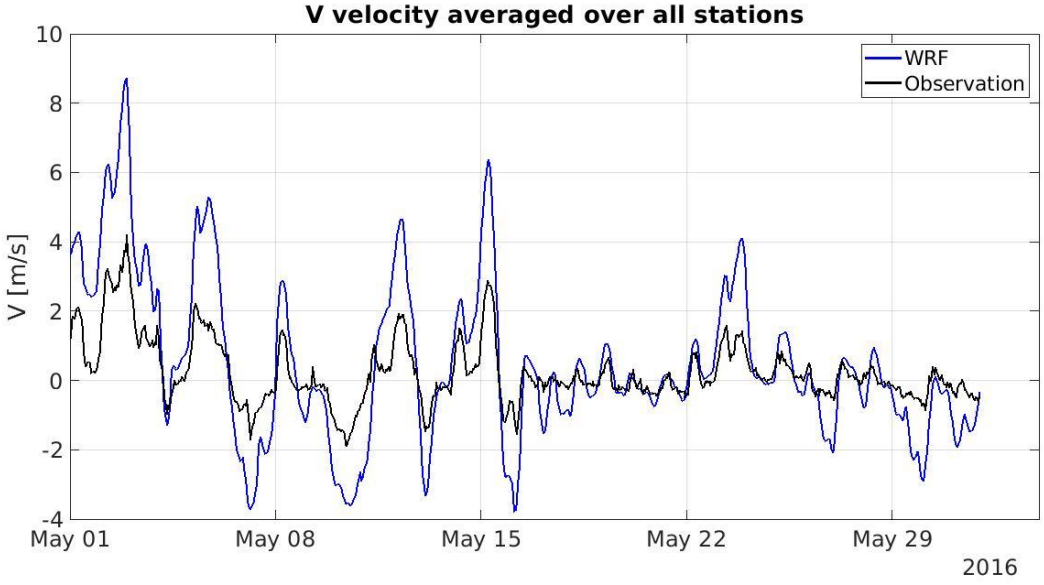

Figure S2: V wind averaged over all stations from WRF compared with ground observation during May 2016.

Table S3: Windspeed and direction from WRF predictions compared with Radiosonde measurements in May 2016

	IOA	Correlation	RMSE	MAE
Wind Speed	0.8616	0.7642	6.5722	4.9589
Wind Direction	0.7341	0.6269	70.1072	49.2412

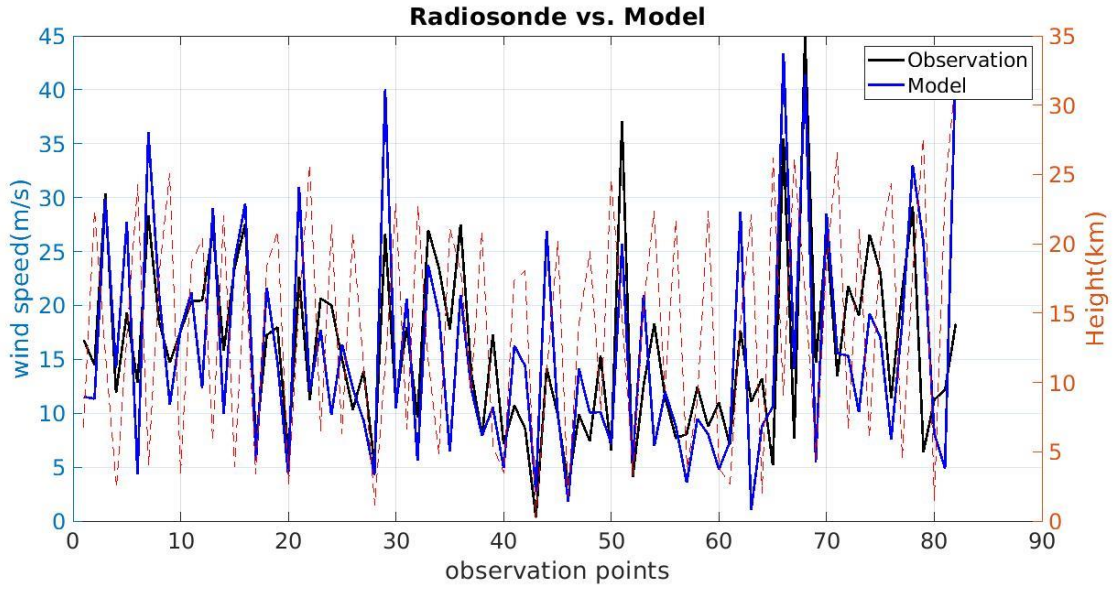

Figure S3: Wind speed comparison of Radiosonde data vs. WRF predictions through May 2016

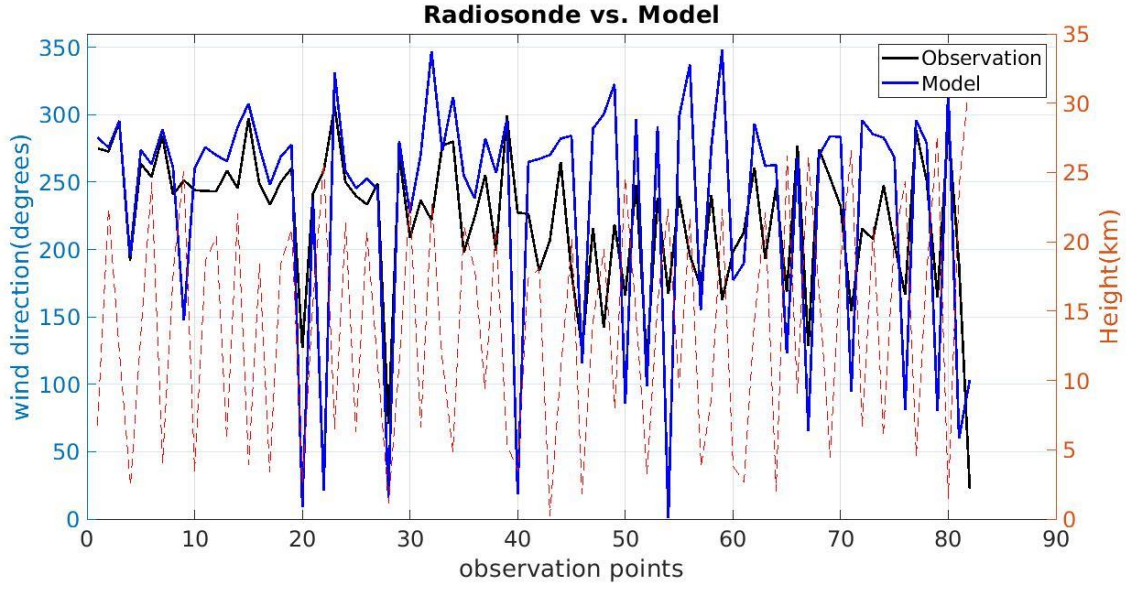

Figure S4: Wind direction comparison of Radiosonde data vs. WRF predictions through May 2016

Table S4: CMAQ CO predictions compared with South Korea stations measurements during May 2016 (number of stations = 25)

	IOA	Correlation	RMSE	MAE
CO concentration	0.4932	0.3128	199.85	168.02

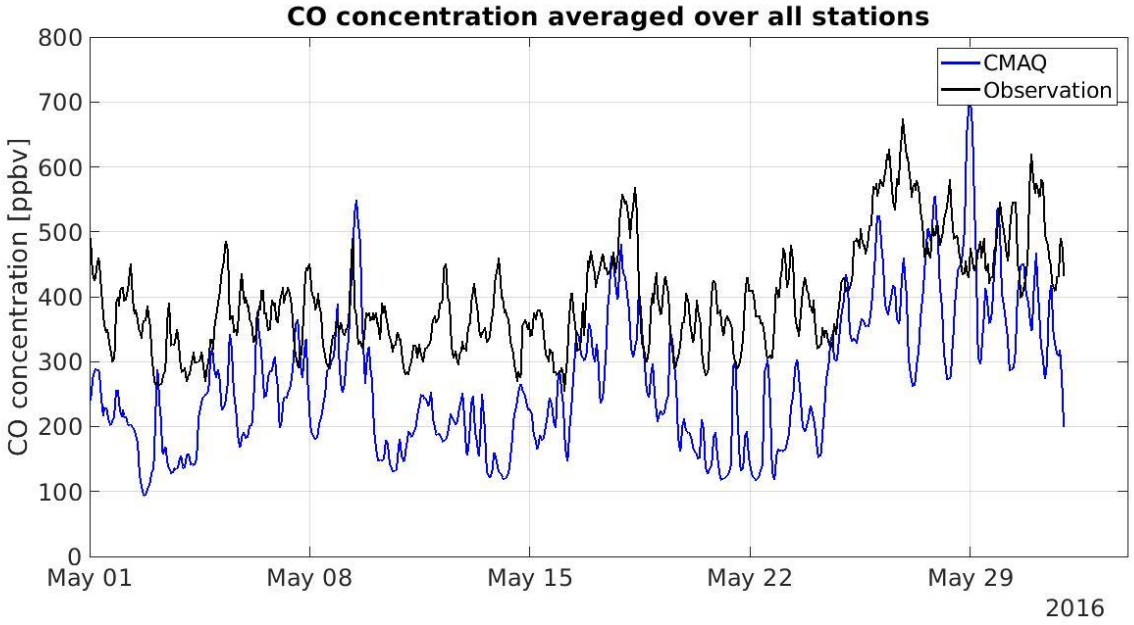

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Figure S5: CMAQ CO concentration compared with surface observations over South Korea during May 2016

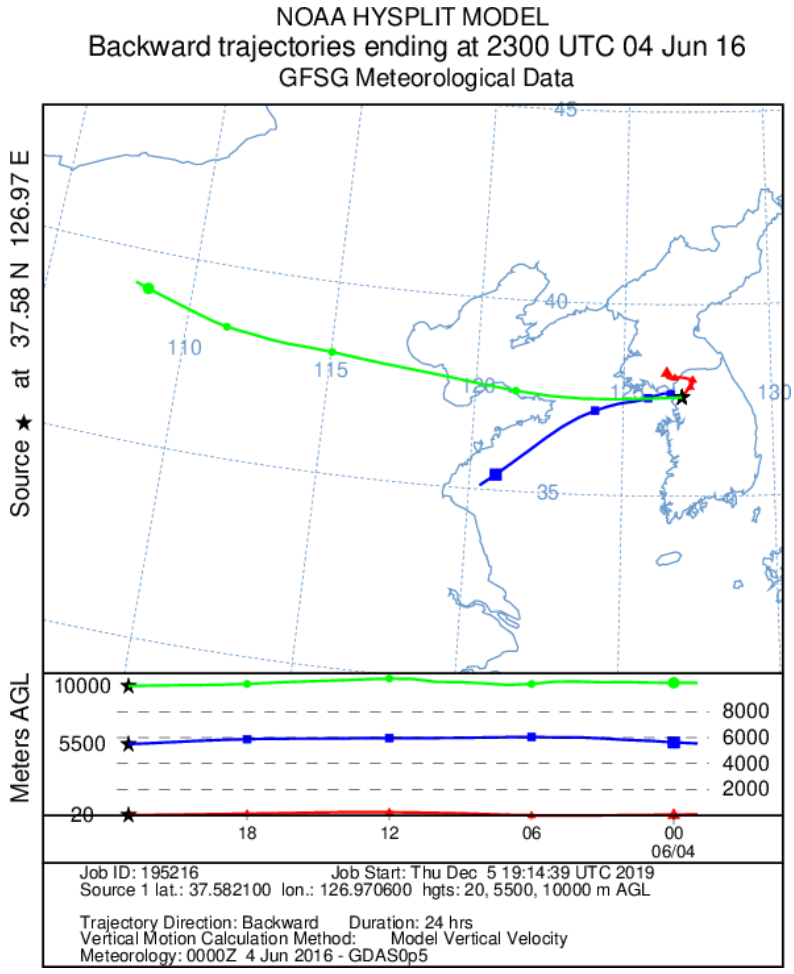


Figure S6: HYSPLIT back-trajectory output for June 4, 2016 from three different heights similar to packets.

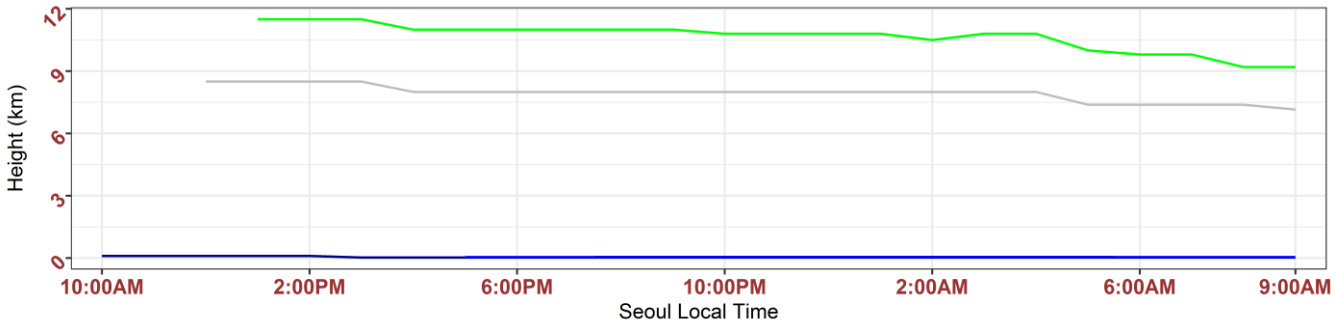
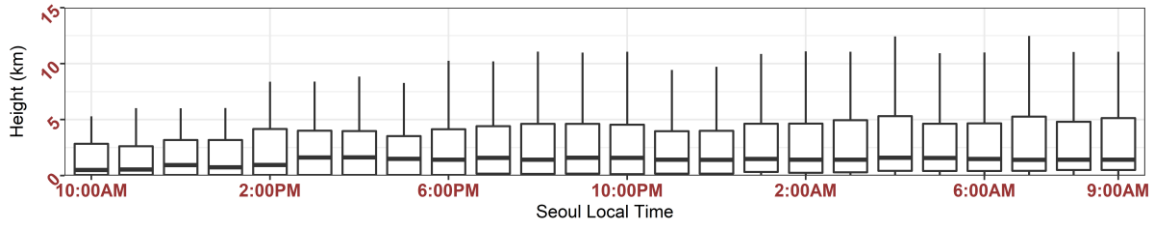
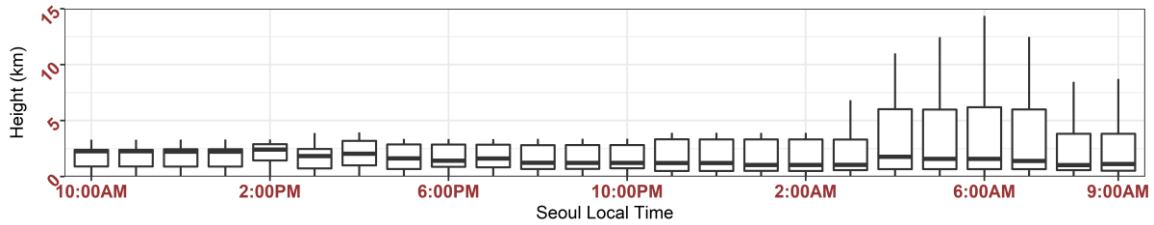


Figure S7: Changes in the height (km) of four aged packets moving toward Seoul from source points

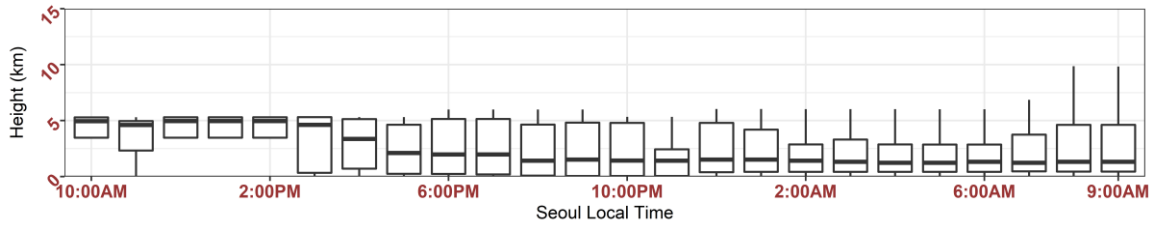
(a)



(b)



(c)



(d)

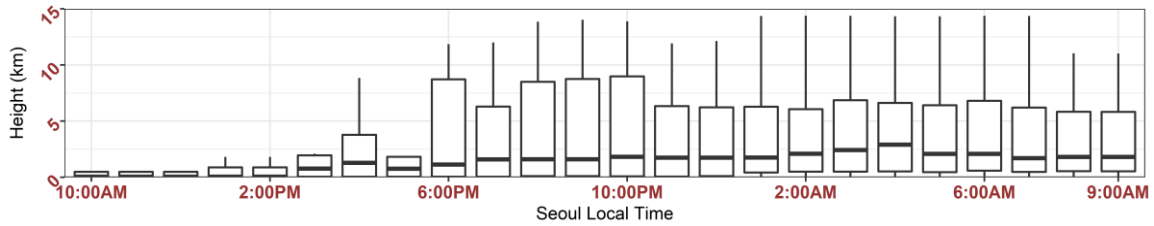


Figure S8. Boxplot outputs of Heights of C-TRAIL outputs for different periods of May 2016, (a) the entire month of May 2016 (b) Dynamic weather period (DWP) (c) Stagnant period (SP) (d) Extreme pollution period (EPP)