



Performance evaluation of the updated and developed air quality forecasting system for South Korea

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Introduction

- The Korean AQFS(KAQFS) forecasts air quality up to three days later, two times every day, and it has been operation since 2007(Koo et al., 2008, <http://www.kaq.or.kr>).
- The initial configuration of KQFS was run by MM5 v4.7 and CMAQ v4.3 models, and used TRACE-P emission inventory for 2000 and the Korean emission data of CAPSS from 2003.
- KQFS was updated to WRF v3.1 and CMAQ4.6 using Asian emission inventory for INTEX-B as well as the Korean emission data of CAPSS for 2007 to 2011(Koo et al. 2012)
- In order to enhance the forecasting accuracy for PM, it is necessary to improve elemental technologies consisting of the forecasting system such as meteorological prediction model, emission inventories, observation and analysis methods and data assimilation method.
- In this study the Asian dust emission module, the inverse modeling to enhance the emission data, the data assimilation model, and the convergence model using the air quality measurements at the ground stations over China and Korea were developed and the KQFS(www.kaq.or.kr) forecasts air quality using developed model up to five days later, two times every day, and it has been in operation since 2017(Choi et al. 2018a,b;2019).

Method and data

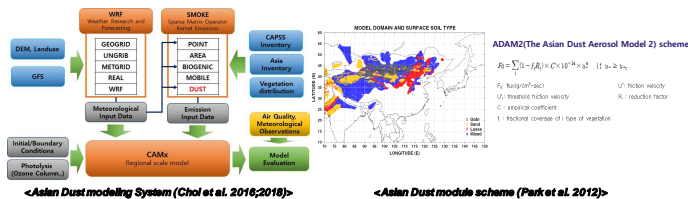
Observations and emissions

- Surface Observation sites

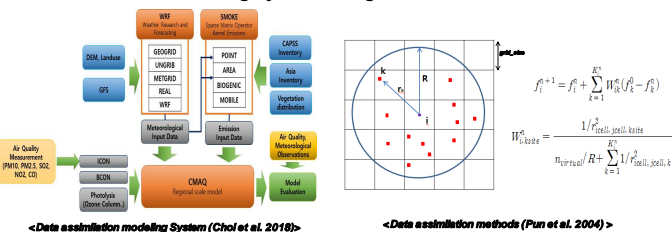


- Locations of PM10 observation sites of AQMM sites in China(www.pm25.in) and Korea(www.airkorea.or.kr).
- These site used evaluation of model performance as well as input of data assimilation and inverse model.

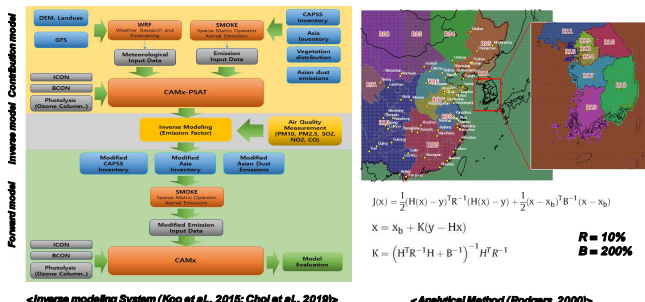
Asian dust modeling System using ADAM2 dust module



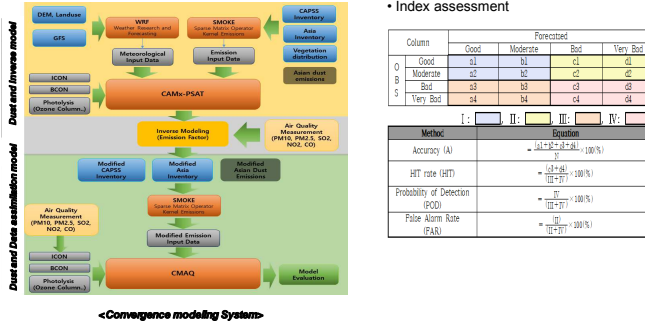
Data assimilation modeling system using surface observations



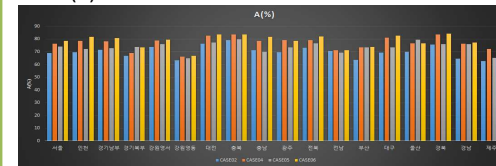
Inverse modeling system using surface observations



Convergence modeling system

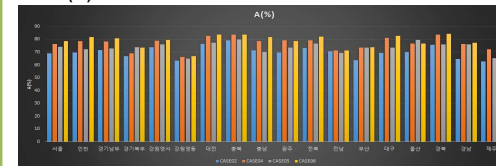


POD(%)



- CASE05 and CASE06 are the best model in most south Korea regions for probability of detection

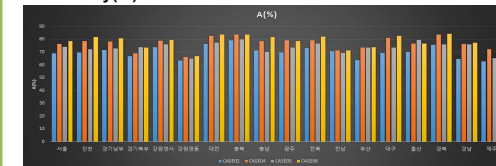
FAR(%)



- CASE04 and CASE06 are the best model in most south Korea regions for false alarm rate

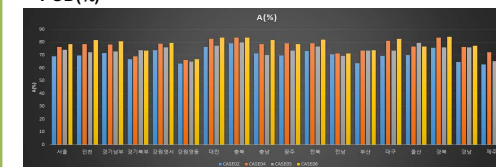
PM10 Forecasting Index Assessment for next day (2018 year)

Accuracy(%)



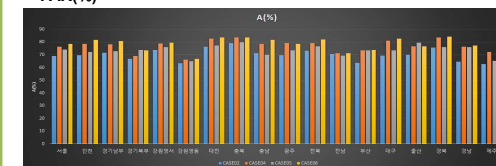
- CASE04, CASE05 and CASE06 are the best model in most south Korea regions for accuracy index

POD(%)



- CASE05 and CASE06 are the best model in most south Korea regions for probability of detection

FAR(%)



- CASE04 and CASE06 are the best model in most south Korea regions for false alarm rate

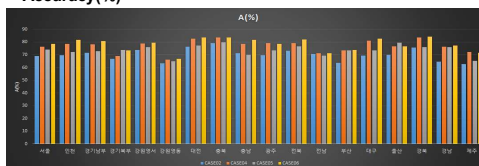
Results and Discussion

Model Configurations

Items	Global Met.	Met., AQ. Model	Asia emission	Korea emission	Model
CASE02	GFS	WRF v3.6.1, CAMx v6.0	MEIC(2010) REAS(2008)	2011 CAPSS	Dust Model
CASE04		WRF v3.6.1, CMAQ v4.7.1			Data Assimilation Model
CASE05		WRF v3.6.1, CAMx - PSAT CAMx v6.0			Inverse Model
CASE06		WRF v3.6.1, CAMx - PSAT CMAQ v4.7.1			Convergence Model

PM10 Forecasting Index Assessment for next day (2017 year)

Accuracy(%)



- CASE04 and CASE06 are the best model in most south Korea regions for accuracy index

Conclusions

- The convergence forecasting system by integrating the inverse and data assimilation models with dust emission module was finally proposed and tested by running the system in real time forecasting.
- The performance of convergence forecasting showed better agreement comparing with those of individual modules in respect to A, POD, and FAR in most regions in Korea for 2017 and 2018.

Acknowledgements

This subject is supported by the National Institute of Environmental Research.