Nested Model Working Group

Co-chairs:

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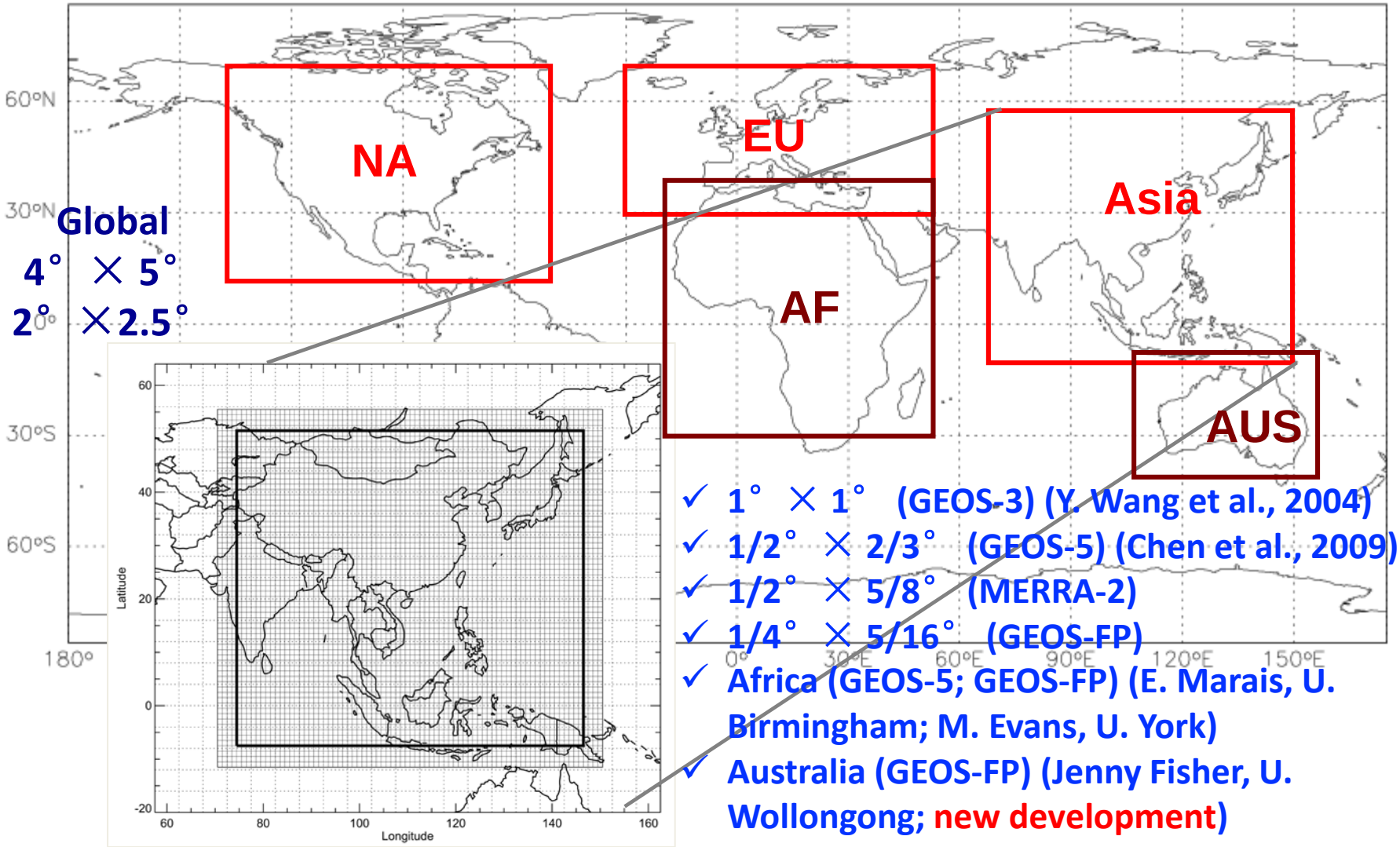
The nested-grid GEOS-Chem

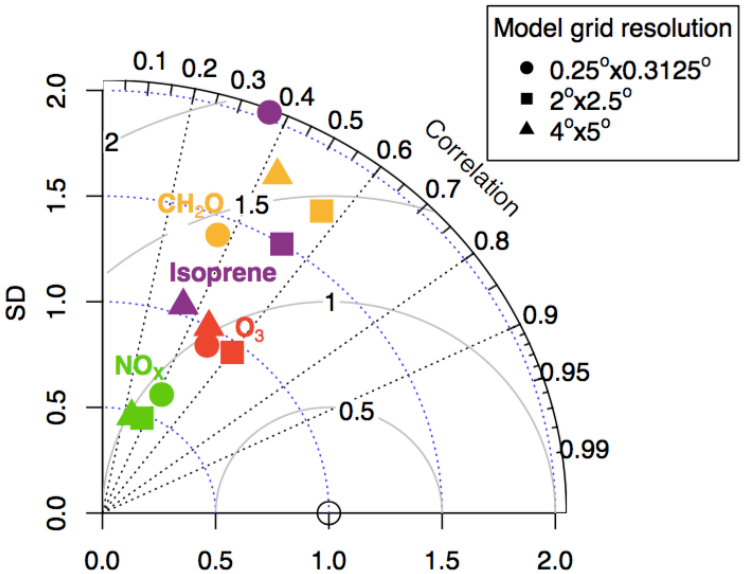
- Run GEOS-Chem at the native GEOS grid resolution over nested domains
- Apply the same chemical and transport mechanism as the global simulations
- Dynamic lateral boundary conditions from the consistent global simulations



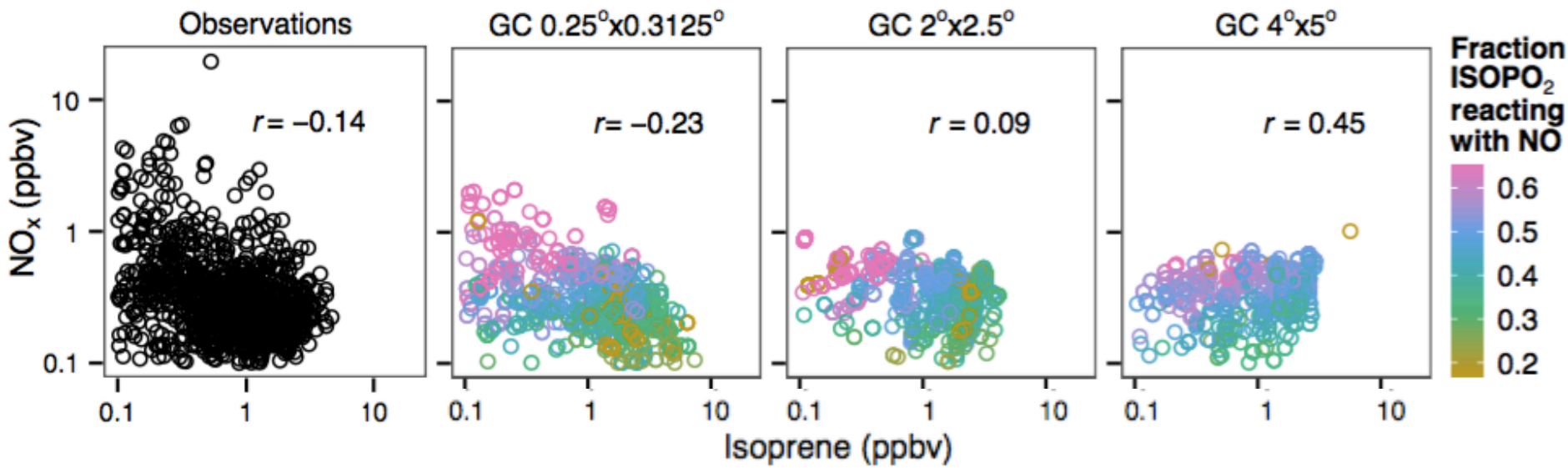
- ✓ 1° × 1° (GEOS-3) (Y. Wang et al., 2004)
- ✓ 1/2° × 2/3° (GEOS-5) (Chen et al., 2009)
- ✓ 1/2° × 5/8° (MERRA-2)
- ✓ 1/4° × 5/16° (GEOS-FP)
- ✓ Africa (GEOS-5; GEOS-FP) (E. Marais, U. Birmingham; M. Evans, U. York)
- ✓ Australia (GEOS-FP) (Jenny Fisher, U. Wollongong; new development)

1/4° ×5/16° nested model over North America

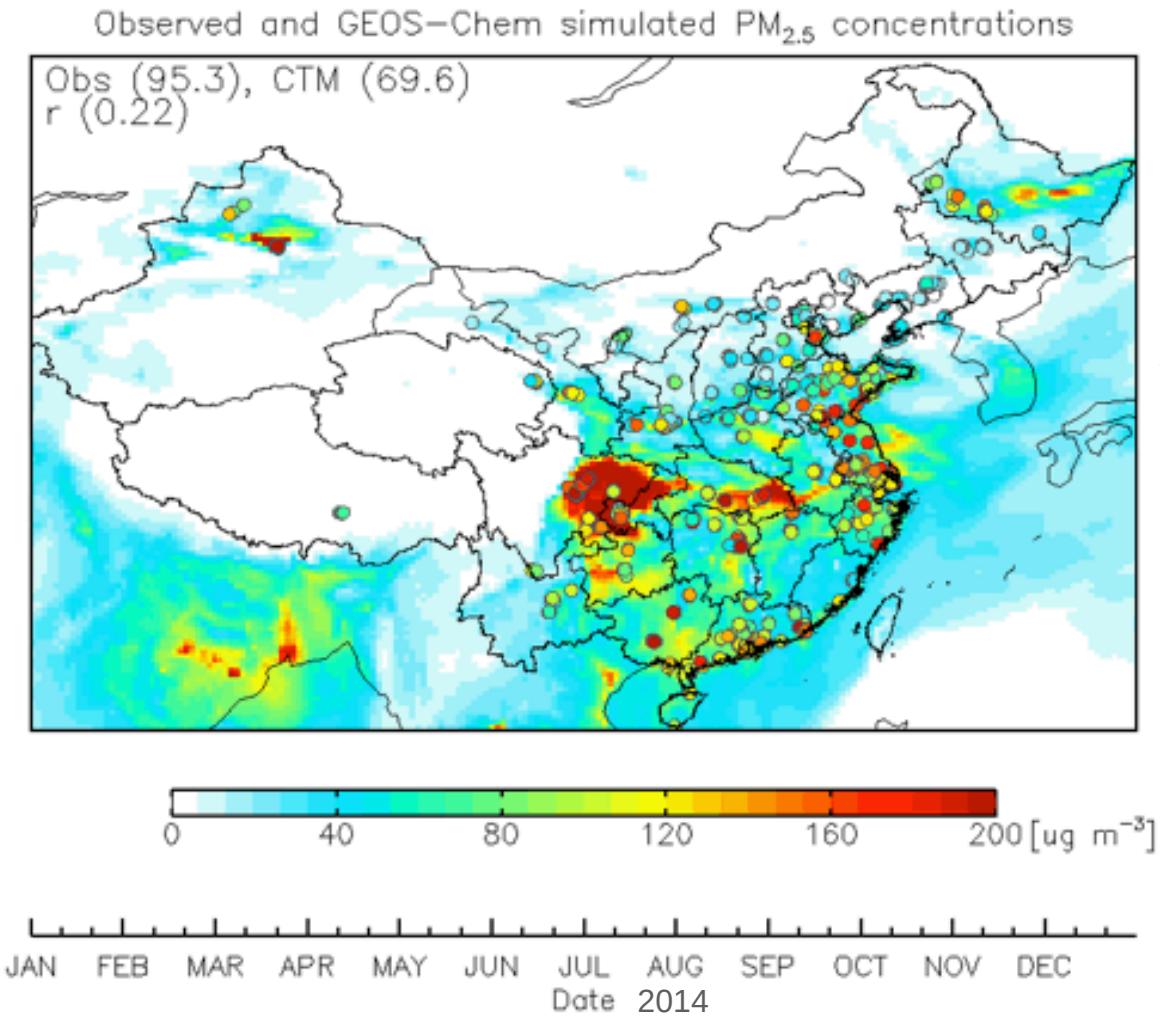
Sensitivity to model resolution



- Applications of the 1/4° ×5/16° nested model at Harvard Univ. on the interpretation of observations from the SEAC^{4}RS aircraft campaign over the Southeast US.
- **Karen Yu et al. (ACP 2016)** shows that the high-resolution model captures the observed negative correlation between NO_x and isoprene.
- Model simulated ozone and NOx at the regional scale are insensitive to grid resolution.



1/4° ×5/16° nested model: $PM_{2.5}$ simulation over China



Circles denote surface measurements from CNEMC

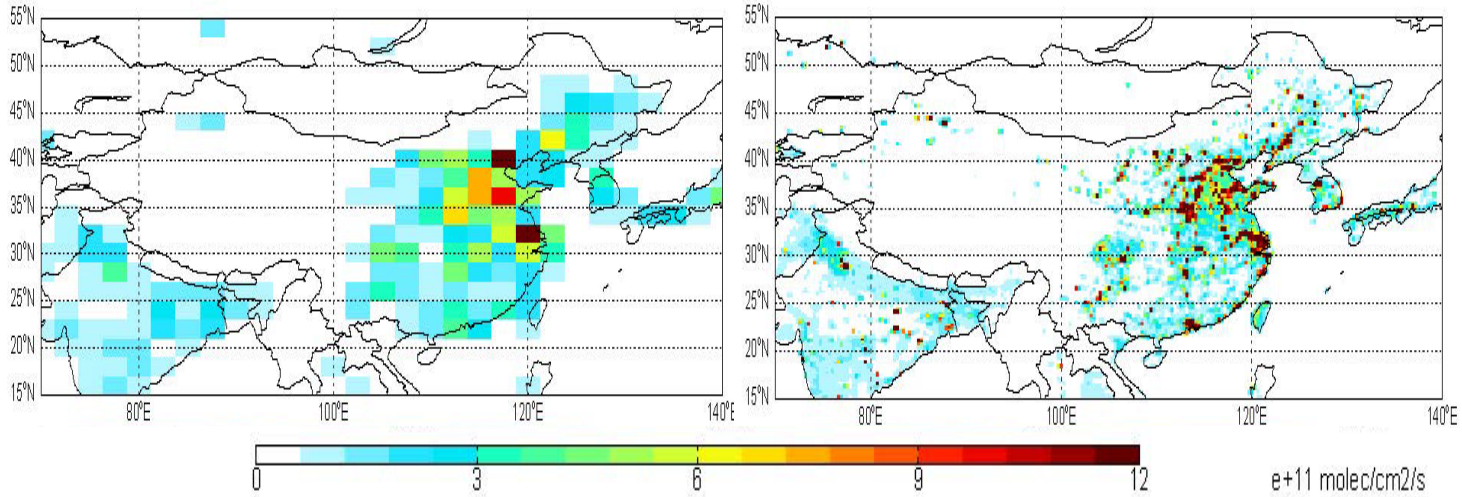
- The nested model simulates most of the day-to-day variability in $PM_{2.5}$ concentrations over China.

[Lin Zhang, Peking Univ.]

GEOS-Chem v10-01 and newer: nested-grid fully compatible with HEMCO

- Nested-grid emissions are now processed with HEMCO;
- With high-resolution emissions implemented in the model, we do not need to generate the emission files for the nested models.

Anthropogenic NO emissions at 2° ×2.5° **1/4° ×5/16°**

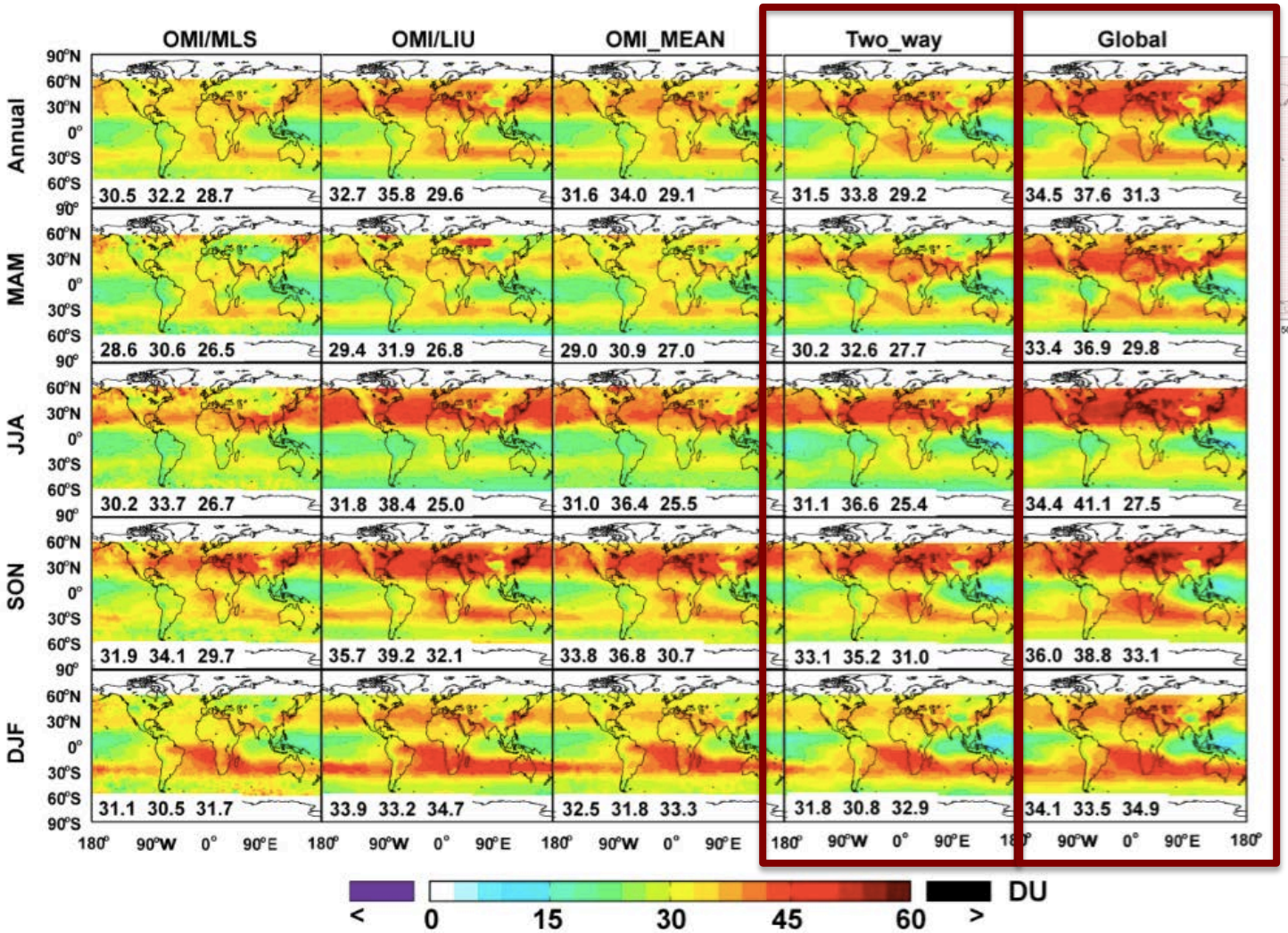


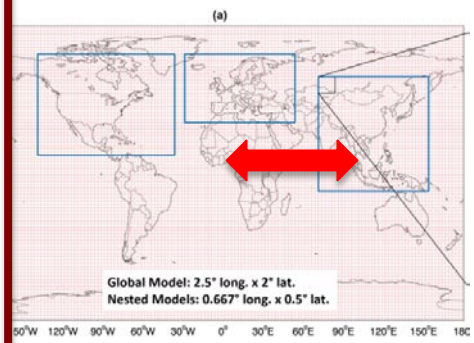
For details of the nested model setup:

http://wiki.seas.harvard.edu/geos-chem/index.php/Setting_up_GEOS-Chem_nested_grid_simulations#How_to_run_the_0.25x0.3125_nested-grid_for_GEOS-FP

[Yuxuan Wang, U. of Houston/Tsinghua]

Two-way nesting model: application on tropospheric ozone





- Global 2° ×2.5° coupled with three nested-grid domains at 1/2° × 2/3° resolution (Y.Y. Yan, ACP 2014; 2016);
- **Developed by J.T. Lin's group, Peking Univ.**

Publications with the GEOS-Chem nested model

Asia: 36+

North America: 23+

Europe: 6+

Adjoint, two-way, others: 6+

http://wiki.seas.harvard.edu/geos-chem/index.php/GEOS-Chem_nested_model_publications

GEOS-Chem

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GEOS-Chem nested model publications

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3 Other nested-grid domains
4 Nested-grid Adjoint
5 Two-way nested-grid

Asian nested-grid

- Wang, Y. X., Mcelroy, M. B., Jacob, D. J., and Yantosca, R. M.: A nested grid formulation for chemical transport over Asia: Applications to CO, J. Geophys. Res. Atmos., 109, D22307, 10.1029/2004JD005237, 2004.
- Wang, Y. X., McElroy, M. B., Wang, T., and Palmer, P. I.: Asian emissions of CO and NOx: Constraints from aircraft and Chinese station data, J. Geophys. Res. Atmos., 109, 10--1029, 2004.
- Chen, D., Wang, Y., McElroy, M. B., He, K., Yantosca, R. M., and Le Sager, P.: Regional CO pollution and export in China simulated by the high-resolution nested-grid GEOS-Chem model, Atmos. Chem. Phys., 9, 3825-3839, 10.5194/acp-9-3825-2009, 2009.
- Wang, Y., Hao, J., McElroy, M. B., Munger, J. W., Ma, H., Chen, D., and Nielsen, C. P.: Ozone air quality during the 2008 Beijing Olympics: effectiveness of emission restrictions, Atmos. Chem. Phys., 9, 5237-5251, 10.5194/acp-9-5237-2009, 2009.
- Jeong, J. I., Park, R. J., Woo, J. H., Han, Y. J., and Yi, S. M.: Source contributions to carbonaceous aerosol concentrations in Korea, Atmos. Environ., 45, 1116-1125, 2011.
- Lin, J. T.: Satellite constraint for emissions of nitrogen oxides from anthropogenic, lightning and soil sources over East China on a high-resolution grid, Atmos. Chem. Phys., 12, 2881-2898, 2012.
- Trivitayanurak, W., Palmer, P. I., Barkley, M. P., and Robinson, N. H.: The composition and variability of atmospheric aerosol over Southeast Asia during 2008, Atmos. Chem. Phys., 11, 22033-22073, 2011.

Nested Model WG Breakout

Day 2, 15:45-16:45 pm, Meteorology Building 1115

To join email list send email to:
geos-chem-regional-join@seas.harvard.edu

Nested grid simulations
• GEOS-Chem nested grid simulations • Setting up GEOS-Chem nested grid simulations • Available met data for nested grid simulations • Protocol for nested-grid data downloads • Steps to setup new nested domains • GEOS-Chem nested model publications

http://wiki.seas.harvard.edu/geos-chem/index.php/GEOS-Chem_nested_grid_simulations