

New Developments for WRF/Chem

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Many national and international collaborators

Main contributors for chemistry part so far: NOAA,
PNNL, NCAR



WRF/chem –what was in V2.1 ?

- ARW only
- Online
- Chemical mechanisms: RADM
- Online photolysis: Madronich
- Aerosols: Modal (MADE/SORGAM)
- Biogenic emissions: Gunther, BEIS3.09
- Feedback direct effect: only very simplified with Dudhia radiation

Real-time AQ forecasts with WRF/ Chem since 2002



WRF/chem –where are we with V2.1.2 ?

PNNL Additions

- New chemical mechanisms: CBMZ
- New online photolysis: Fast-j
- Aerosols: sectional (4 or 8 bins) MOSAIC
- Feedback direct effect: Mie theory for optical aerosol properties. Currently for MOSAIC/ Goddard shortwave radiation coupling only
- 2-way nesting
- Restarts

*Most of these additions: PNNL (Jerome Fast, Bill Gustafson,
Steve Ghan, Richard Easter)*



WRF/chem –where are we with V2.1.2 ?

PNNL-Technical changes

- Emissions options to simplify use of emissions data sets
- Options for boundary and initial condition profiles
- Option to run the model in tracer mode only (emissions, resolved and unresolved transport)



WRF/chem –where are we with V2.1.2 ?

Some more substantial “feature” corrections

- Fixed various deposition bugs
- Fixed some parameterized convective transport issues



WRF/chem –V2.1.2 x

Code already available, very soon in repository

- CMAQ aqueous phase module in convective transport routine for wet deposition of gases and aerosols
- Direct connection of convective parameterization with photolysis (always) and short wave radiation (by choice)

Real-time AQ forecasts with WRF/Chem with V2.1.2x this summer



WRF/chem –V2.1.2x or V2.2

Code already available, not thoroughly tested

- Cloud aerosol interaction (Goddard short wave, Lin et al. Microphysics, sectional aerosols)
 - See talk 6.3 Gustafson et al.
- NMM core



WRF/chem – V2.1.2x or V2.2

Code already available, not tested

- KPP automatic generation tool for chemical mechanisms and their adjoints (currently with RACM-MIM and RACM equation files, no adjoints)
 - See talk 6.4 by Marc Salzmann
- CMAQ modules: Carbon Bond Mechansim (CB05), MADRID sectional aerosols
 - See talk 6.2 by Huang et al.

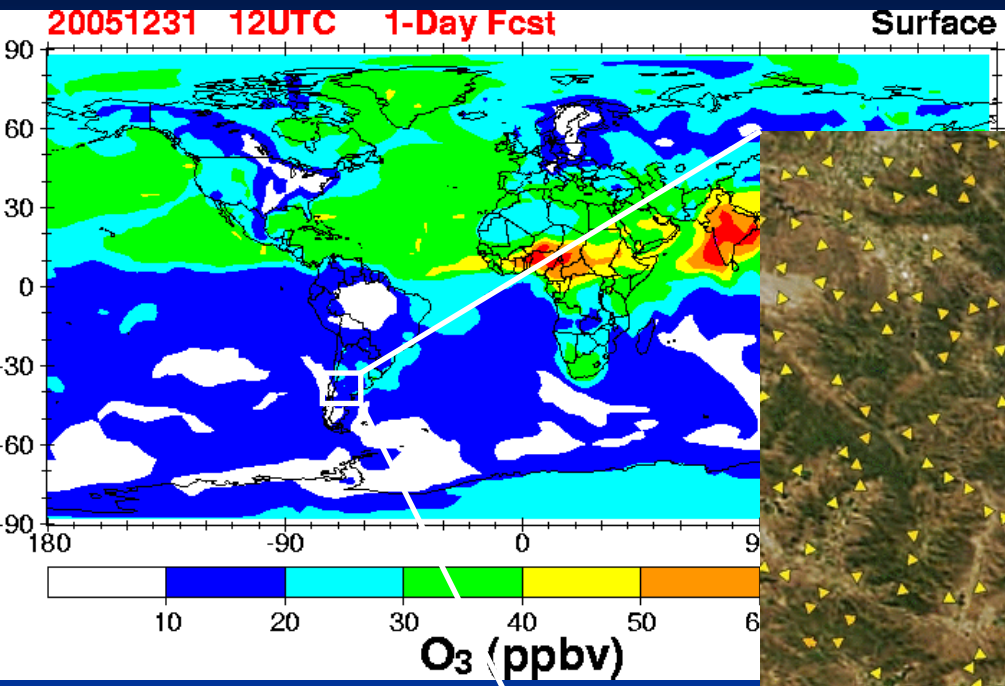


WRF/chem – V2.2, V2.3 ?

- Coupled SMOKE emissions model
 - See talk 6.5 by John McHenry and Carlie Coats
- Offline version
- Boundary conditions from Global chemistry model (already available, but....)
- Urban canopy model (courtesy of Alberto Martilli and Rainer Schmitz)
- Official community support from NOAA/ESRL/GSD (will include better documentation and tutorials)



Use of chemical data from GCM for boundary conditions



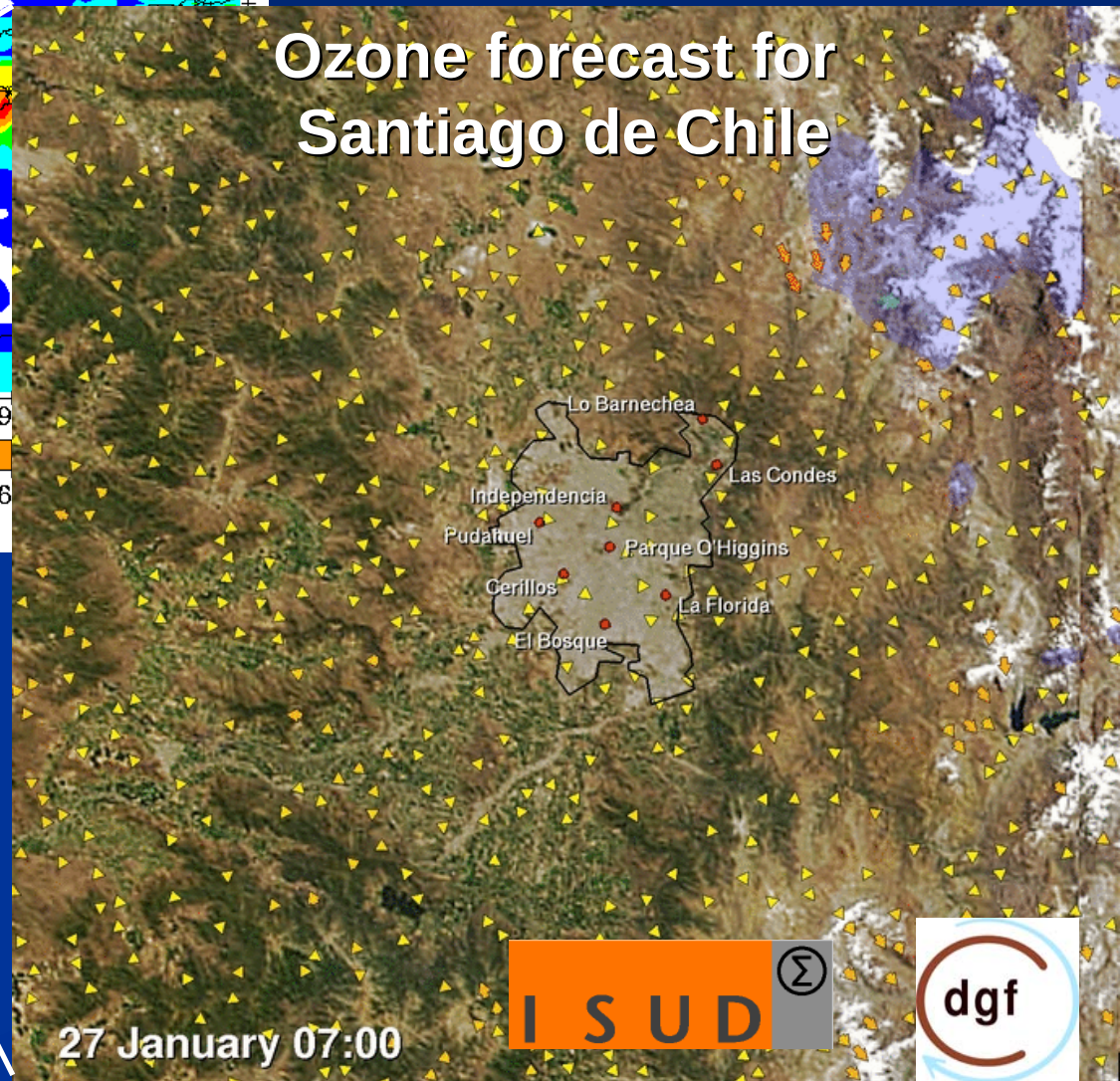
Global forecast by Max-Planck-Institute, Mainz, Germany
MATCH-MPICH
(Lawrence, 2003)

Interface also available
soon for MOZART

Provided by Rainer Schmitz,
Univ. Of Chile

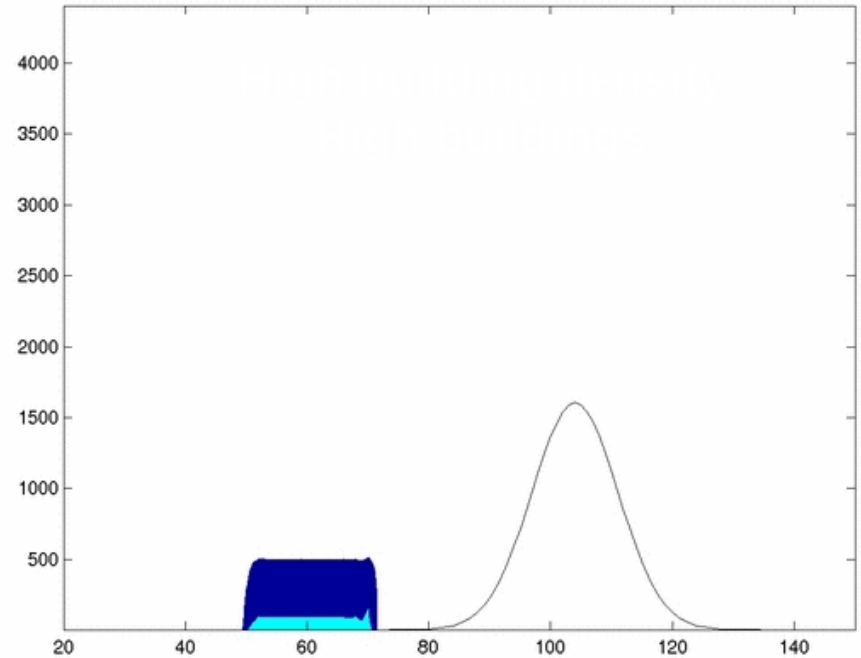
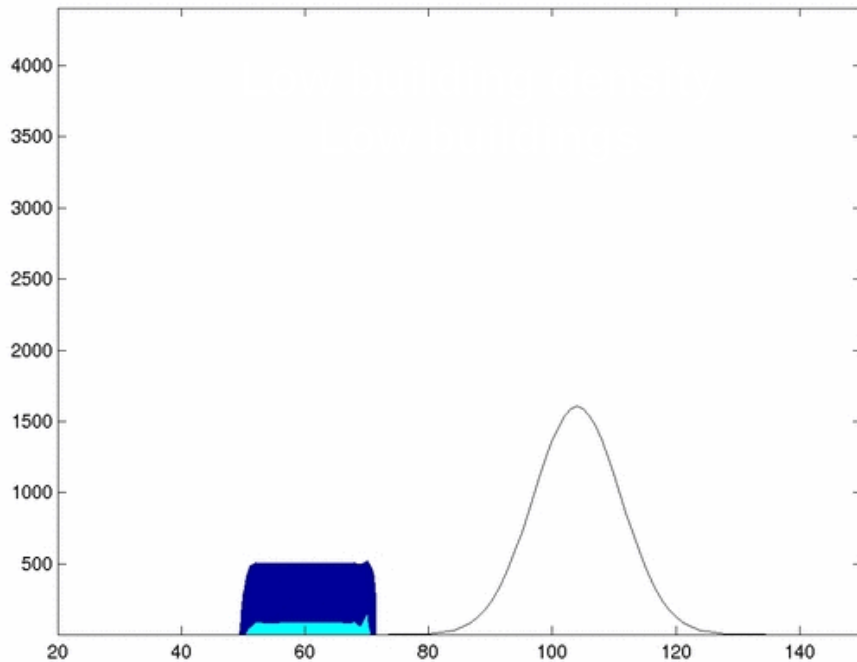
6/27/2006

Ozone forecast for Santiago de Chile



Urban parameterization -2D WRF/Chem simulation

(Martilli *et al.*, 2002)



- MYJ scheme
- Drag approach for momentum (u and v) and TKE
- Shadowing and radiative trapping effect for sensible heat

Provided by Rainer Schmitz, University of Chile

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Urban classes are represented by:

- average building width
- average street (canyon) width
- probability of building sides facing the street

I SUP



WRF/chem – the future

- 3dvar/4dvar
 - collaboration between WRF-Var and chemical 4dvar data assimilation group will start (meeting today at lunch time)
 - Possibly extension of GSI to include 3dvar for some species
- Global model version (possibly as early as this Fall!!)
- More CMAQ modules
- Real-time fire emissions
- Dust parameterizations (several groups)
- More aerosol microphysics interaction packages
- Simple aerosol package
- Improvements on KPP implementation
- Different advection scheme
- Efficiency work on NMM-WRF/Chem



Future development plans, currently in WRAB doc:

- Computational efficiency (monotonic, conserving), possibly other technical changes, more aerosol-microphysics
- Advanced data assimilation methods
- Full implementation of KPP
- Collaboration with WRV-Var, REGCLIM, LSM, Physics WG's

How can we improve the current model

- Physics improvements - pbl

What else is needed for “futuristic” developments

Upgrade dry deposition to link with LSM through canopy conductance, PBL higher order closures

