# The TEMF PBL Scheme in WRF: Experience in real-time forecasts for California

Wayne M. Angevine

*CIRES, University of Colorado, and NOAA ESRL*

Thorsten Mauritsen

*Max Planck Institute for Meteorology, Hamburg*

- It runs and is running
- Results are subtly different than reference configuration
- Systematic evaluation is yet to come
- Here are some examples

# What is TEMF?

- Total Energy – Mass Flux
- In stable conditions, based on total turbulent energy and LES-derived stability functions
- In convective BLs, combines eddy diffusivity for local transport with mass flux for non-local
- Particulary intended for stable BLs and BLs with shallow cumulus / stratocumulus
- New:  Subgrid cloud parameterization

# Forecasting for CalNex

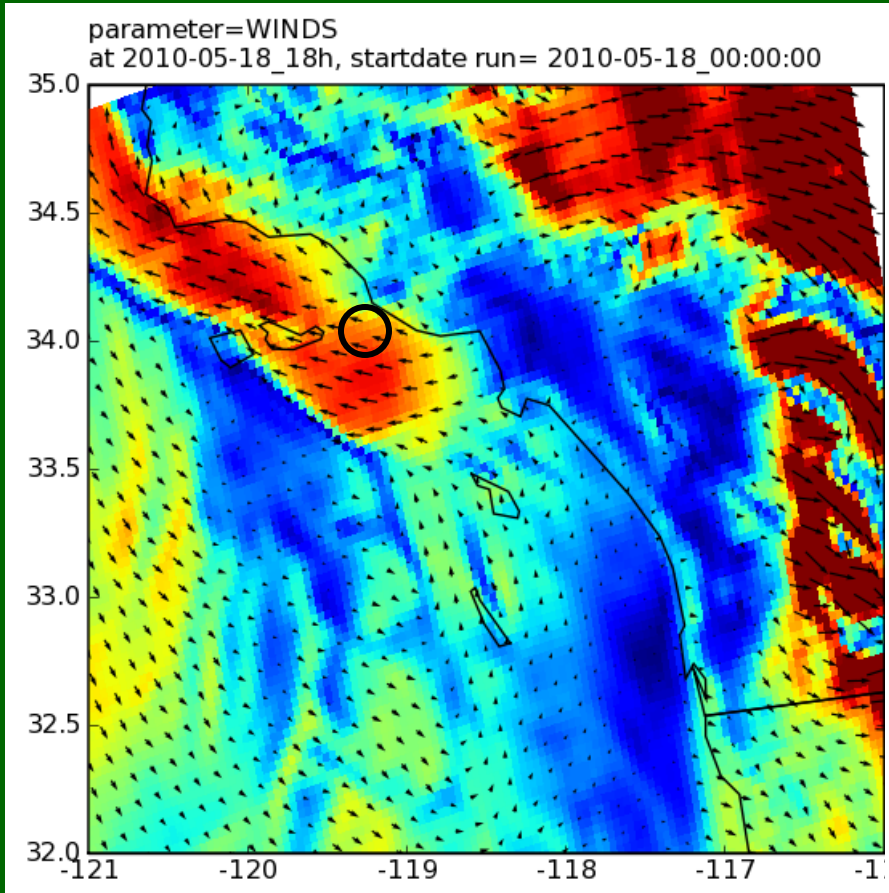
- Large field project in California
  - multiple aircraft, ship, ground sites
  - May – July 2010
- Fine-scale modeling needed to handle complex terrain and coastline
- WRF domains:
  - Triple nest (36, 12, 4 km)
  - Matched to EPA emissions inventory projection
  - Inner domain (d03) 300x200, covers all of CA
- Driving Flexpart particle dispersion model

# WRF configurations for CalNex

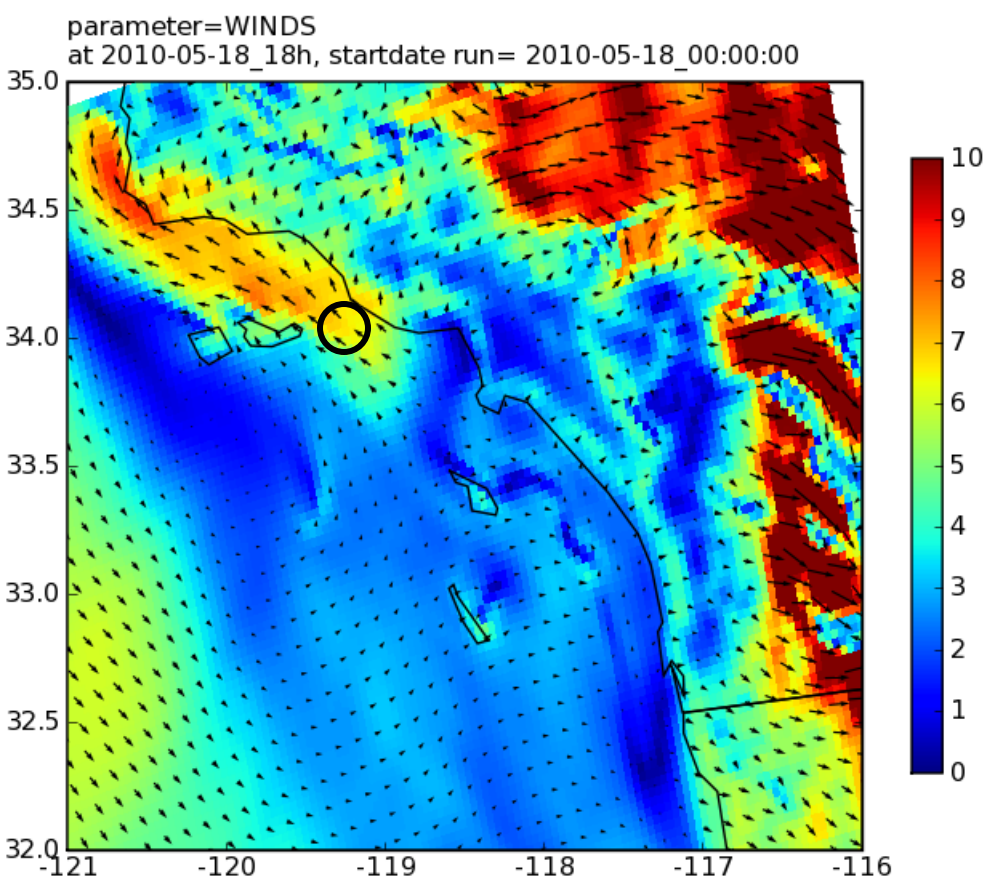
- "Reference" configuration
  - MYJ PBL & surface layer
  - 5-layer thermal (slab) LSM (1)
  - Navy high-resolution SST
  - Eta microphysics (5)
  - RRTM longwave (1)
  - Dudhia shortwave (1)
  - Kain-Fritsch cumulus (1) d01 only
- TEMF configuration
  - same as reference except TEMF PBL & surface layer on d02 & d03

# 18 May Southerly jet

Ref 50 m wind speed



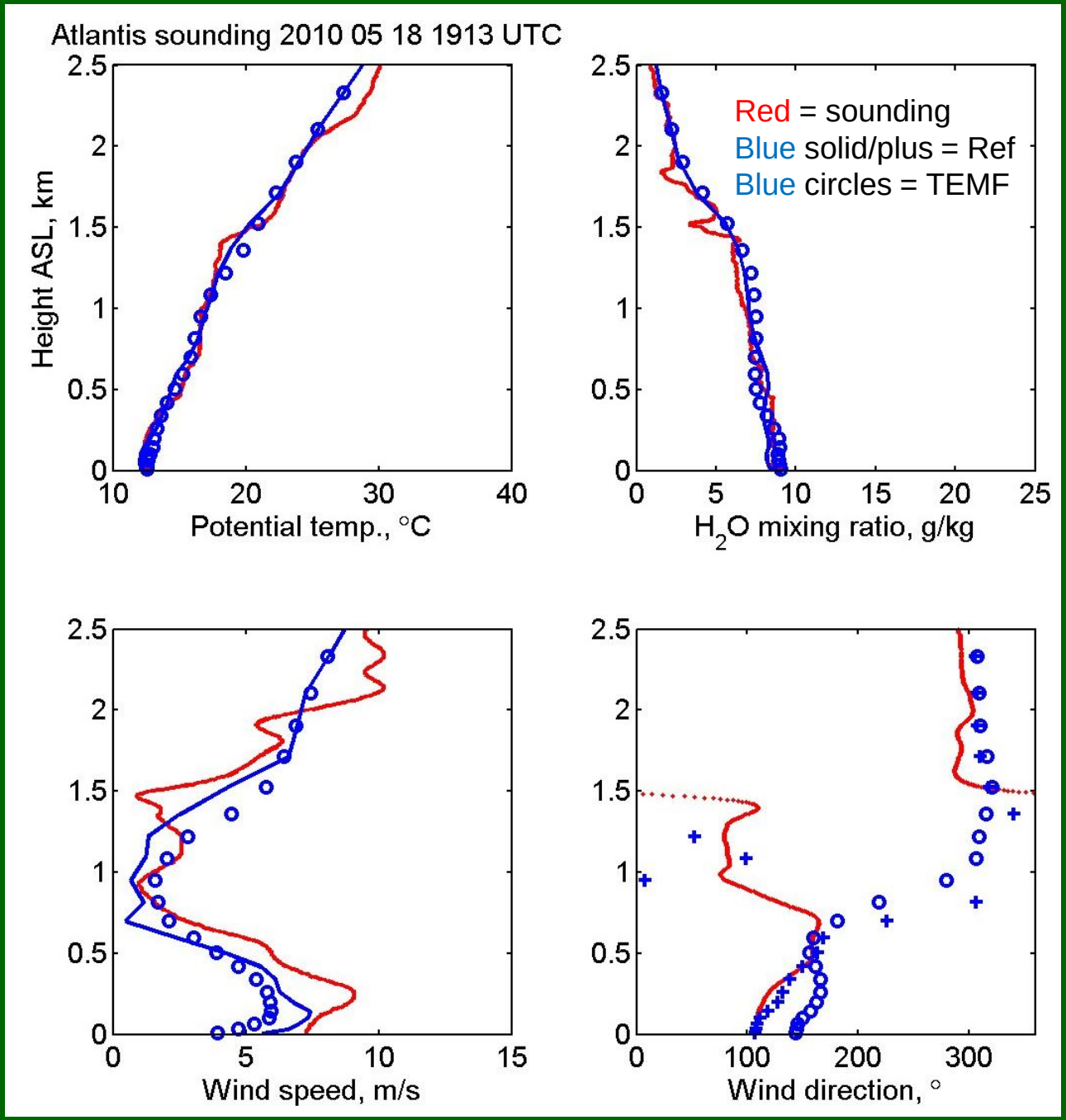

TEMF 50 m wind speed



# 18 May Southerly jet

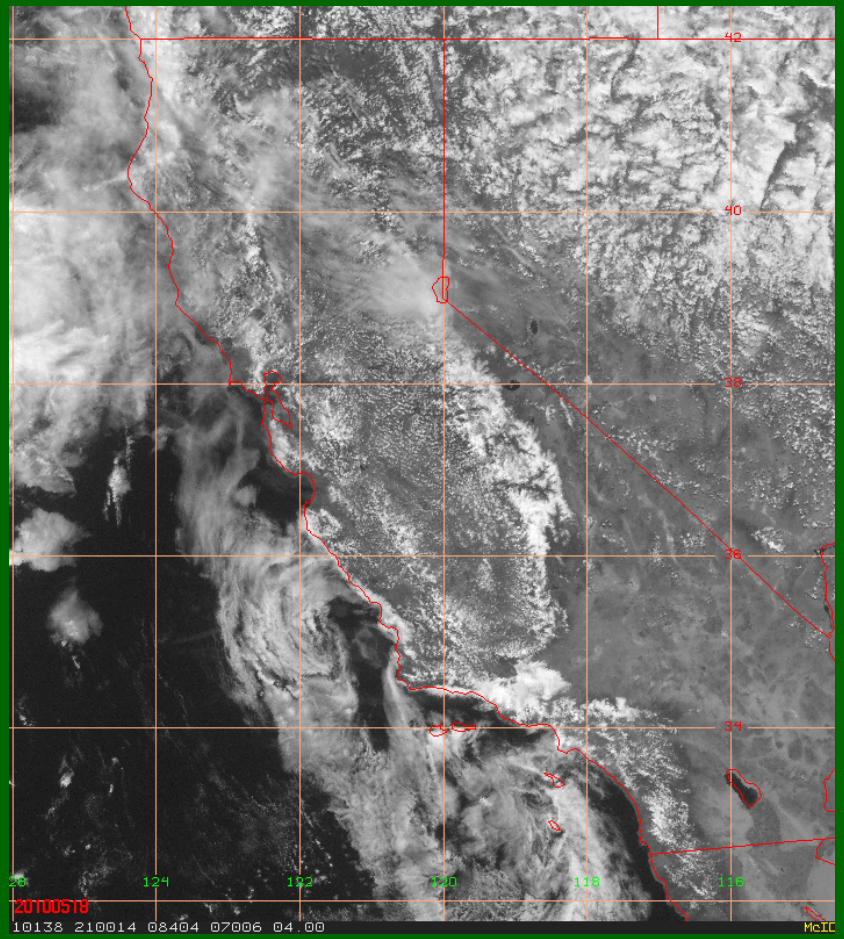
Both WRF runs under-forecast jet strength

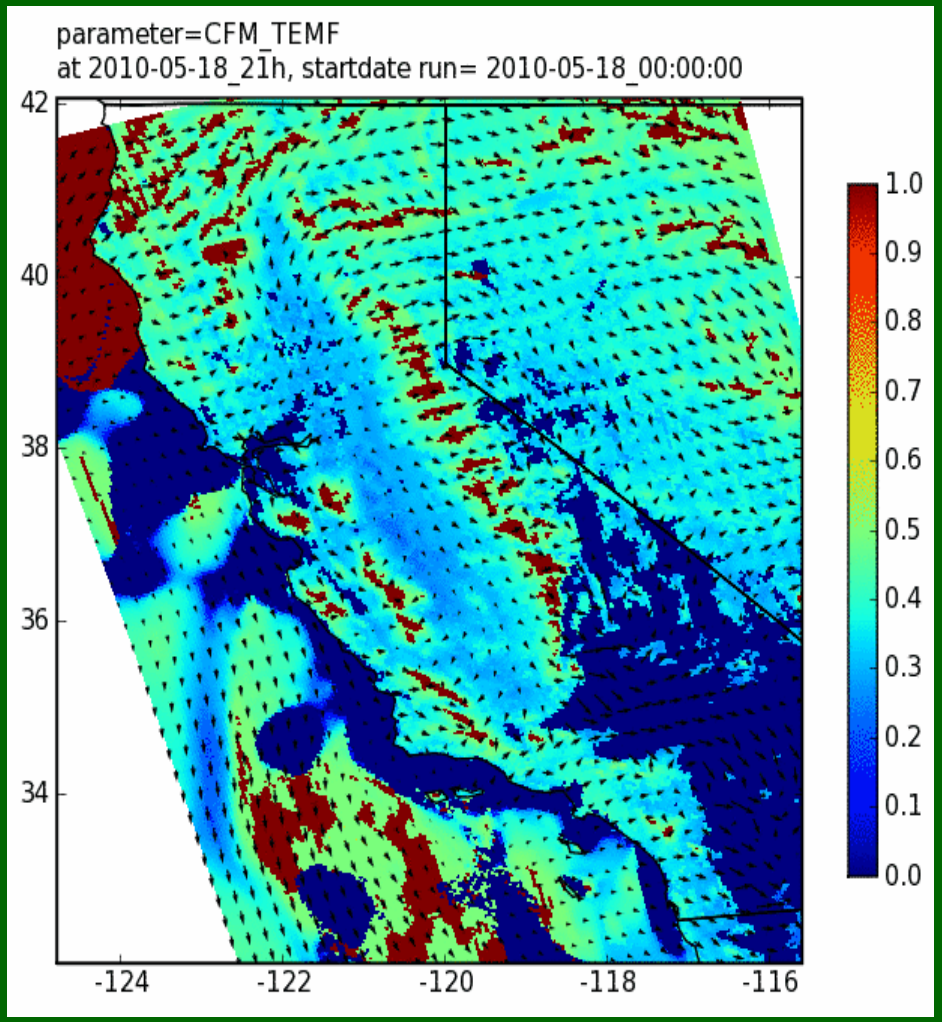
Ref slightly better at time and place of sounding



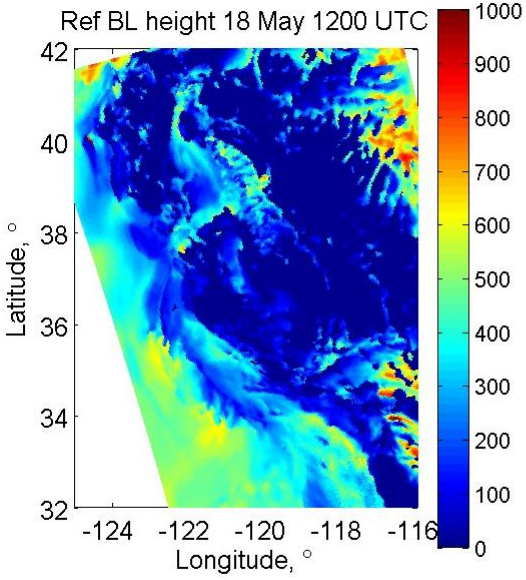
# 18 May 21Z cloud forecast

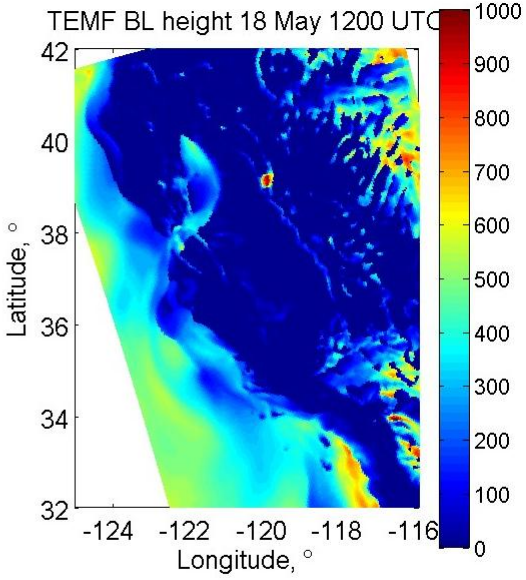
Column max. cloud fraction



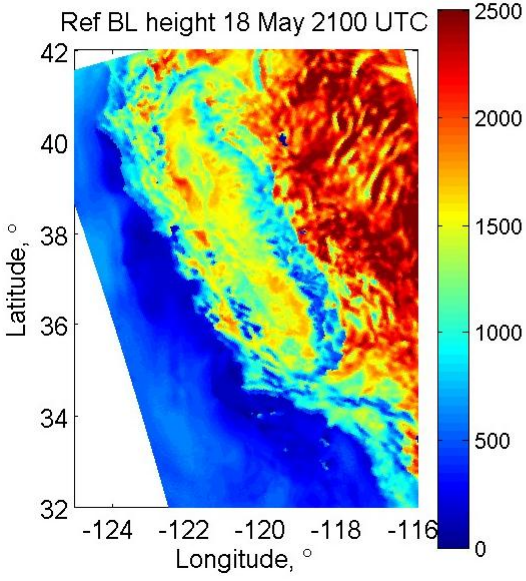
# 18 May BL heights

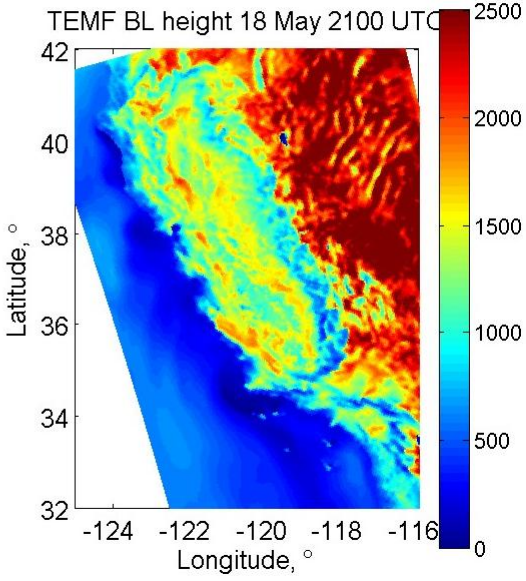



Ref

TEMF

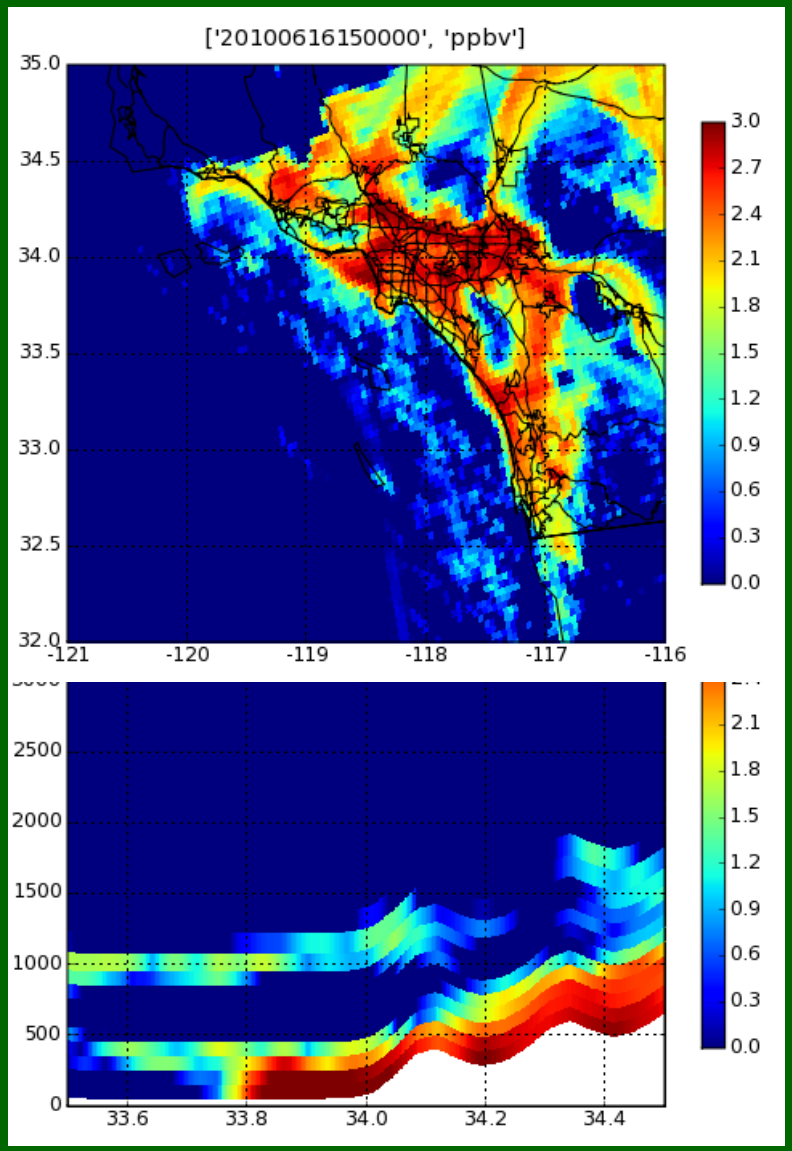


# 16 June outflows from LA area
# Flexpart So.Cal. tracer

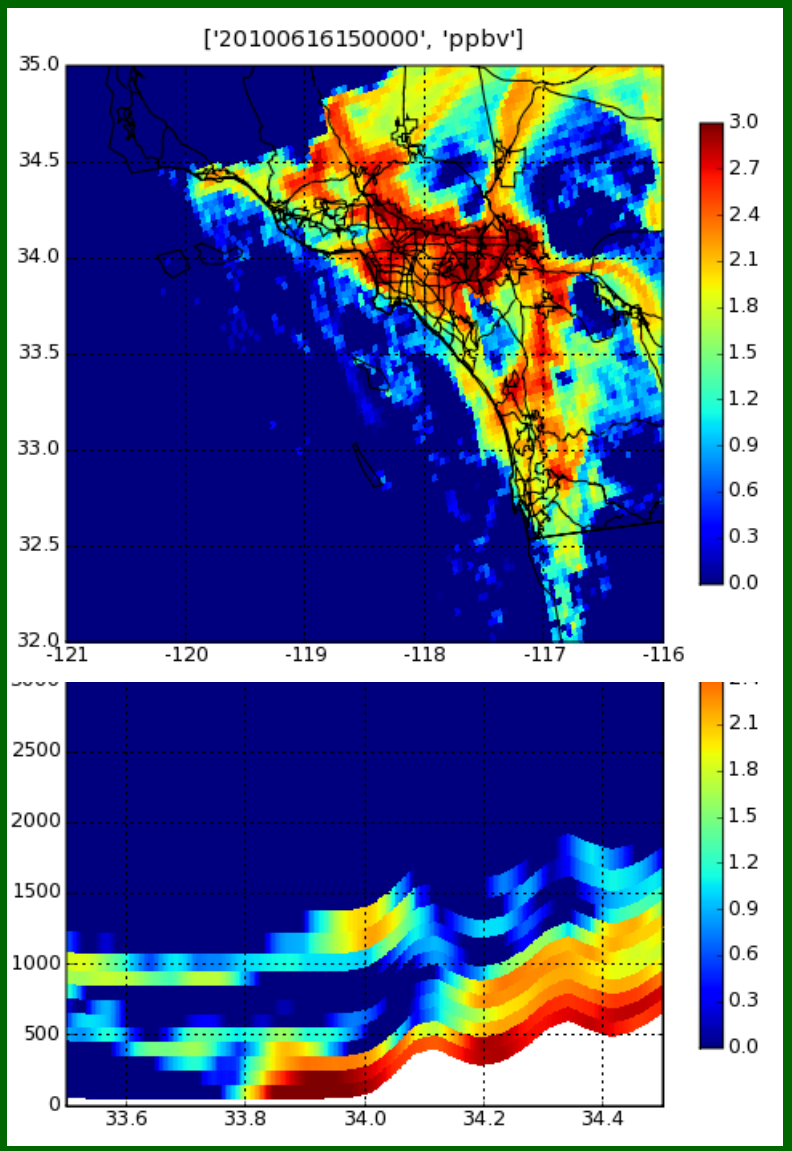
Ref

TEMF




Horizontal (0-200 m)

Vertical (lat.-118.5)



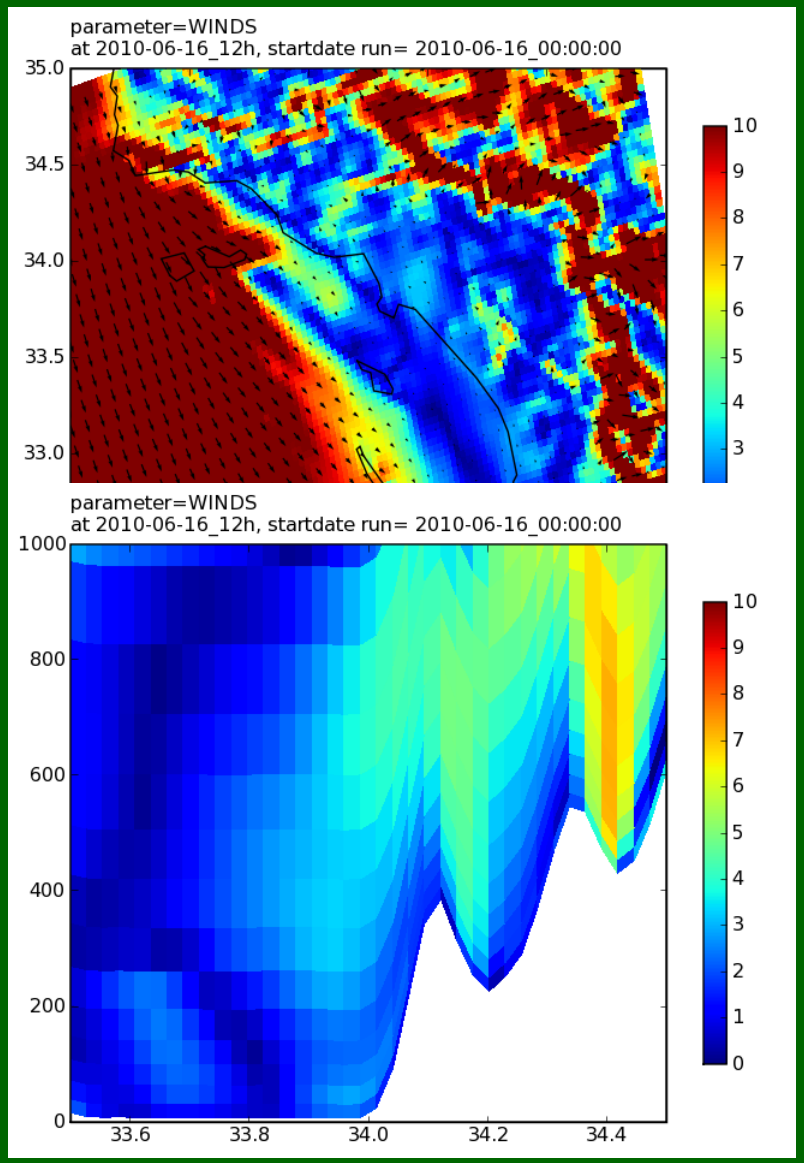
# 16 June outflows from LA area
# WRF winds

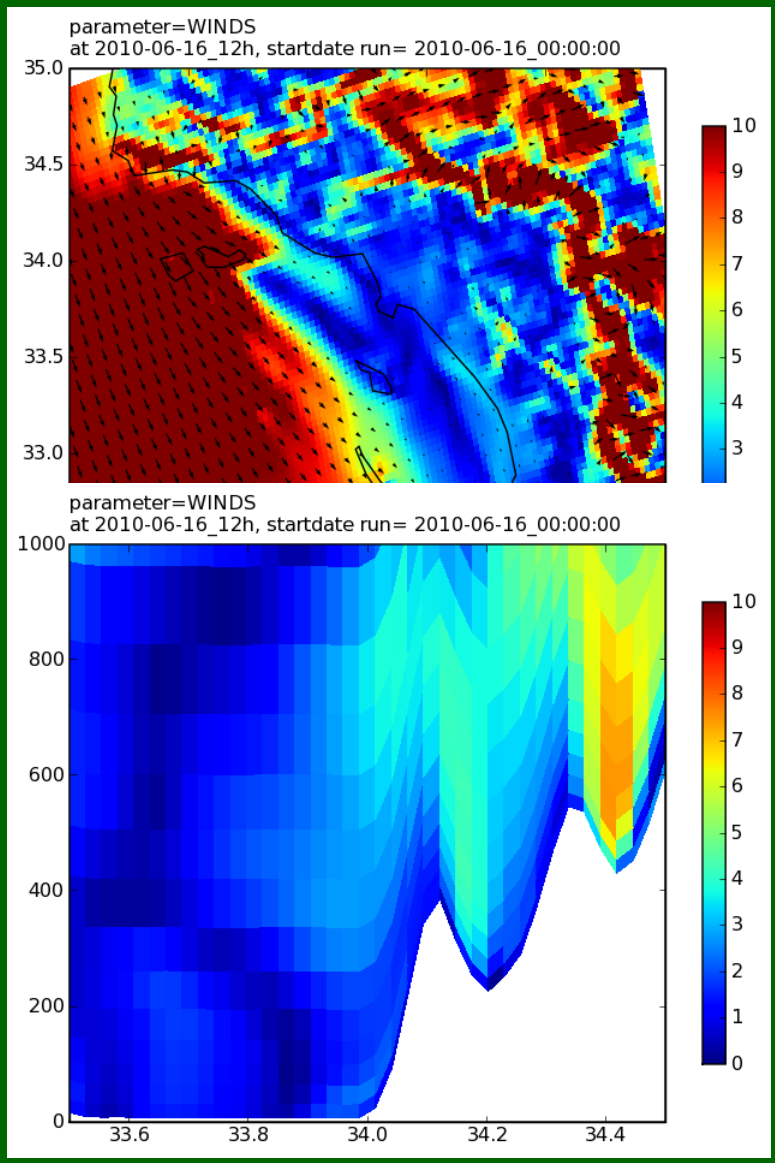
Ref

TEMF

Horizontal
(50 m AGL)

Vertical
(lat.-118.5)



# To Do

- Implemented in WRF v3.1.1 (not released)
  - Make ready for release (priority?)
  - Couple to radiation scheme(s)
  - Test with other physics combinations
  - Improve numerics to allow longer timesteps?
- Systematic evaluation
  - Winds (vs. profilers)
  - Forecast time (effect of initialization)
  - Cloud fraction prediction (vs. satellite pics)

# Thanks to:


- Kevin Durkee, SCAQMD (LA area profiler data)
- Dan Wolfe and Dave Welsh, NOAA ESRL (sonde data)
- Owen Cooper, NOAA ESRL (satellite pics and surface obs)
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- Stephan de Roode for help with the cloud fraction parameterization