



Air Quality Modeling for PM_{2.5}, Haze, and Ozone

VISTAS- SESARM
MARAMA meeting
February 11, 2009

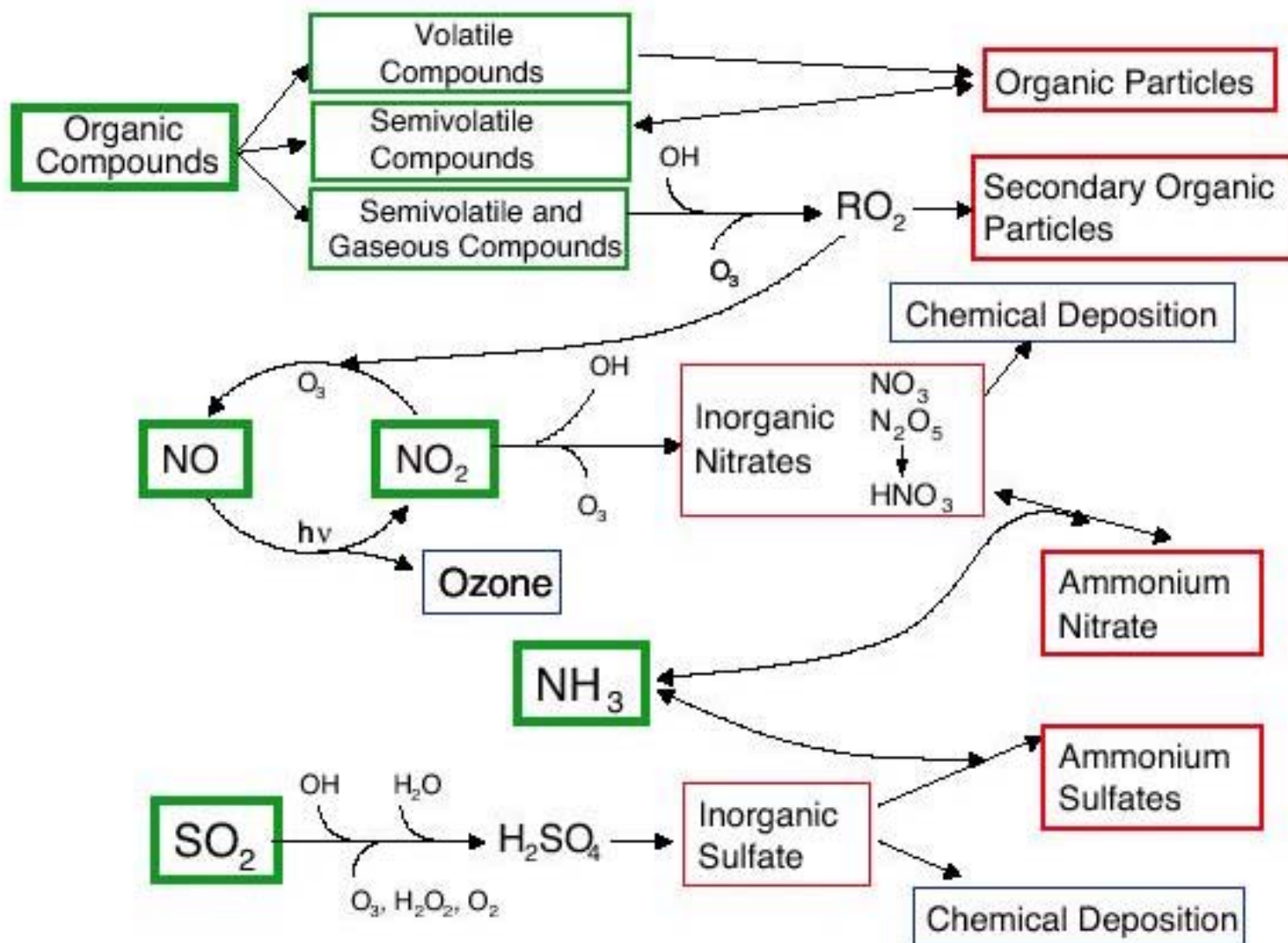


Planning for Next SIPs



- One-Atmosphere approach to air quality modeling and regulatory demonstrations
 - Daily PM_{2.5} SIPs due spring 2012
 - Revised 8-hr ozone SIPs due summer 2013
 - Regional haze progress demonstration due Dec 2012
- Use one modeling platform for all three issues even if need to model more than one year to address all requirements

One Atmospheric Approach to Air Quality Management



Source: Particulate Matter Science for Policy Makers
 – A NARSTO Assessment, 2003.

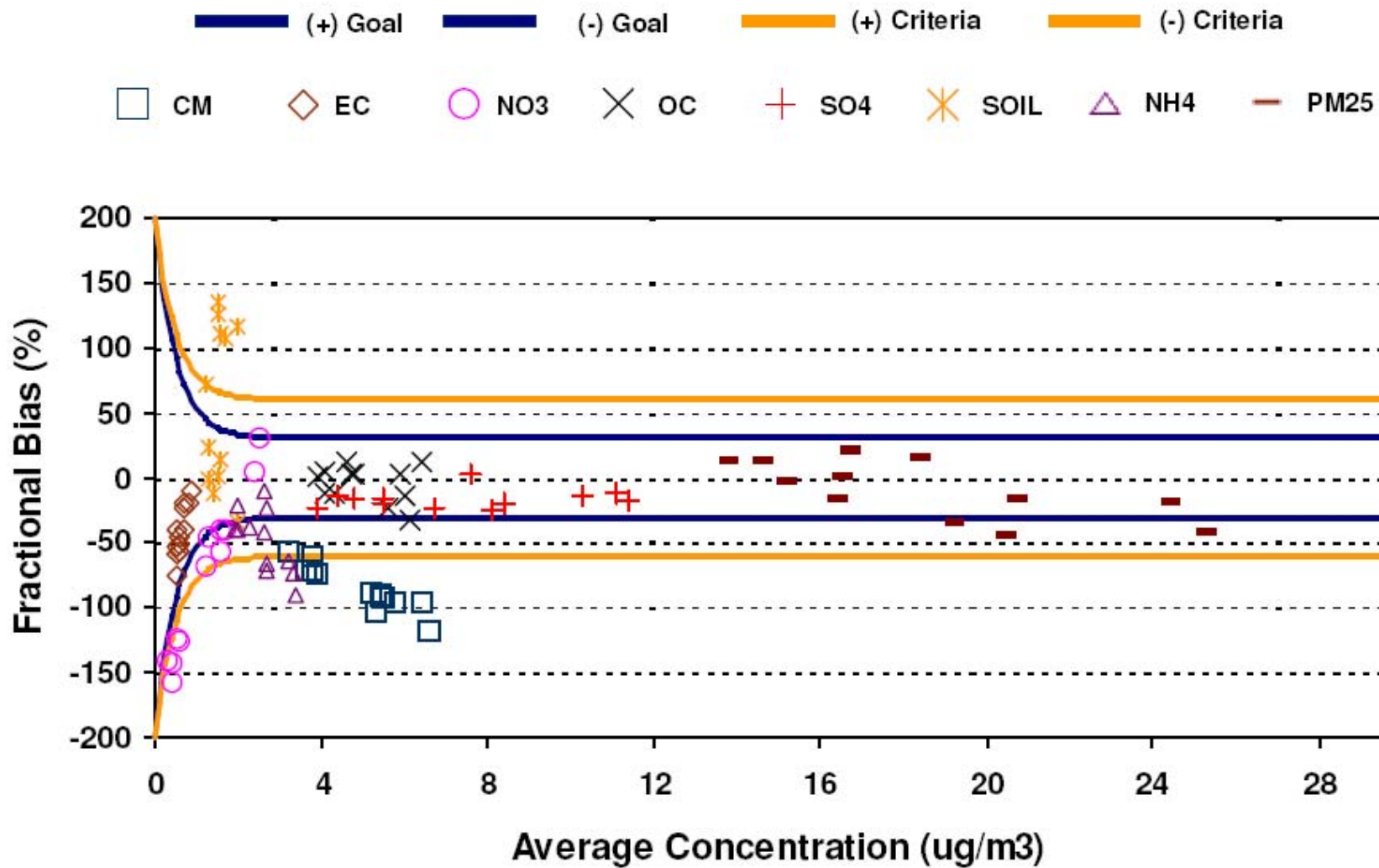


Modeling Lessons Learned



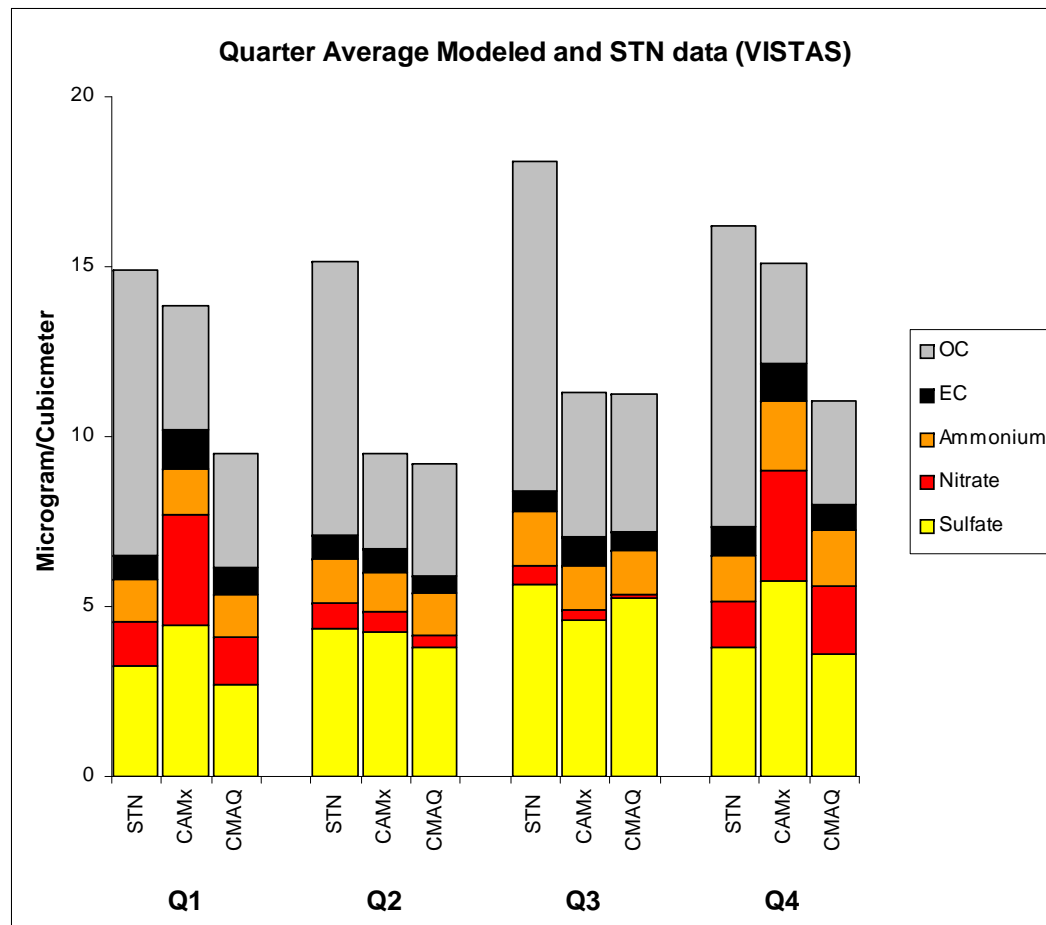
- Need good meteorological performance to get good air quality performance
 - Use as fine grid resolution as can afford
 - Focus on wind speed, boundary layer, moisture
 - May need more than one regional configuration
- CMAQ and CAMx air quality model performance
 - Generally acceptable for SO_4 , NH_4 , EC, ozone
 - Need improvements for NO_3 , OC, soil
 - Improve inventories
 - Improve model treatment of SOA formation
 - Except soil, models generally under predict $\text{PM}_{2.5}$ and components

VISTAS CMAQ 2002 Actual Base G2 12k IMPROVE



CMAQ and CAMx Model Performance Across All Sites in VISTAS Region

2002 CAMx & CMAQ





Modeling Lessons Learned



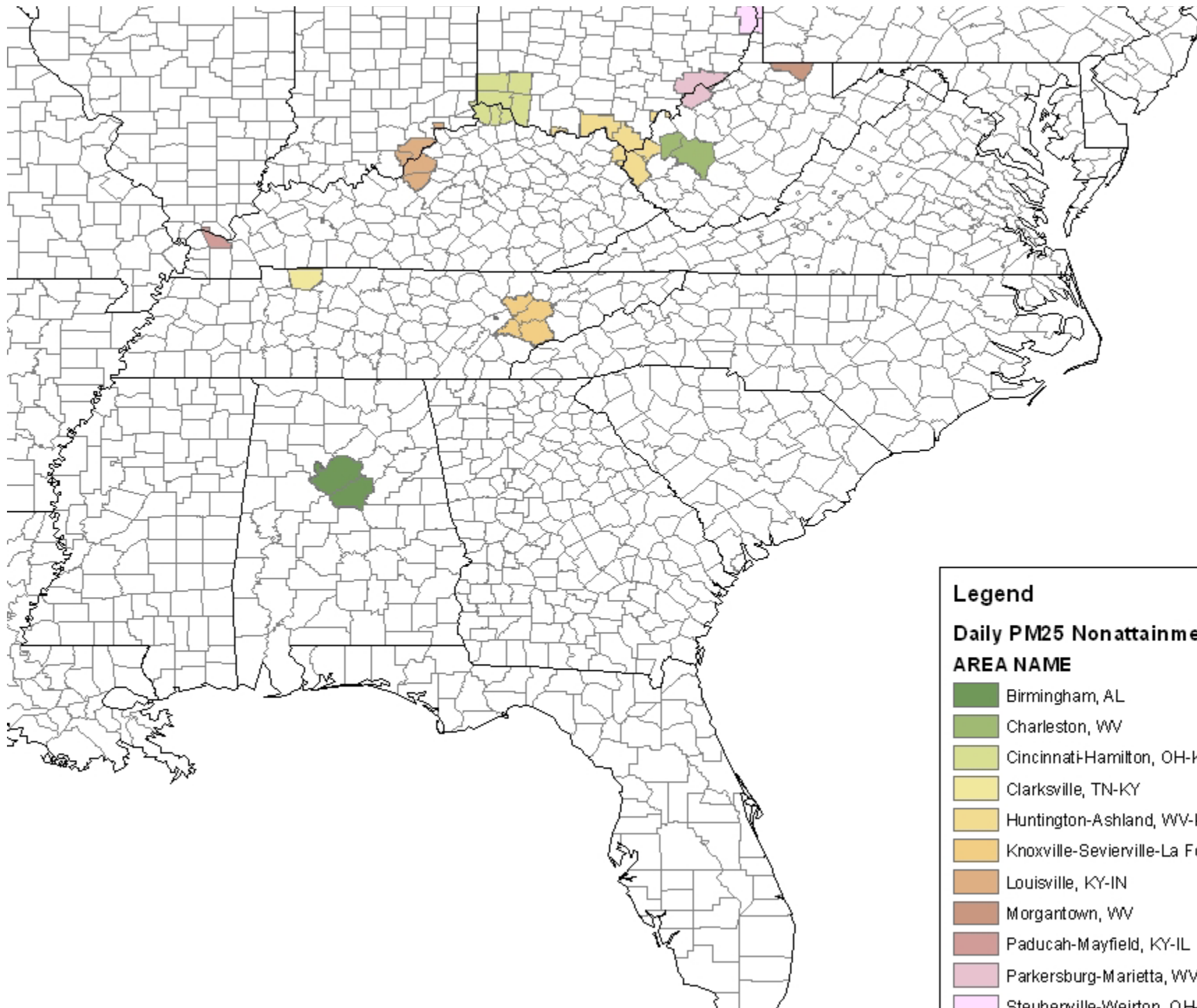
- Boundary conditions are important
 - Re-circulation of continental emissions over Atlantic and back into modeling domain
 - May need to extend eastern modeling domain further east for accurate source apportionment



Daily PM_{2.5} Standard



- EPA designated non-attainment areas
 - Based on 2005-2007 PM_{2.5} values
 - Some areas already demonstrating attainment, other areas same as annual PM_{2.5} non-attainment
- Attainment plans due in spring 2012, demonstrate attainment by 2014
 - Attainment modeling needs to be completed spring 2011 to allow SIP development
 - Suggests 2005 as initial base year; 2012 or 2013 as initial projection year
- In particular need to understand role of fire and exceptional events



Legend

Daily PM25 Nonattainment Areas (2006)

AREA NAME

- Birmingham, AL
- Charleston, WV
- Cincinnati-Hamilton, OH-KY-IN
- Clarksville, TN-KY
- Huntington-Ashland, WV-KY-OH
- Knoxville-Sevierville-La Follette, TN
- Louisville, KY-IN
- Morgantown, WV
- Paducah-Mayfield, KY-IL
- Parkersburg-Marietta, WV-OH
- Steubenville-Weirton, OH-WV



Revised Ozone Standard



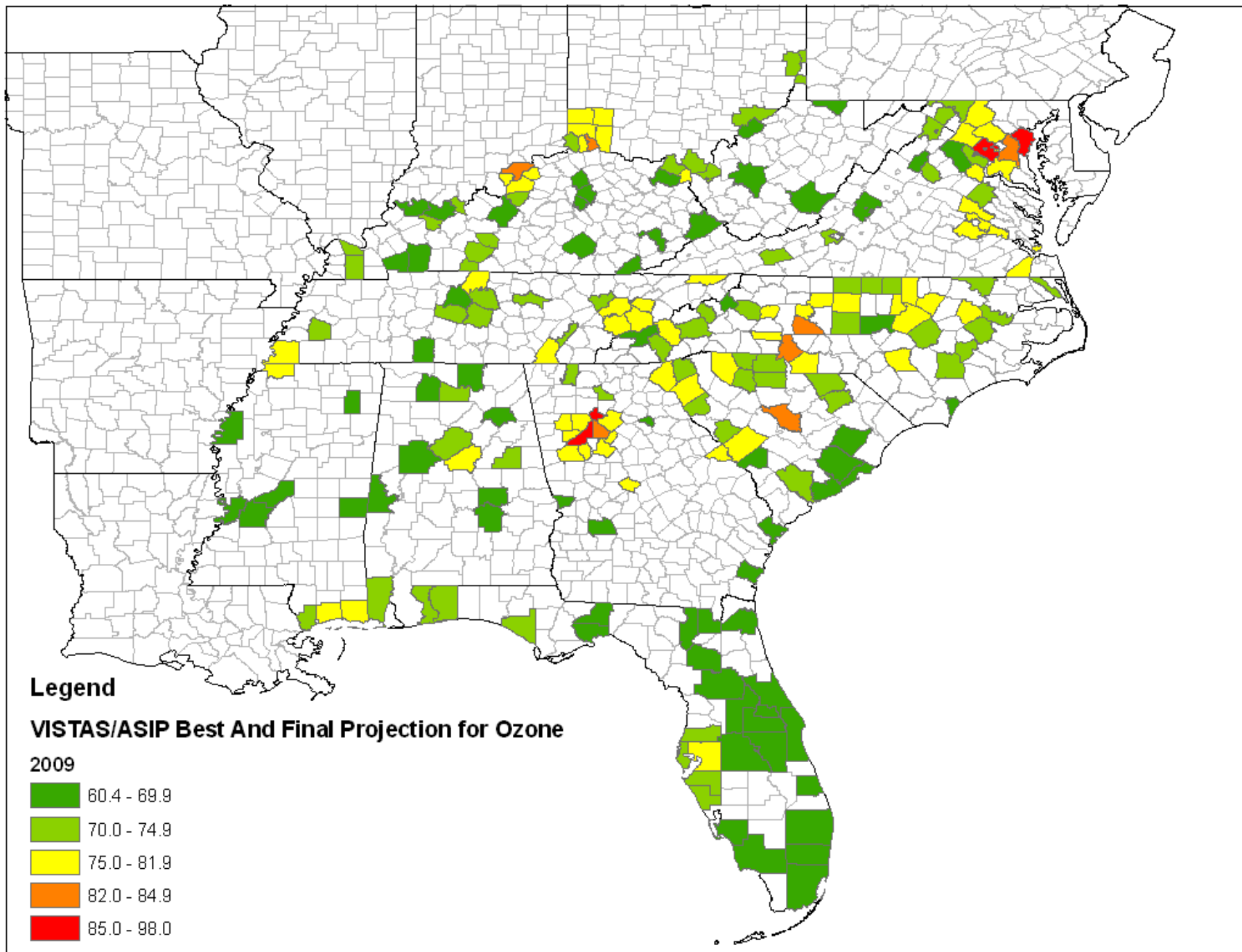
- EPA promulgated Mar 2008
- States to recommend non-attainment areas for revised ozone standard (0.075 ppm) in spring 2009, based on 2006-2008 data
- EPA to designate based on 2007-2009 data
- Demonstrate attainment in 3 years (2013) for marginal areas, 6 years (2016) for moderate areas, 9 years for serious areas
 - Suggests 2008 as base year, 2012 or 2013 as one demonstration year
 - NC and VA need to evaluate implications of 2008 fires



Ozone Modeling



- Best and Final modeling assumes CAIR is implemented
- 1997 ozone standard (0.08 ppm)
 - All areas attain by 2009, except Atlanta, GA and northern VA, which attain by 2012
- 2008 ozone standard (0.075 ppm)
 - In 2009, 32 non-attaining monitors
 - In 2012, 23 non-attaining ozone monitors





2012 Regional Haze Demonstration



- 2012 reasonable progress demonstration will focus on monitoring trends and emissions inventory data
 - Are actual emissions consistent with projected emissions reductions (especially for CAIR)?
 - Are we on track to meet reasonable progress goals in 2018?
 - Air quality modeling results for daily PM_{2.5} will also benefit reasonable progress demonstration
- Consult with FLM/EPA early and often



Planning for Next SIPs



- Meteorological Model
 - MM5 no longer supported
 - States are migrating to WRF
 - States will begin modeling spring-summer 2009
- Emissions model
 - CONCEPT is conceptually more transparent model than SMOKE but better documentation needed for new users
 - States expect to continue to use SMOKE



Planning for Next SIPs



■ Air Quality Model

- CMAQ is EPA-supported, community add-ons
- CAMx was developed by ENVIRON but other firms, states are running CAMx
- CMAQ and CAMx have comparable model performance
- Both CMAQ and CAMx have source apportionment tools
 - CAMx-PSAT most widely demonstrated to date
- States currently have more experience running CMAQ but open to use either or both models for next SIPs – decision in 2009



Planning for Next SIPs



- VISTAS states will assume in-house regional modeling responsibilities for next SIPs
 - VISTAS to release request for proposals for met, em, and air quality modeling this spring 2009
 - Intend contractor to help define model base year configurations based on model performance
 - Transfer base year model run to states to benchmark and operate
 - States in lead modeling role with contractor support
 - GA and NC will have lead responsibilities
 - VA capabilities split between OTC and VISTAS
 - SC developing capabilities



Planning for Next SIPs

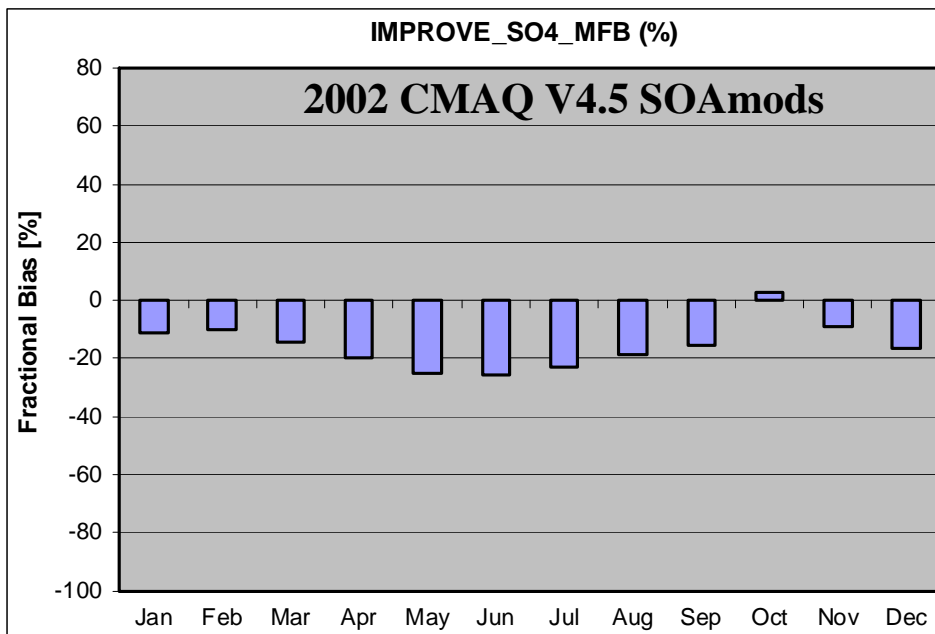
- State Collaborative modeling
 - Advantages: common modeling platform, common assumptions
 - Disadvantages: 36 km domain, LADCO inventory assumptions, not as good model performance as VISTAS modeling
- VISTAS states expect to continue to participate in State Collaborative modeling and to conduct southeastern regional modeling



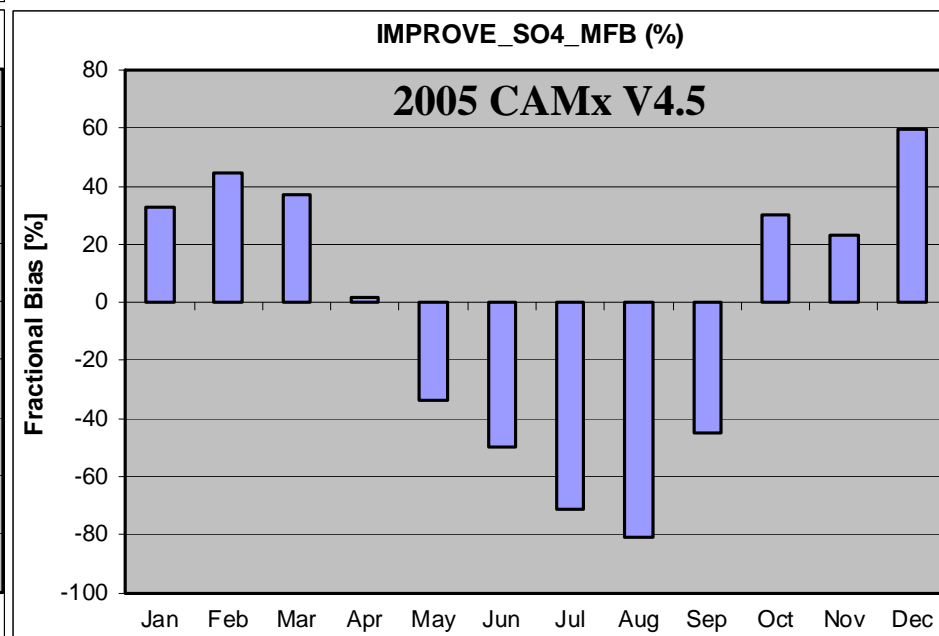
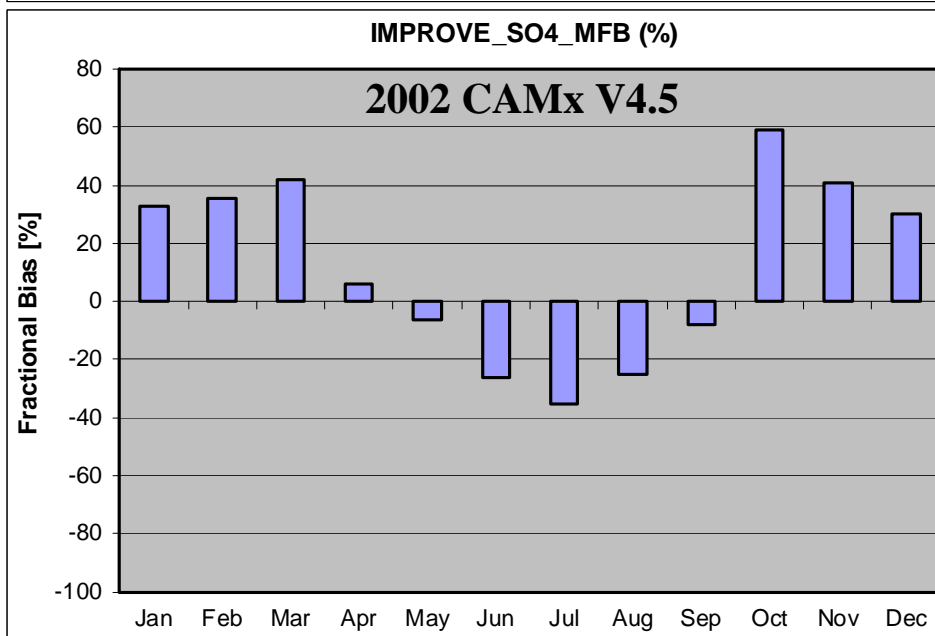
Planning for Next SIPs

- Modeling decisions
 - Modeling Domain
 - Expand eastern border of 36-km national grid?
 - 12-km southeastern regional grid
 - States may need 4-km grid for specific non-attainment areas
 - Modeling Platform: WRF, SMOKE, CMAQ/CAMx
 - During 2009 GA and NC intend to conduct initial WRF meteorological model performance evaluation for 2005 and 2008 with contractor support

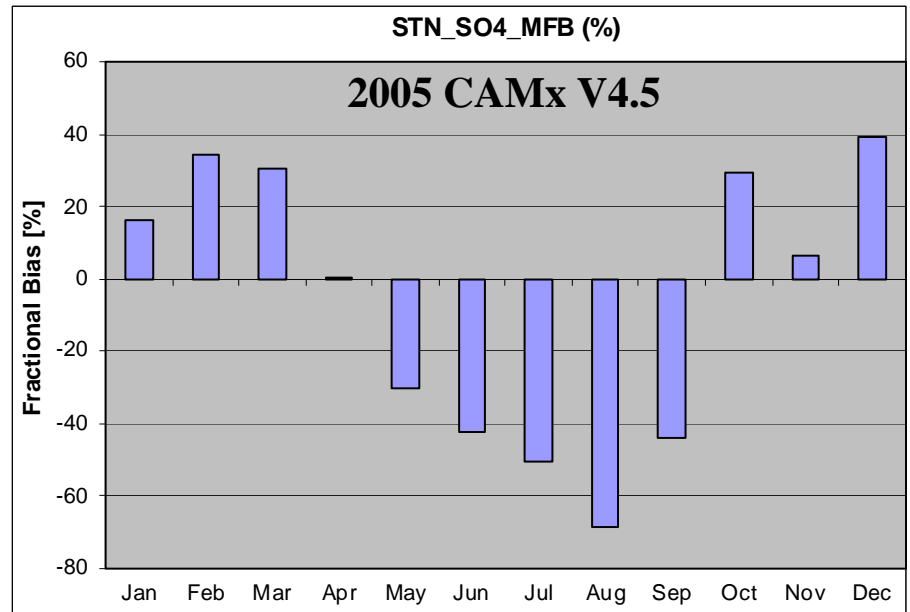
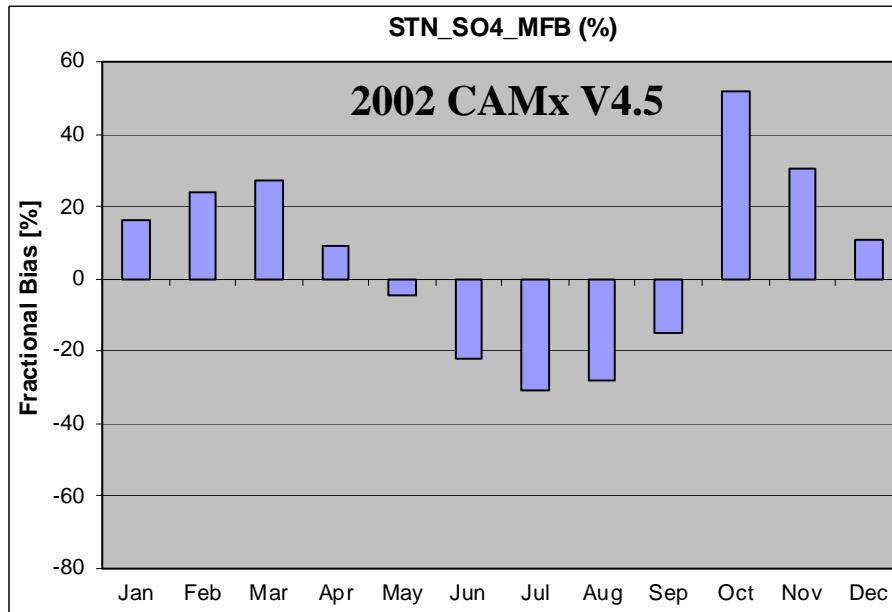
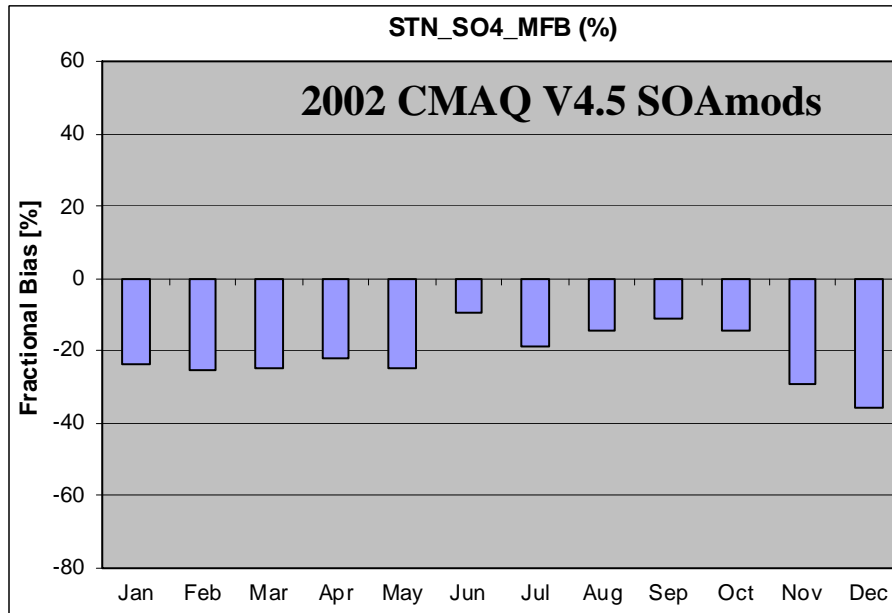
Model Performance: VISTAS IMPROVE Network: SO₄



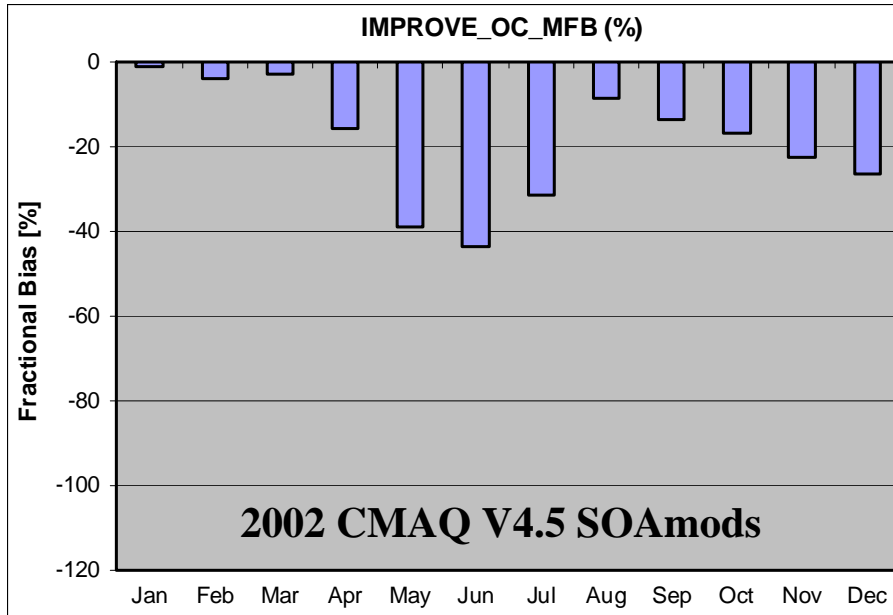
The "Good"



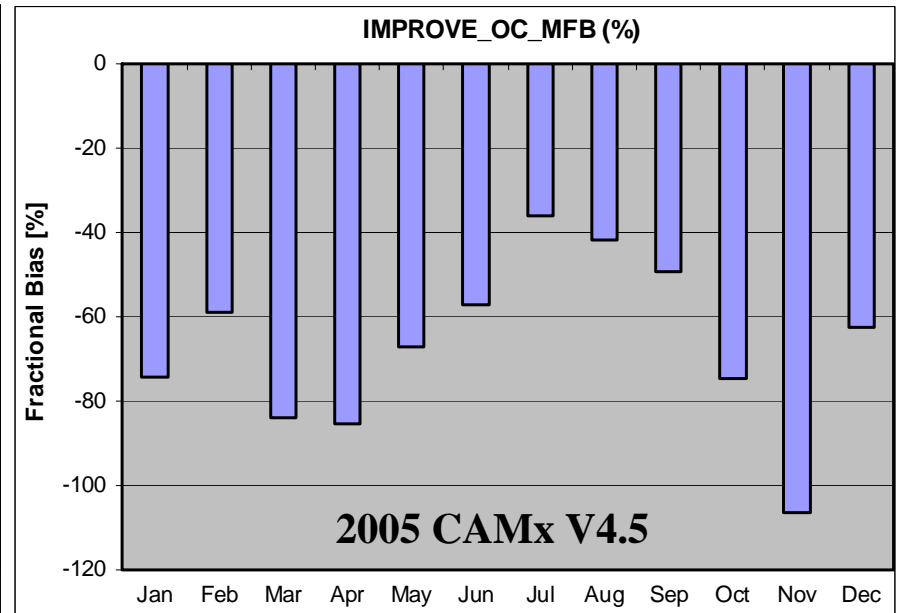
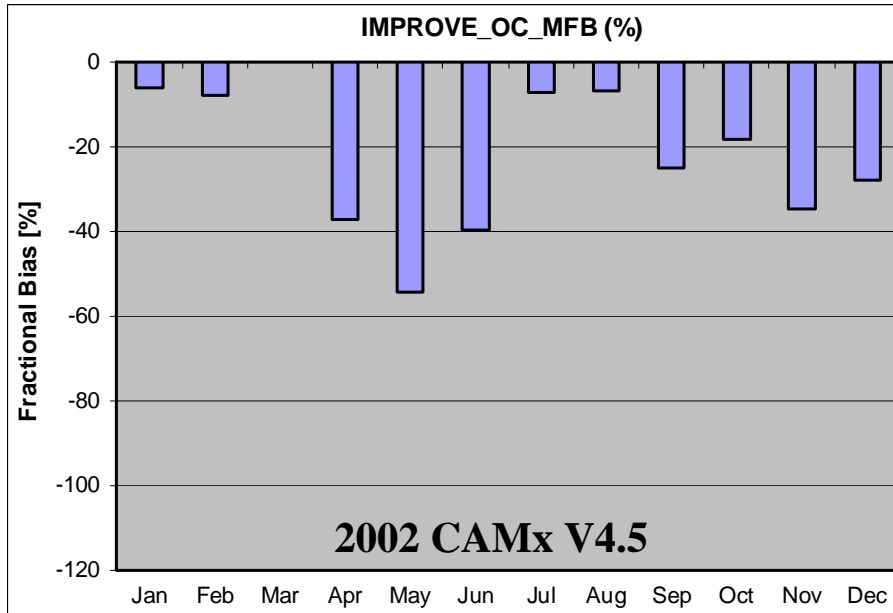
Model Performance: VISTAS STN Network: SO₄



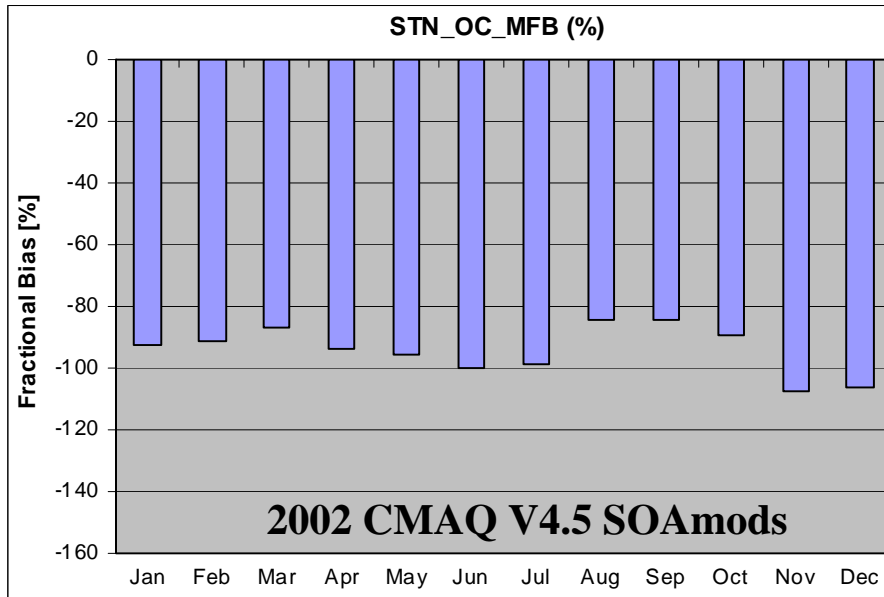
Model Performance: VISTAS IMPROVE Network: OC



The "Bad"



Model Performance: VISTAS STN Network: OC



The "Ugly"

