

# **Attribution of Haze Workgroup's Monitoring Metrics Document Status:**

- 1) 2018 Visibility Projections – Alternative Procedures  
using Relative Response Factors**
- 2) Ambient Haze Monitoring Data Substitution**



**Implementation Workgroup Meeting  
December 6, 2006**

# Monitoring Metrics Document Status

- Issue identified at late July AoH Workgroup meeting
- Document to provide consensus technical recommendations to support haze planning
- 4 major topics
  - ✓ Adopt revised IMPROVE equation – done
  - ✓ Adopt alternate natural conditions values (by species) – done
  - ✓ Adopt 2000-04 IMPROVE dataset for sites with complete data – done
    - Sites with insufficient data identified and data substitution underway
    - Analysis of default and alternate visibility projections methods
      - 2 calls completed, next call 12/13, maybe 1 additional call
      - Potential methods explained later
- Final draft of Monitoring Metrics document out for review early January

## WRAP Sites With Data Completeness Problems

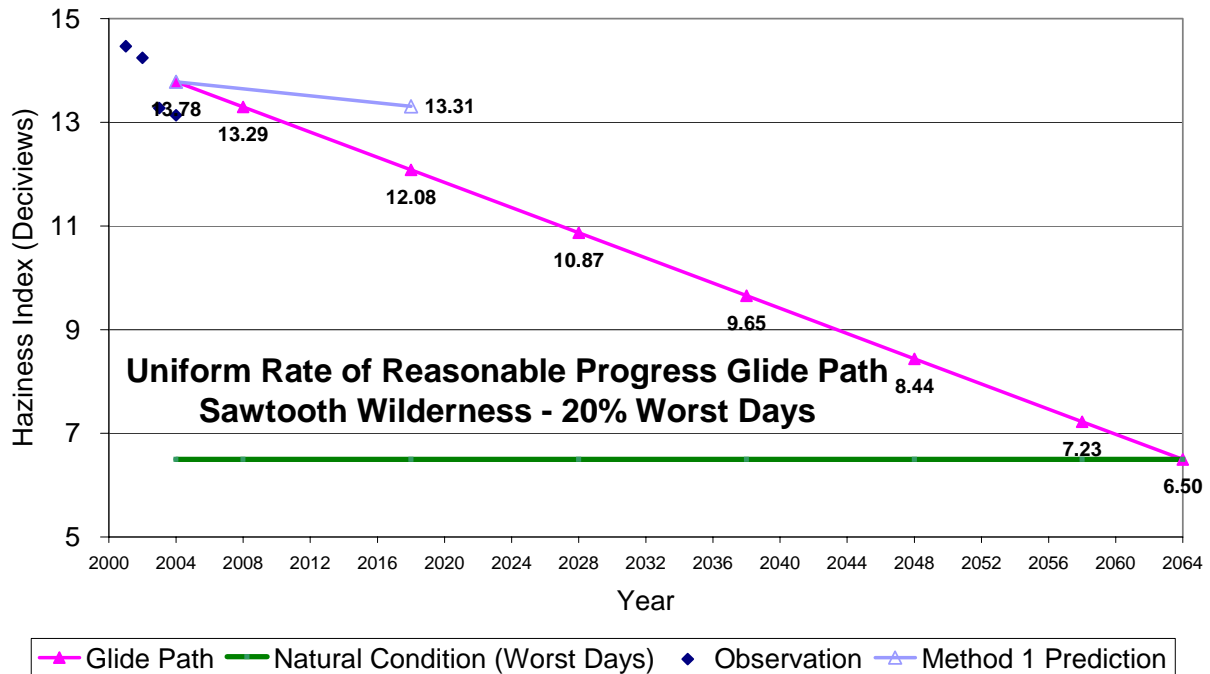
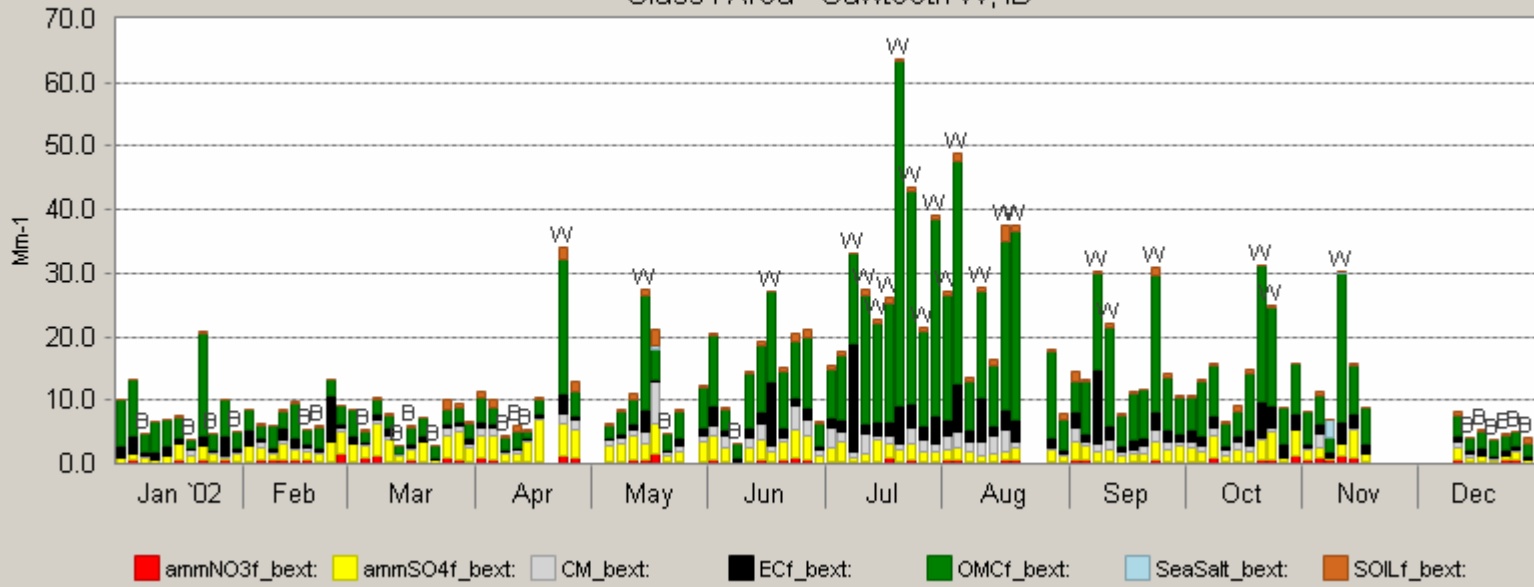
Site Name (State)	Site Abbr.	Fewer Than 3 Years	Missing 2002
Mt. Baldy (AZ)	BALD	X	X
Indian Garden (AZ)	INGA		X
Tonto (AZ)	TONT		X
Kaiser (CA)	KAIS	X	X
Point Reyes (CA)	PORE		X
San Rafael (CA)	RAFA	X	X
Sequoia (CA)	SEQU		X
Trinity (CA)	TRIN		X
Flathead (MT)	FLAT		X
Fort Peck (MT)	FOPE		X
Glacier (MT)	GLAC		X
Northern Cheyenne (MT)	NOCH		X
Capitol Reef (UT)	CAPI	X	X
North Cascades (WA)	NOCA	X	

# Introduction to Visibility Projections

- Difficult to meet 2018 Uniform Rate of Progress (URP) goal for western Class I areas using EPA default or alternative modeled 2018 visibility projections methods due to large contributions of:
  - Fires (High EC and OC)
  - Dust (High Soil and CM)
  - International Transport
- Most of these emissions are natural, unpredictable and uncontrollable
- Unable to realistically forecast these sources in 2018
  - many source categories held constant from 2002 to 2018
  - Two examples follow: Crater Lake (CRLA) OR and Salt Creek (SACR) NM

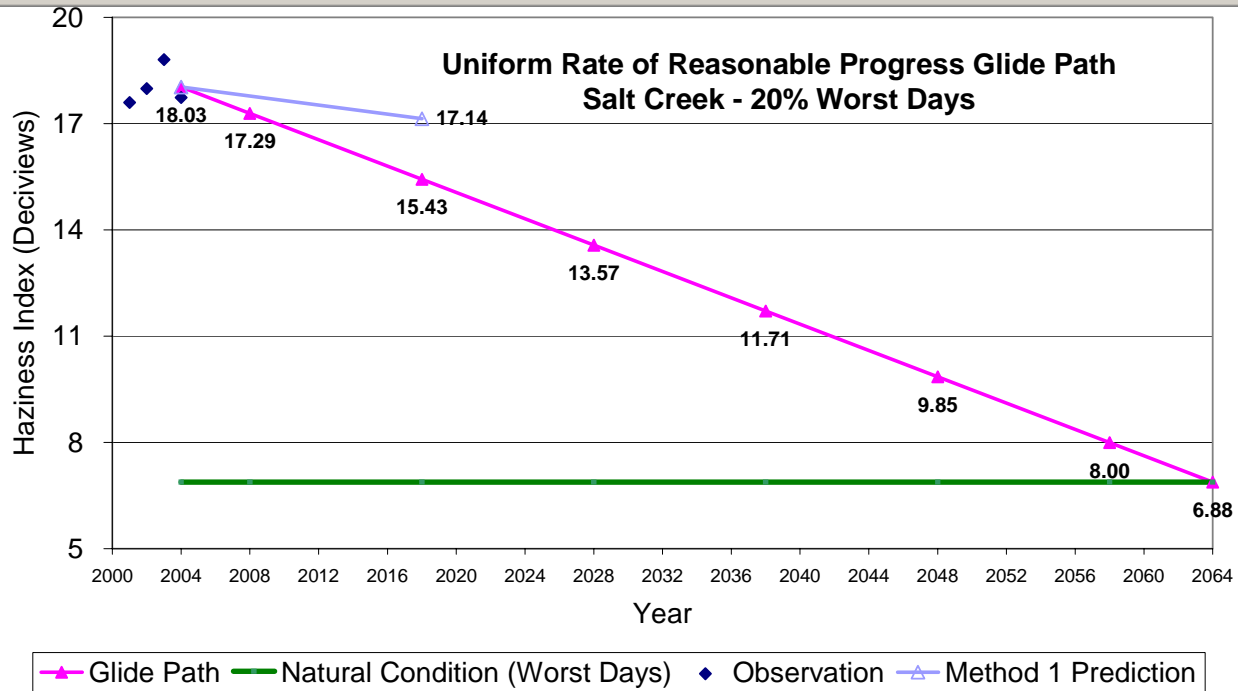
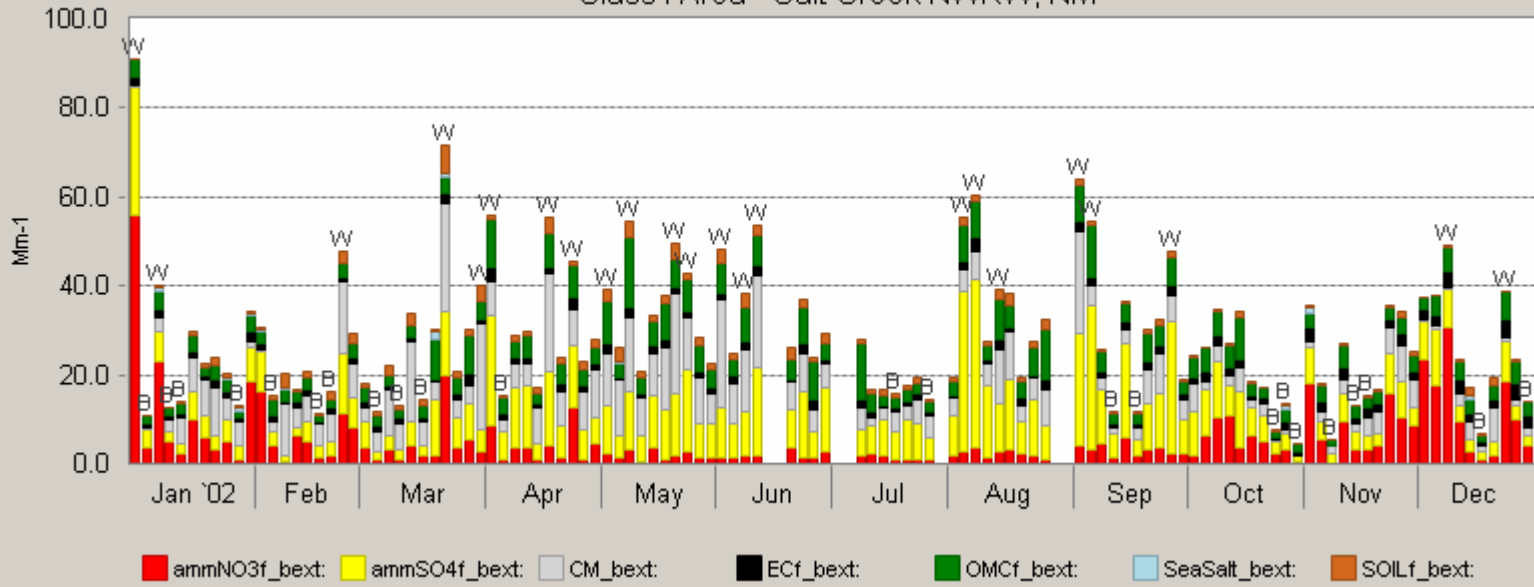
# SAWT1

Class I Area - Sawtooth W, ID



# SACR1

## Class I Area - Salt Creek NWRW, NM



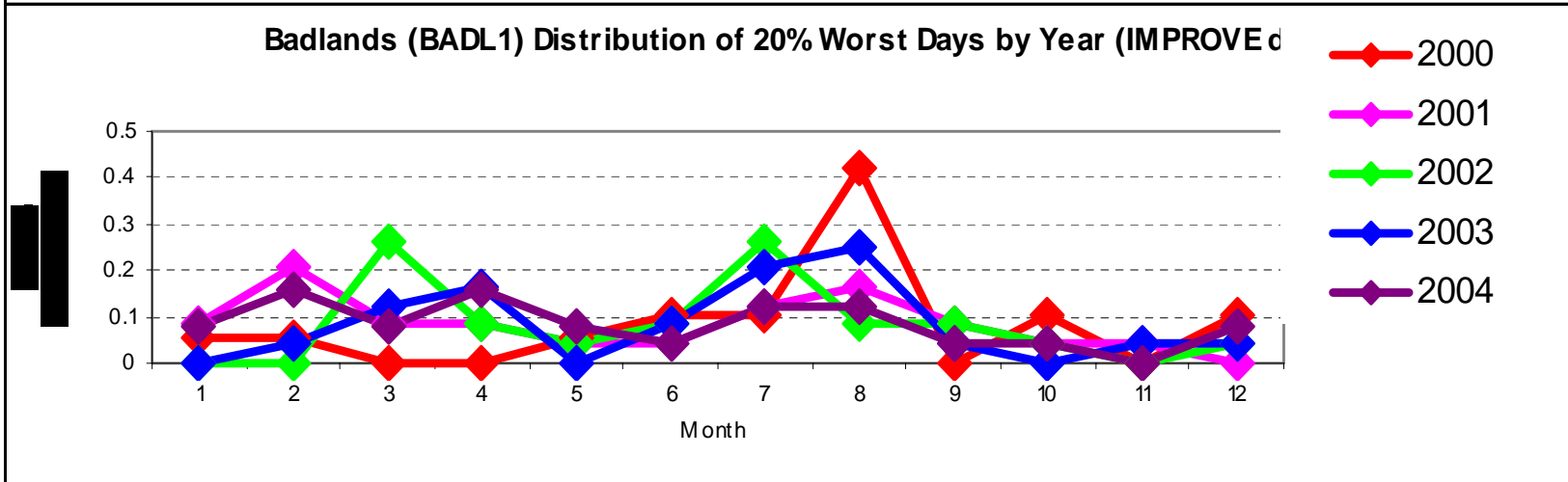
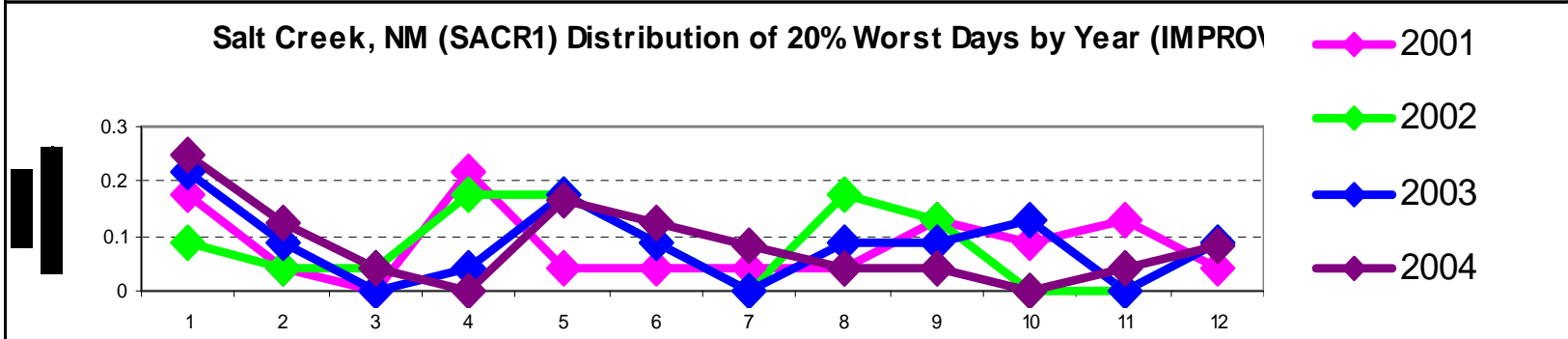
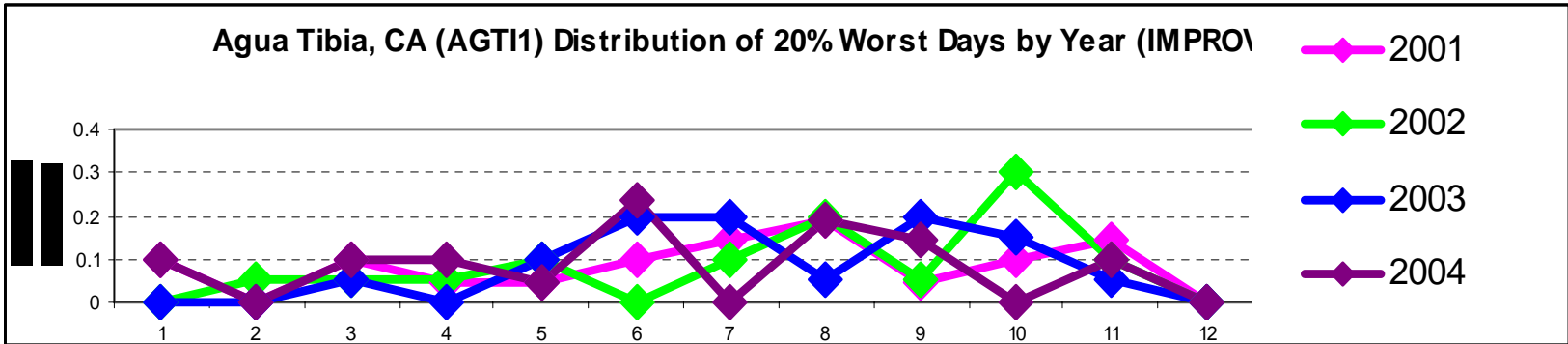
# 2018 Emission Projections

- Sources Held Constant 2000-04 to 2018 base case
  - Biogenics
  - Wind Blown Dust (WRAP model)
  - Ammonia from WRAP model
  - Mexico and Canada
  - Off-Shore Marine
  - Boundary Conditions from GEOS-Chem Global Model
- Sources with emission reductions 2000-04 to 2018 base case
  - Mobile source NO<sub>x</sub>, SO<sub>x</sub>, EC & OC
  - Point and Area Source NO<sub>x</sub> and SO<sub>x</sub> (amount varies by state)
  - Nonattainment areas (mainly VOC & NO<sub>x</sub> in CA)
  - Many other anthropogenic sources relatively unchanged or increase
    - Road dust, oil & gas, some uncontrolled area sources

# 2018 Visibility Projection Issues

- EPA guidance (September 2006) recommends using average modeling results for the 2002 Worst 20% (W20%) days to project 2018 visibility for W20% days from the 2000-2004 Baseline (Relative Response Factors, RRFs)
- W20% days in 2002 may not be representative of W20% days from other years in Baseline
  - 2002 W20% days may occur in different times of the year and therefore emphasize different PM components
  - Episodic events may dominate W20% days in some years
    - Fires dominate 2002 W20% days at some western Class I areas that makes the 2002 year derived RRFs very stiff
    - Fire impacts in other years at Class I areas with little fires in 2002

# Concern 2002 May Not Capture Seasonal Variations



# 2018 Visibility Projection Issues

- Missing IMPROVE data at some Class I areas hinders visibility projection calculations at 18 sites in western U.S.
  - 5 IMPROVE sites did not meet RHR criteria of at least 3 complete years in 2000-2004 Baseline
  - 13 IMPROVE sites did not satisfy data completeness criteria for 2002 so RRFs could not be calculated
  - Data substitution underway to address this issue
- Model performance for Coarse Mass (CM) sufficient bad we do not believe the RRFs are reliable
  - Suspect a lot of measured CM are subgrid-scale to the model so the model 36 km CM estimates are not representative
  - Set RRFs for CM = 1.0

# 2018 Visibility Projection Issues

- 2018 URP goal is not a NAAQS, just one element of the Reasonable Progress (RP) determination
- Four Factor Analysis another important element of RP
- EPA default 2018 visibility projections one approach for using modeling results in RP determination
  - Can we use alternative projection techniques that take into account seasonal differences in W20% days during Baseline
  - Are there other ways we can use the modeling results to assist in the Reasonable Progress determination?

# Approaches for RRFs (1)

- **Method 1: Average RRF Approach from September 2006 EPA Guidance**

- For each Class I area and Observed Worst/Best 20% days from 2002 take the ratio of the average modeled 2018 to 2002 PM species concentrations

$$RRF_j(SO_4) = \frac{\frac{1}{N} \sum_{i=1}^N SO_{4_{ij}}(2018)}{\frac{1}{N} \sum_{i=1}^N SO_{4_{ij}}(2002)} = \frac{\sum_{i=1}^N SO_{4_{ij}}(2018)}{\sum_{i=1}^N SO_{4_{ij}}(2002)}$$

- Applied to observed daily PM components for each Worst/Best 20% day from each year from the Baseline, calculate daily Bext/dv, annual dv and 2018 projected dv same as before

# Approaches for RRFs (2)

- **Method 2A: Average Quarterly RRF Approach**
  - Similar to Average RRF Approach only calculate separate RRFs for each Quarter of the year using the observed Worst/Best 20% days for each Quarter in 2002
  - Allows for seasonal variations in RRFs, has similarities to 24-Hour PM<sub>2.5</sub> projection approach specified by EPA guidance

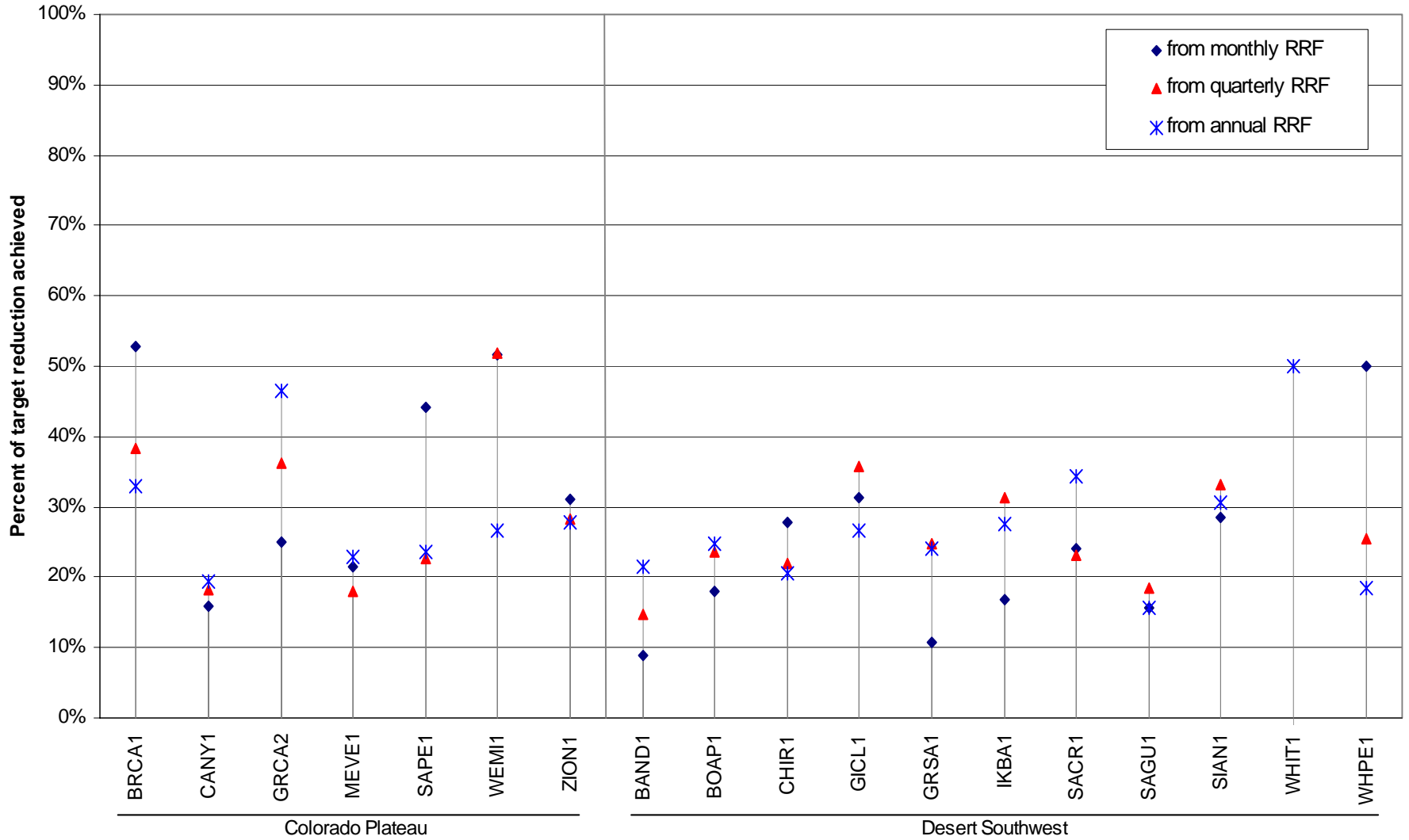
# Approaches for RRFs (3)

- **Method 2B: Average Monthly RRF Approach**
  - Calculate separate RRFs for each Month of the year using the observed Worst/Best 20% days for each Month in 2002
  - Allows for seasonal variations in RRFs
- Results follow for:
  - 2002 Plan02c & 2018 Base18b
  - CMAQ 2002 36 km annual simulations
  - New IMPROVE equation

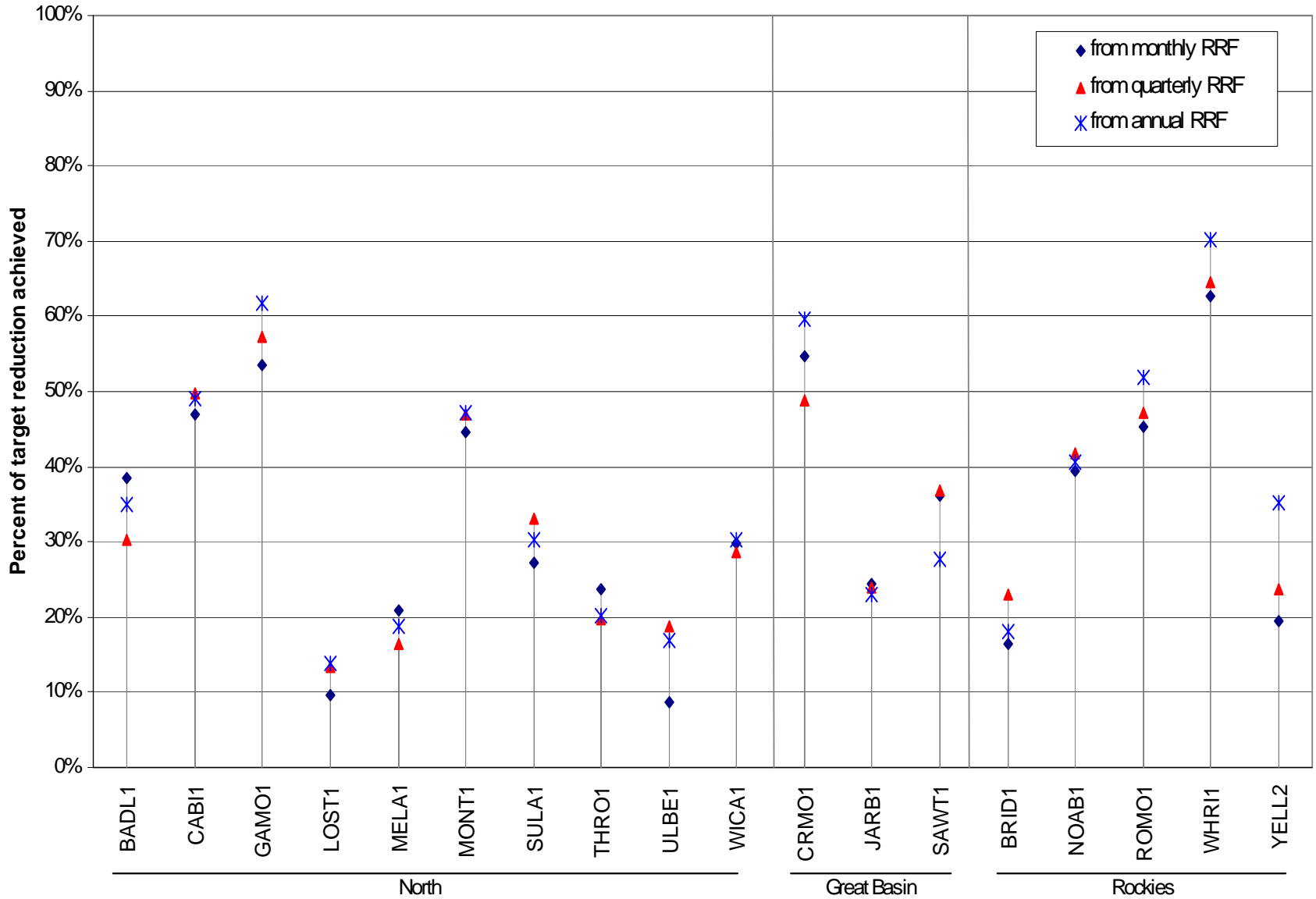
# Visibility Projection Comparisons

- Use DotPlots that present 2018 visibility at Class I areas as a percentage of meeting 2018 URP benchmark
  - Compare Method 1 (Annual W20%) with Method 2A (Quarterly W20%) and Method 2B (Monthly W20%) New IMPROVE Algorithm
  - New IMPROVE equation
  - RRF for CM = 1.0
  - No Western US Class I area achieves 2018 URP benchmark
    - In contrast to eastern US where many Class I areas achieve 2018 URP goal due to sulfate domination

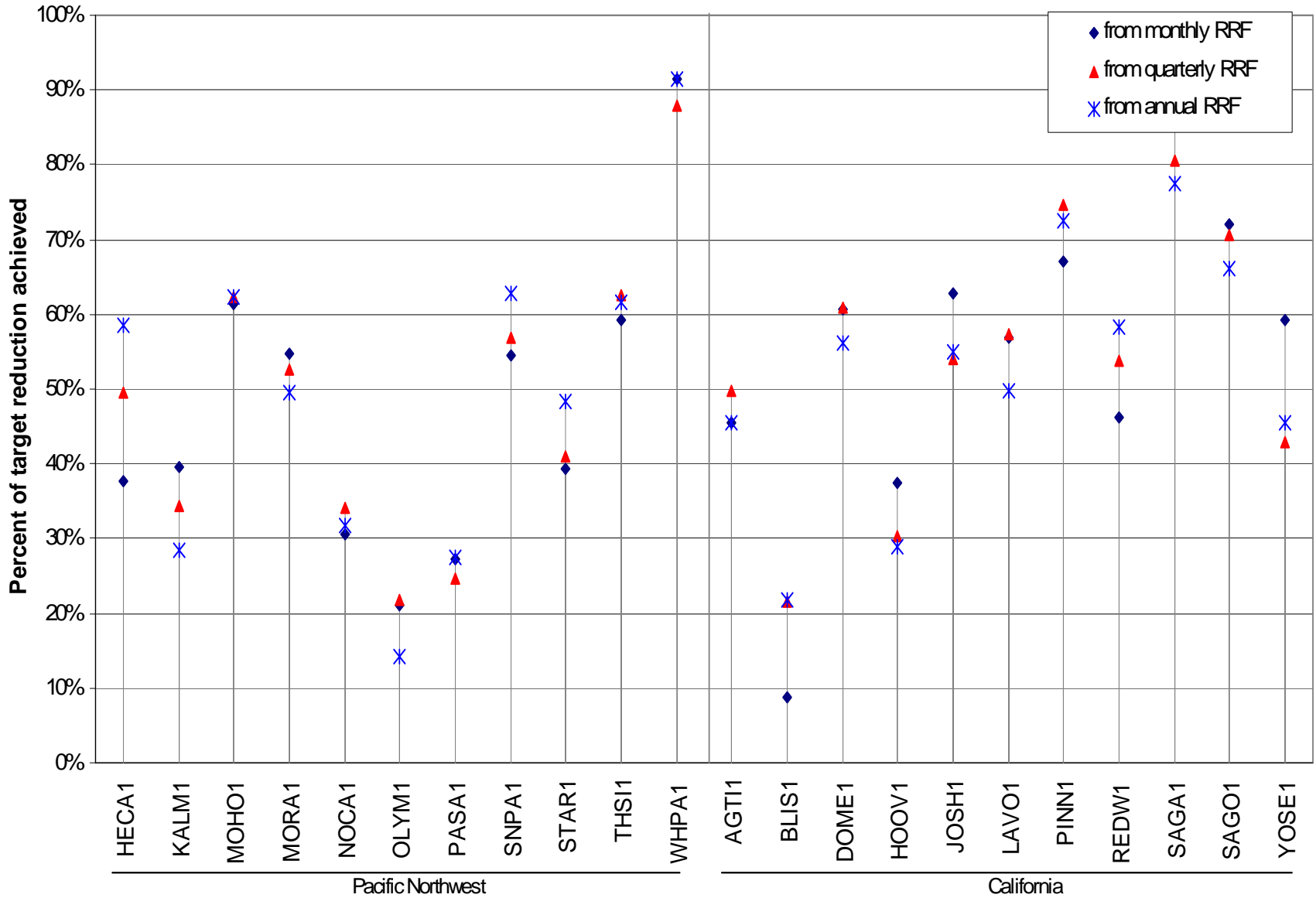
# Visibility Predictions for Colorado Plateau and Desert Southwest sites



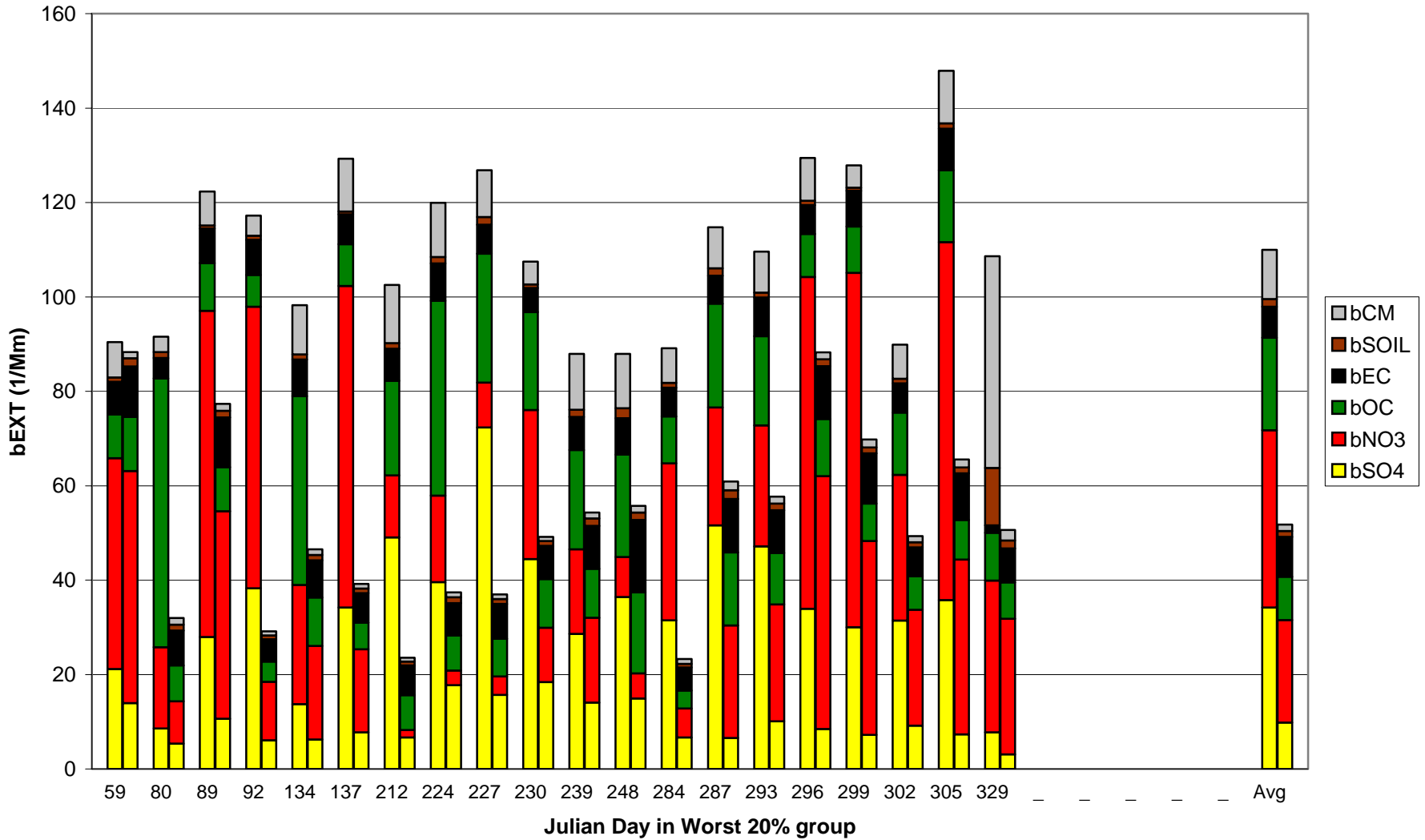
# Visibility Predictions for North, Great Basin and Rockies sites



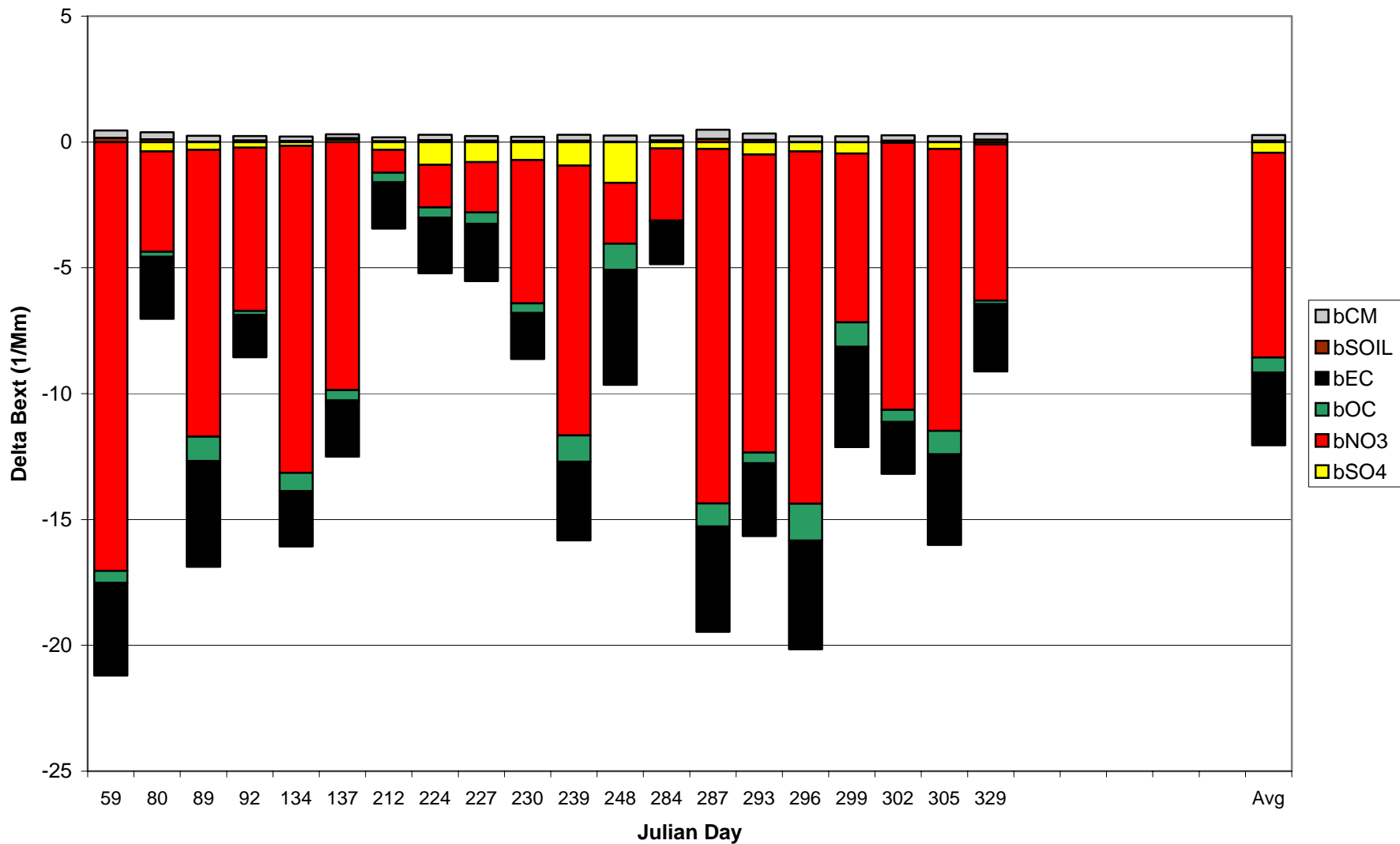
# Visibility Predictions for Pacific Northwest and California sites



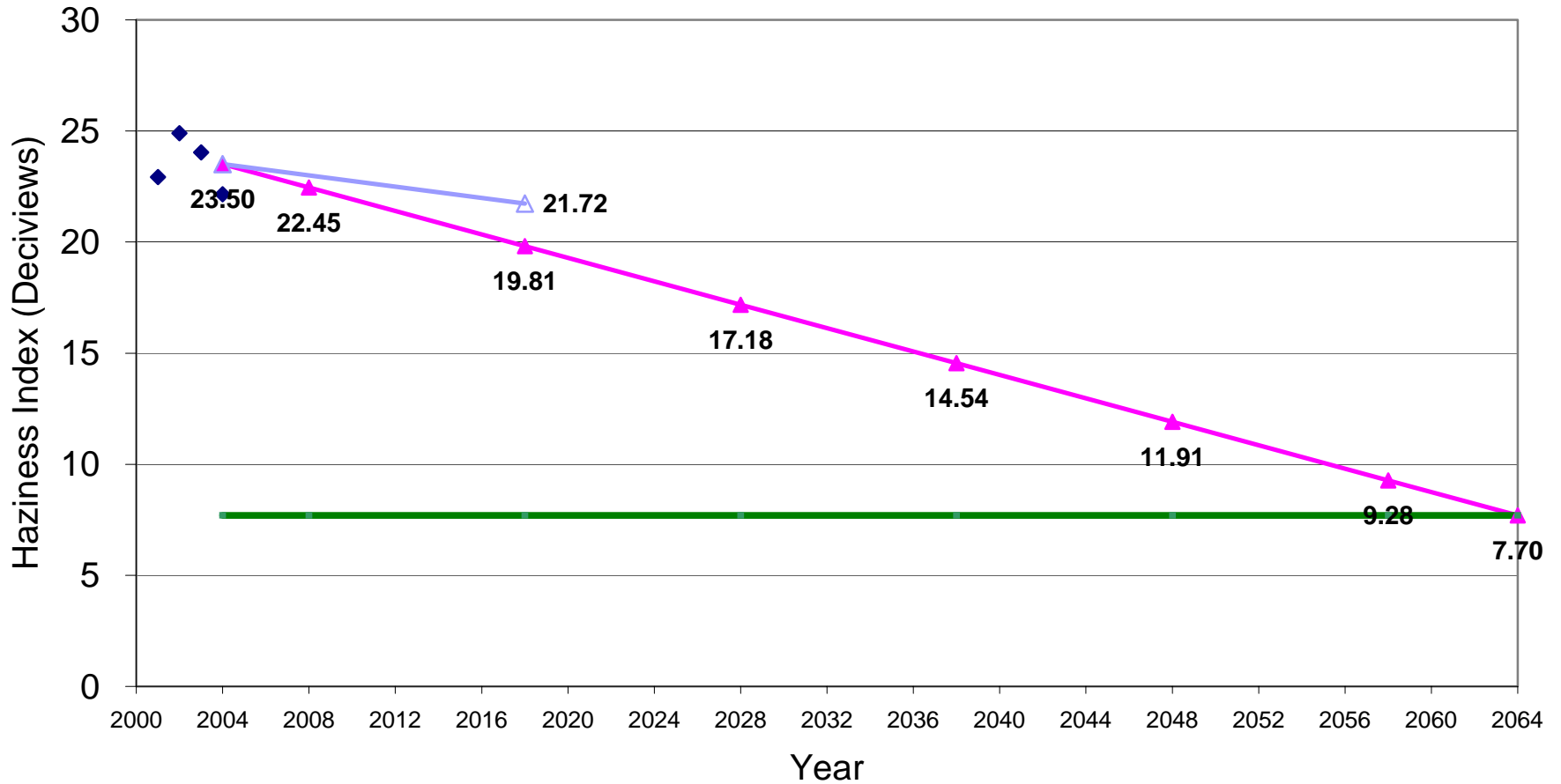
## Worst 20% Obs (left) vs plan02c (right) at AGT11



Bext Response (base18b - plan02c) at AGT11 on Worst 20% Days

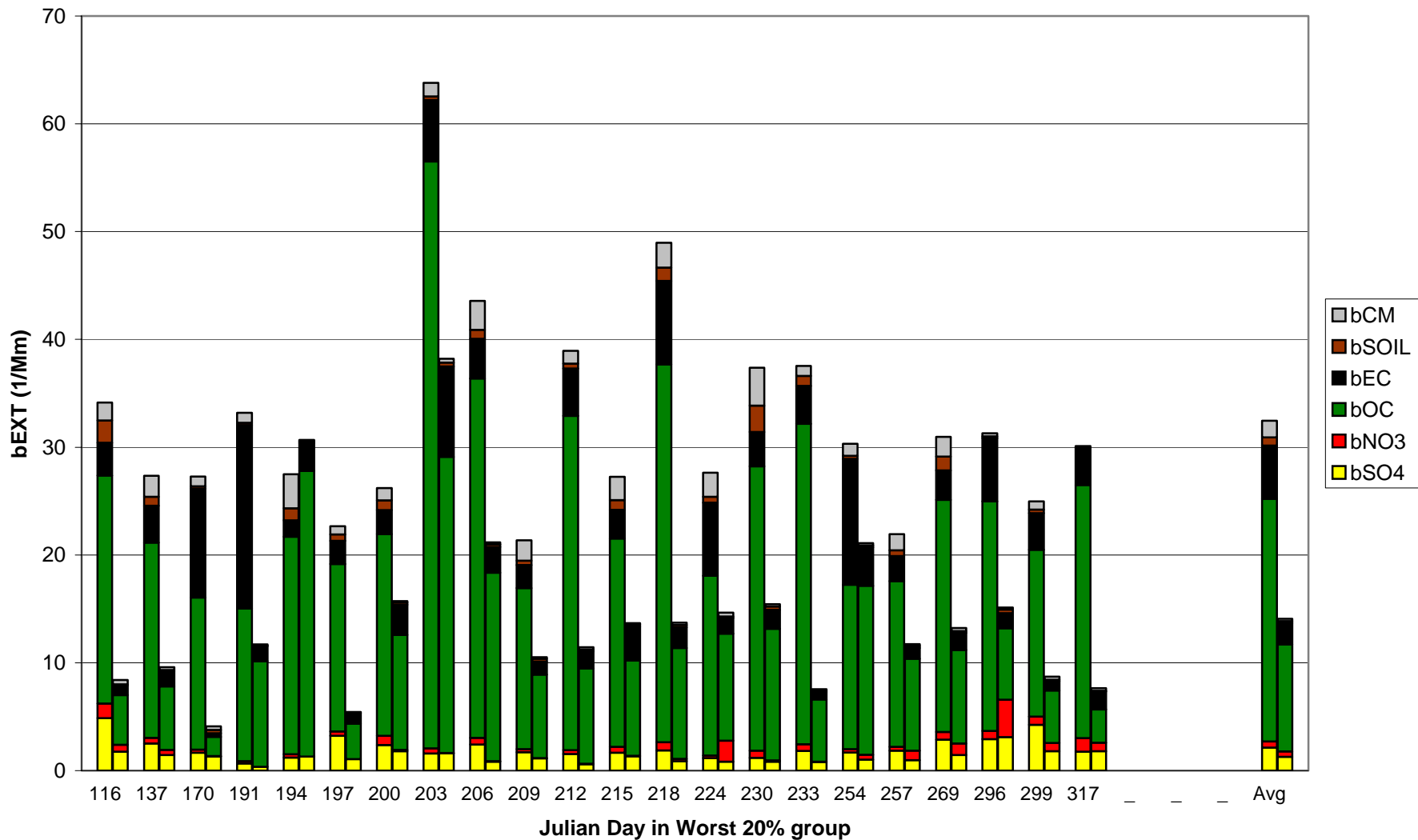


# Uniform Rate of Reasonable Progress Glide Path Agua Tibia Wilderness - 20% Worst Days

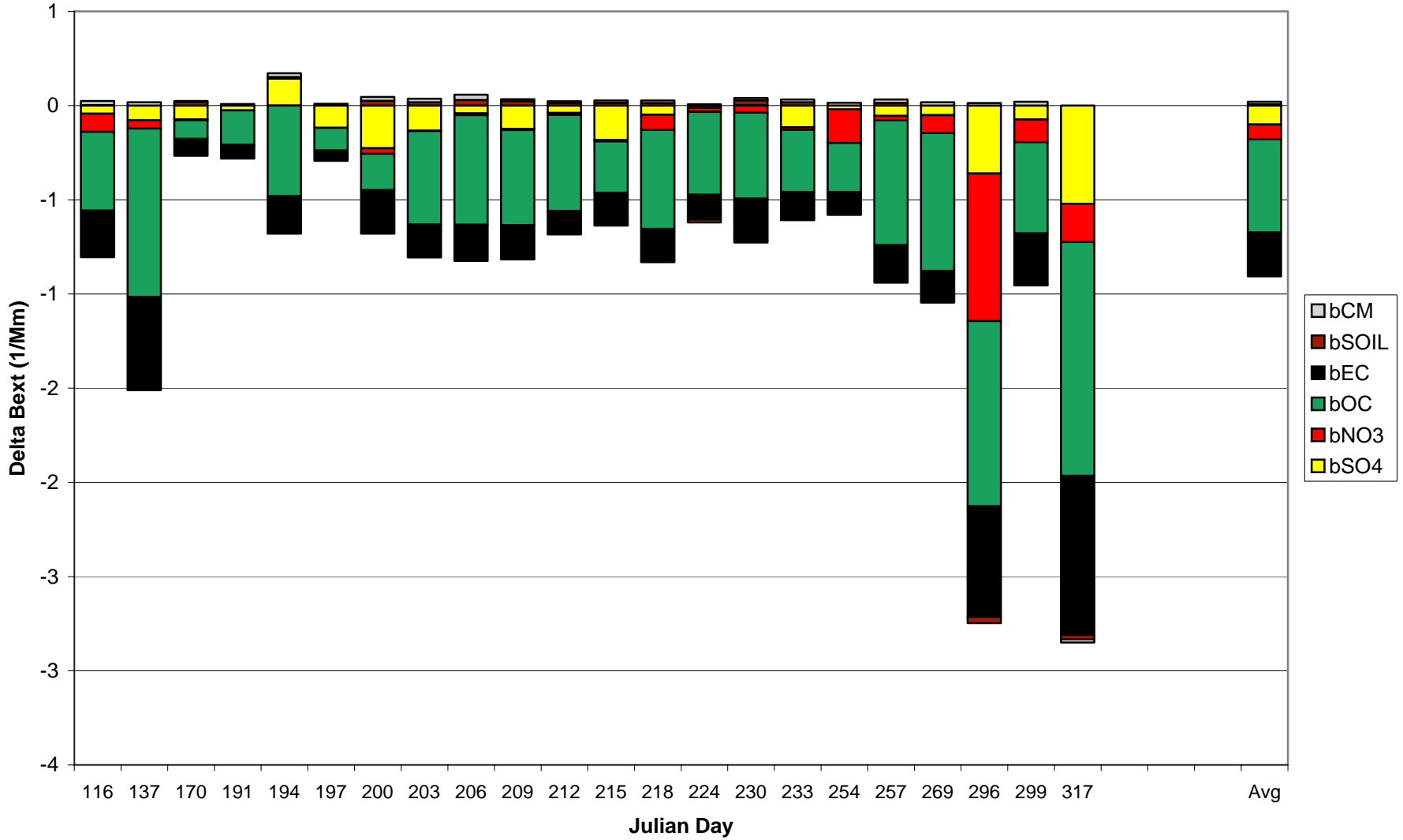


—▲— Glide Path    — Natural Condition (Worst Days)    ◆ Observation    —△— Method 1 Prediction

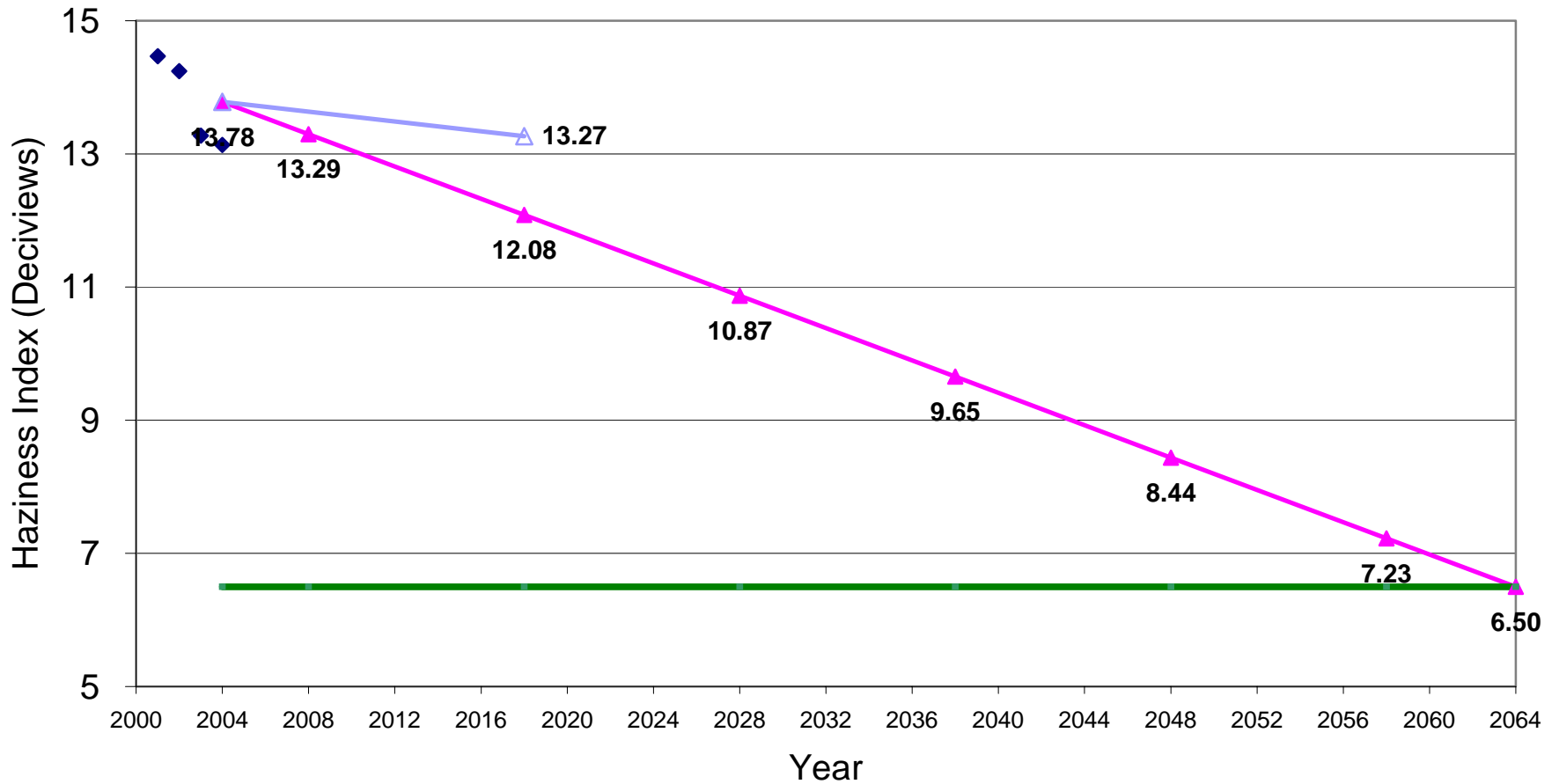
## Worst 20% Obs (left) vs plan02c (right) at SAWT1



Bext Response (base18b - plan02c) at SAWT1 on Worst 20% Days

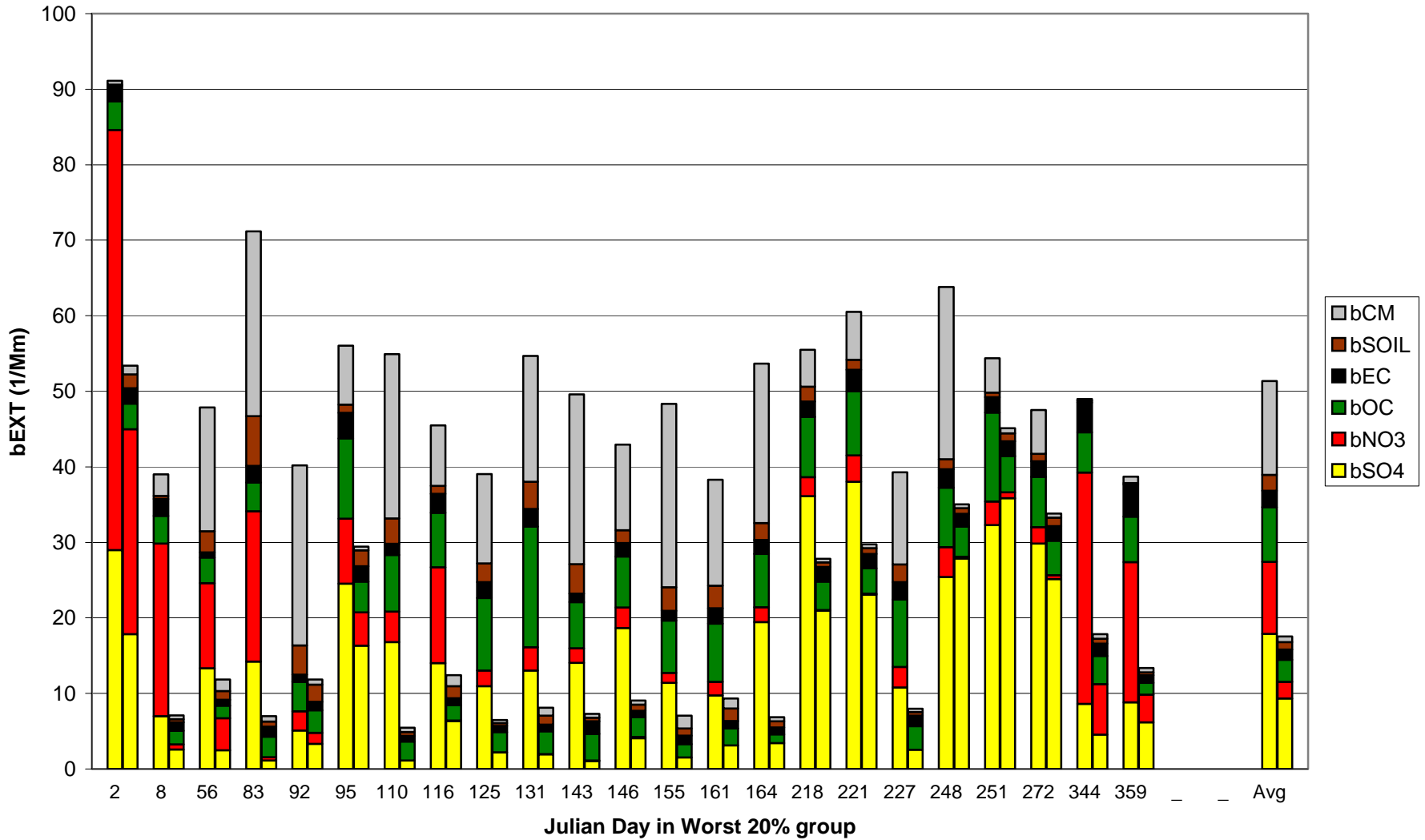


# Uniform Rate of Reasonable Progress Glide Path Sawtooth Wilderness - 20% Worst Days

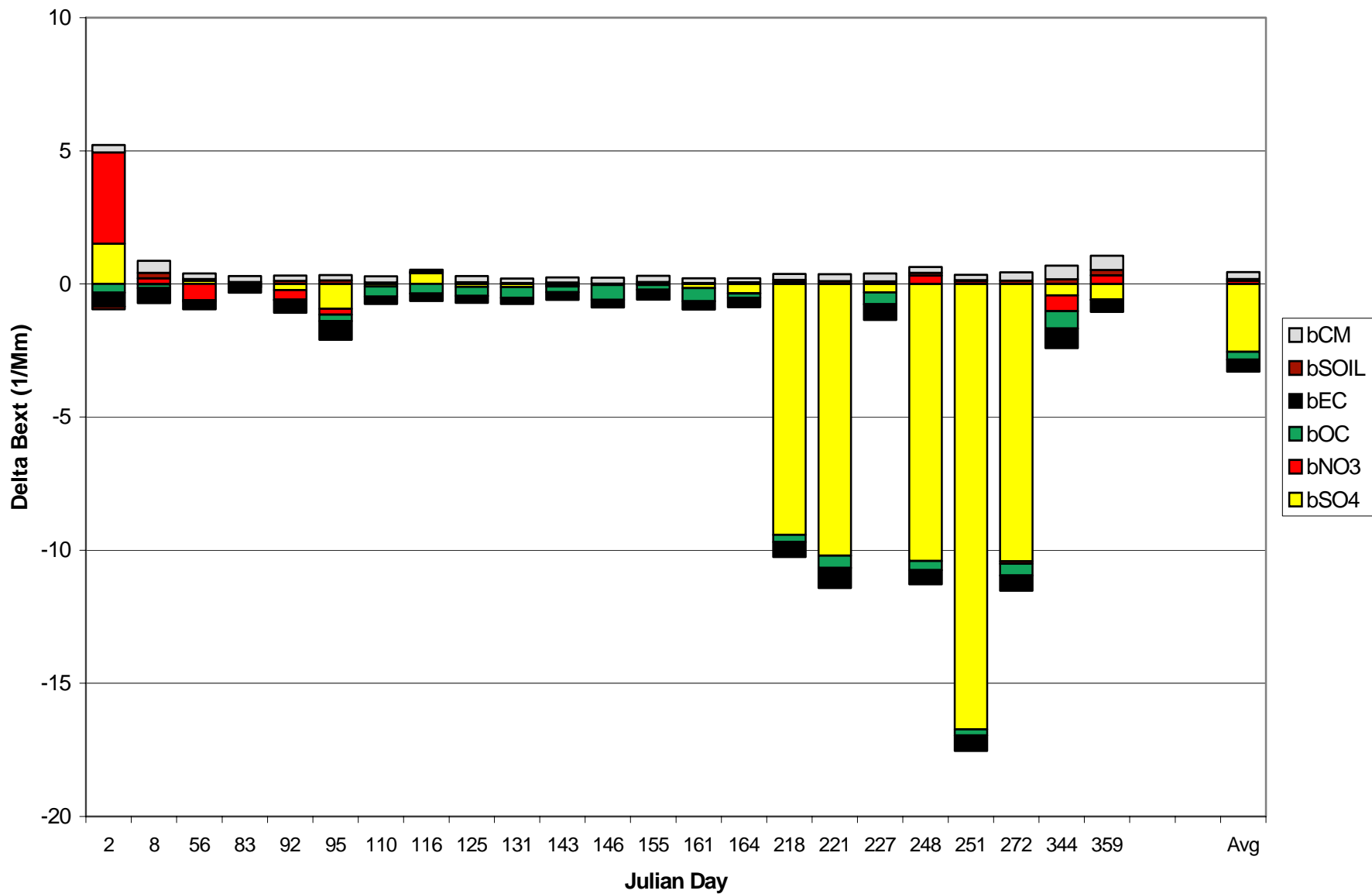


—▲— Glide Path    — Natural Condition (Worst Days)    ◆ Observation    —△— Method 1 Prediction

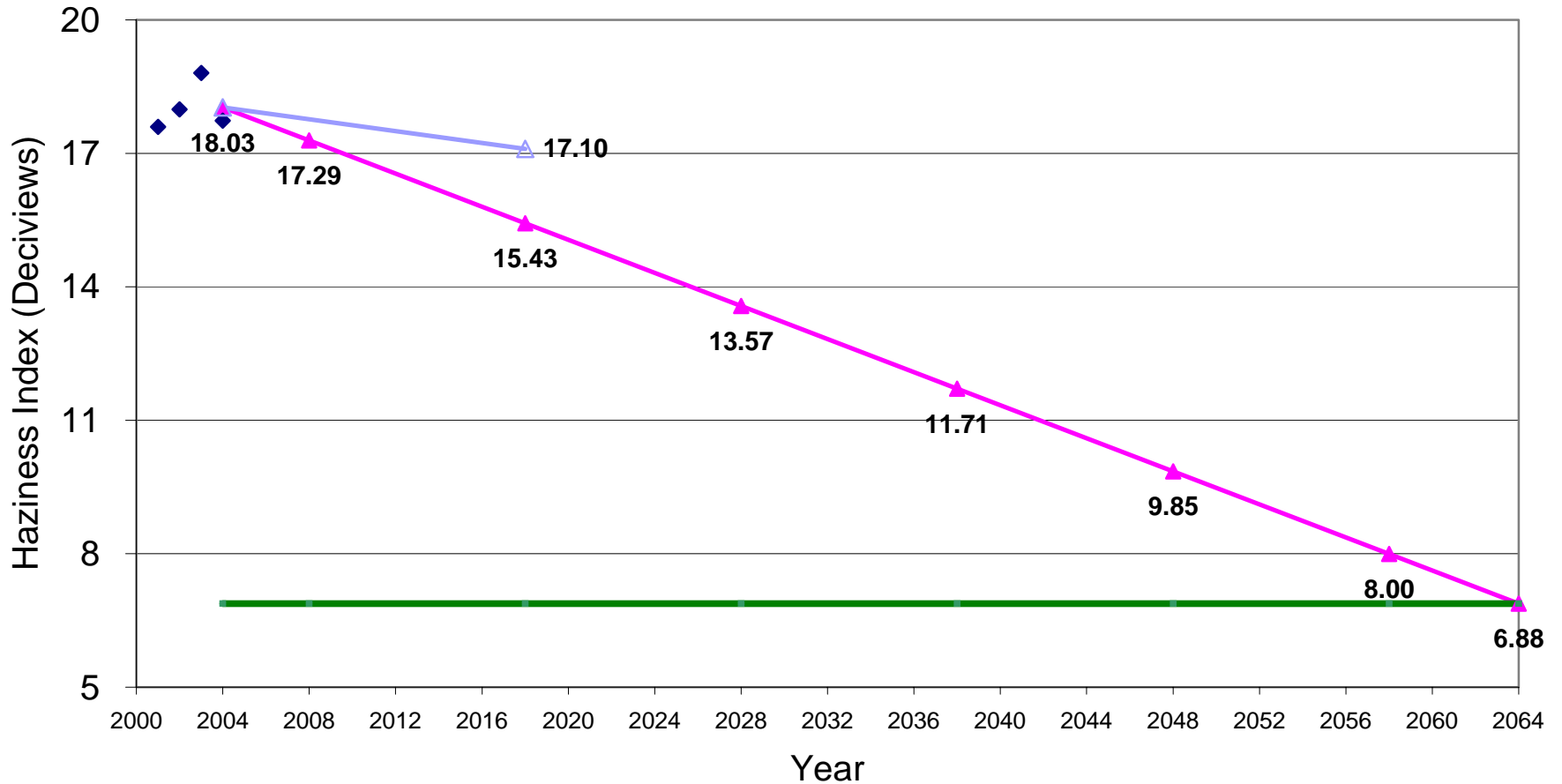
## Worst 20% Obs (left) vs plan02c (right) at SACR1



Bext Response (base18b - plan02c) at SACR1 on Worst 20% Days



# Uniform Rate of Reasonable Progress Glide Path Salt Creek - 20% Worst Days



—▲— Glide Path    — Natural Condition (Worst Days)    ◆ Observation    —△— Method 1 Prediction

# Additional Visibility Projection Metrics

- Need to assess Glide Paths for each component of visibility impairment except CM
  - SO<sub>4</sub>, NO<sub>3</sub>, EC, OC and Fine Soil
  - Adding PM species Natural Conditions as end point
  - Presenting Species glide paths analysis on AoH call 12/13
- More likely [be closer] to meet 2018 URP benchmark when looking at controllable (SO<sub>4</sub> and NO<sub>3</sub>) extinction
- Need to analyze results of alternative methods more closely

# Conclusions

- The EPA Default (Annual Average ) and alternative (Quarterly/Monthly Average) 2018 projection can be used to estimate visibility levels in 2018 for comparisons with the URP benchmark
- Additional PM species-specific Glide Paths and 2018 projections will be made to assess progress in reducing the “controllable” portion of haze
- Data will be used in Reasonable Progress determinations