Continuous Particle Pollution Samplers

Forsyth County (NC) Office of Environmental Assistance and Protection

The Issue

Find the best replacement unit for our aging R&P TEOM 1400AB samplers

Requirements

- Reliable
- Accurate hourly data
- Representative daily averages
- Easy to maintain
- Equivalency (FEM)

Forsyth County, NC

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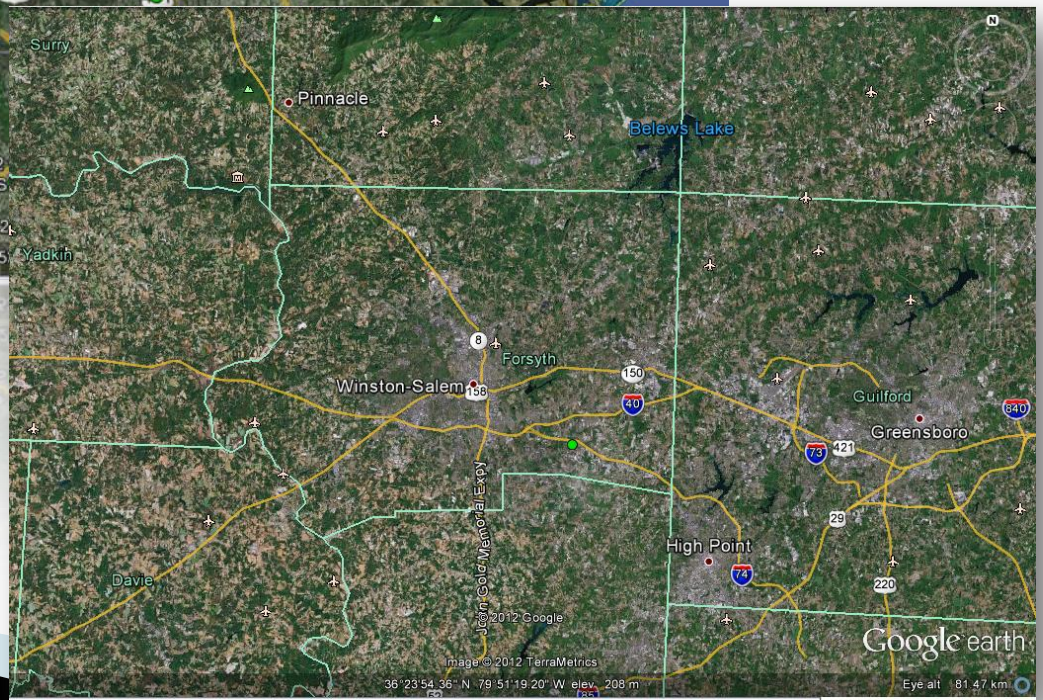
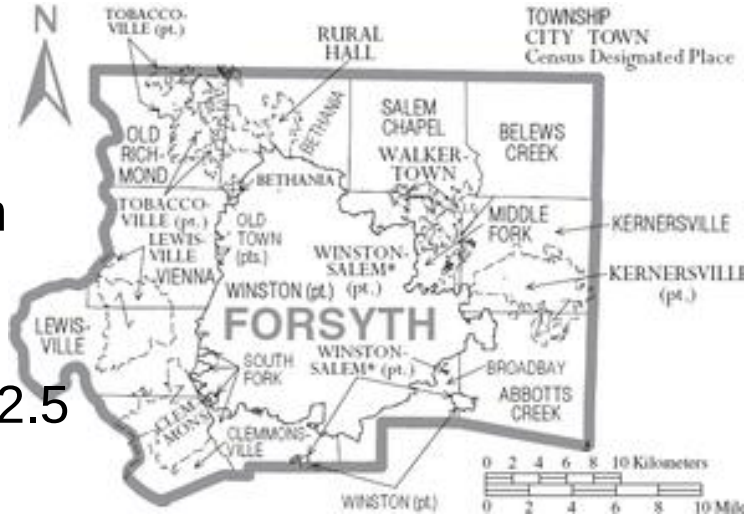


Forsyth County, NC

- Named for Col. Benjamin Forsyth, War of 1812
- 413 sq. miles (3 sq. miles of water)
- Population (2010) – 350,670
- 847 people per square mile

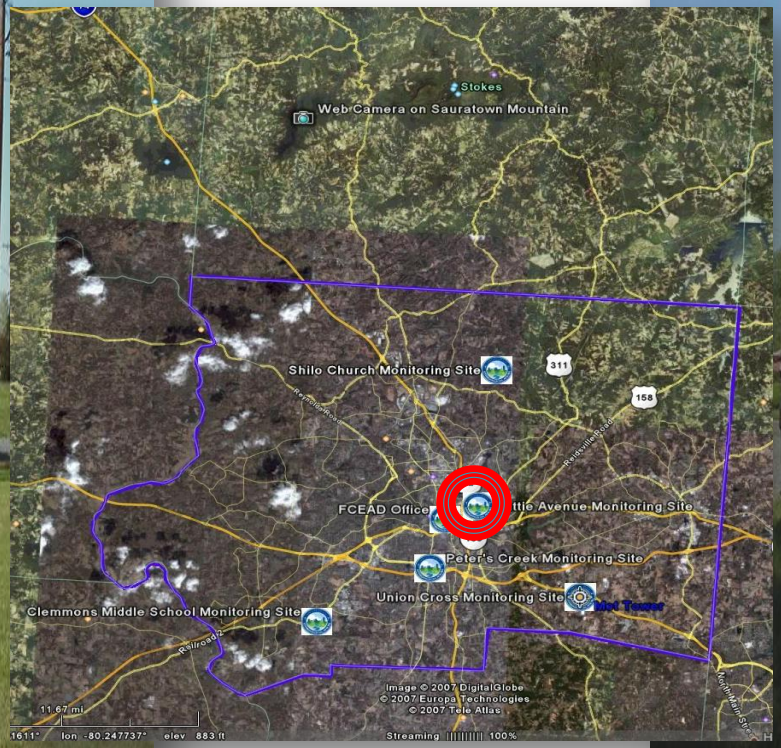


- Ozone design value (2009-2011) – 0.075 ppm
- PM design value (2009-2011) – 10.0 $\mu g/m^3$
- Maintenance area for CO
- Attainment area for ozone (1 and 8-hour), PM2.5

The Study

FRM	Thermo 2025
TEOM	R&P 1400 AB corrected and uncorrected
Environmental Dust Monitor	GRIMM Model 180
Continuous Particluate Monitor	Thermo 5014i Beta (BAM)

The Location



Experience with Vendors

- Daily operation left to us after initial set up of both Thermo-Beta and GRIMM
- Data sharing resulted in IMMEDIATE reactions from both Thermo-Beta and GRIMM (positive)
- Many other duties may prevent immediate attention to samplers, though
- Good communication NECESSARY both ways

- Not here to “endorse” one unit over another
  - Simply want to evaluate

Positives

- Ease of installation and operation
- Little to no maintenance needed
- Relatively low maintenance cost
  - GRIMM no filters/tape
  - Thermo-Beta tape lasts extended period of time
- High sensitivity (could be seen as a neg)
  - Hourly Thermo-Beta “jumpy”
  - GRIMM/TEOM more stable
- ALL Reliable as a FEM

Data Findings

- GRIMM instrument flow setup problem for majority of study – adjustment made 4/19
  - Little change noted after adjustment, though
- ALL show good correlation vs FRM
- ALL show good correlation vs TEOM – C (FRM "like")
- ALL trends as the RH trends (interesting)
  - GRIMM "spikes" during extended RH events
- Thermo-Beta slightly higher versus TEOM –UC
- GRIMM higher versus TEOM –UC
  - Even after adjustments made 4/19
- Thermo-Beta fluctuates during hourly averages
  - Daily averages similar to others, though

PM2.5 Monitor Study (ug/m3)

Monitor	1/1 - 3/15*	1/1-4/19**	4/20 – 5/9
FRM	7.89	7.89	NA
TEOM-FRM Like	7.76	7.83	8.81
TEOM – Uncorrected	8.86	8.96	10.03
Thermo-Beta	8.83	8.66	10.71
GRIMM	11.07	11.01	12.00

* FRM data through 3/15 only

** Before GRIMM “Adjustment”

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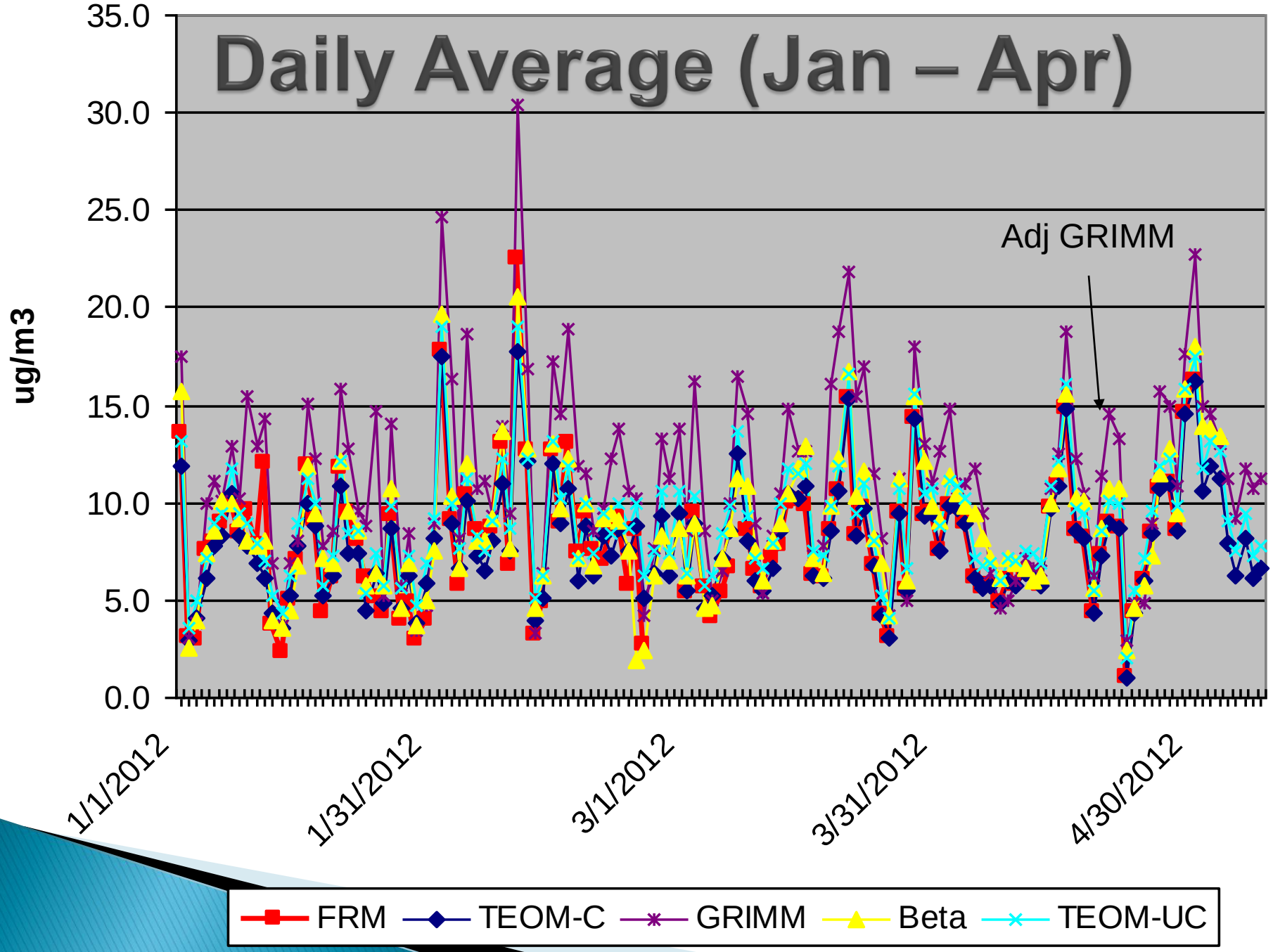
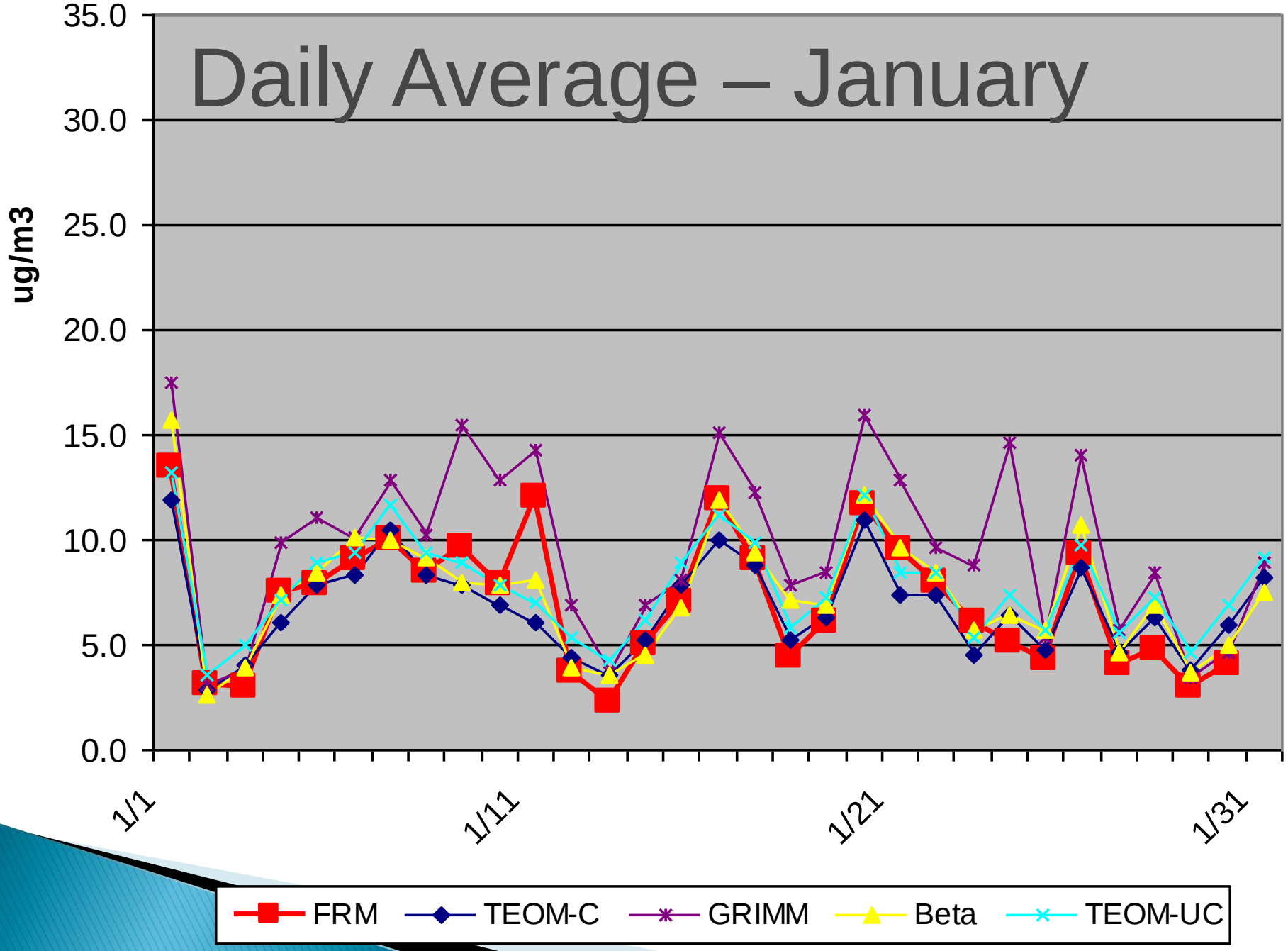
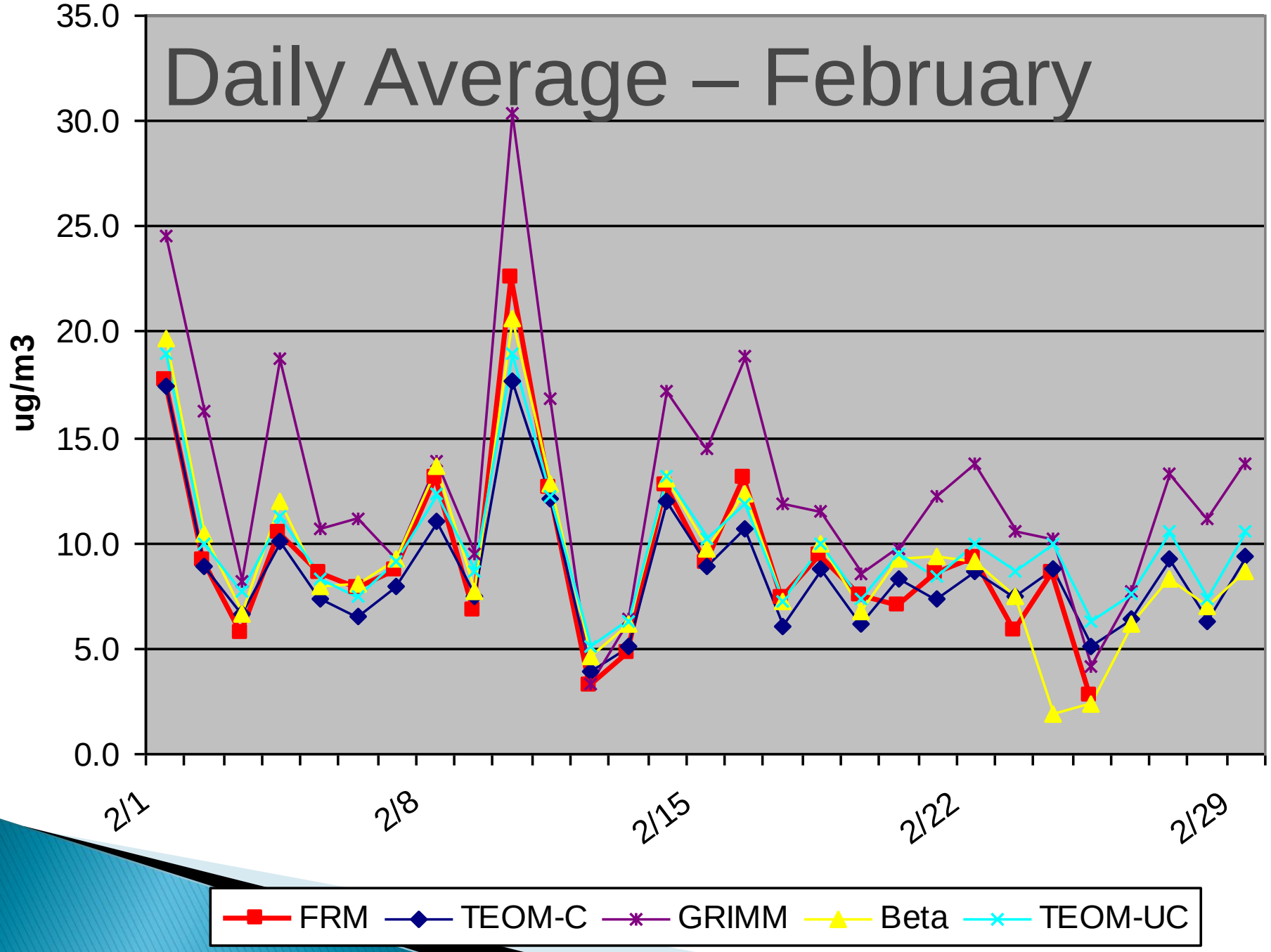
FRM*	7.89	7.89	NA
TEOM-FRM Like	7.76	7.83	8.81
TEOM-Uncorrected (UC)	8.86	8.96	10.03
Thermo-Beta	8.83	8.66	10.71
diff from TEOM- UC	-0.03	-0.30	0.68
% diff	-0.3%	-3.5%	6.3%
GRIMM	11.07	11.01	12.00
diff from TEOM-UC	2.21	2.05	1.97
% diff	20%	19%	16%

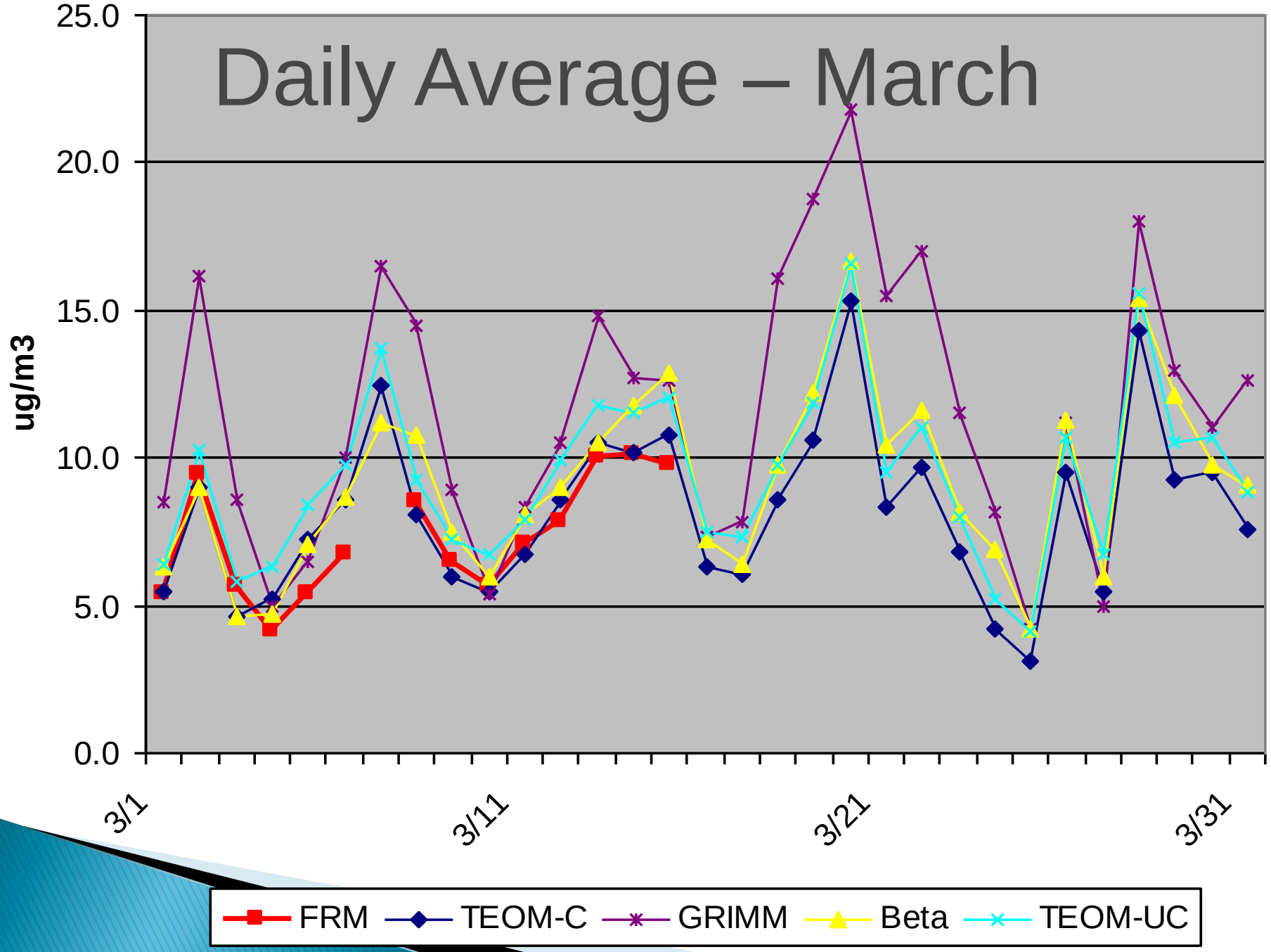
* FRM data through 3/15 only

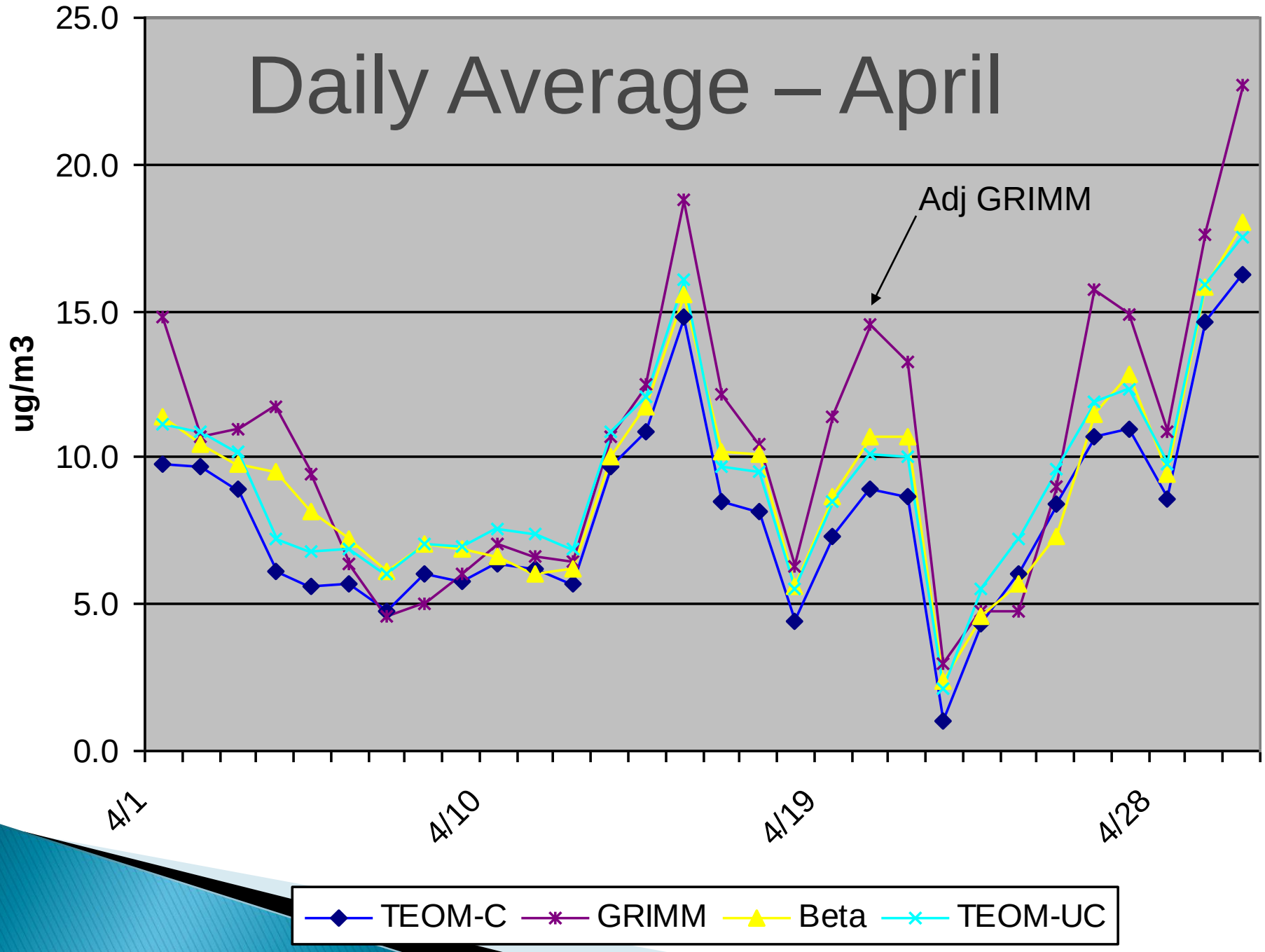
** Before GRIMM “Adjustment”


Daily Average (Jan – Apr)
ug/m3
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Adj GRIMM
1/1/2012
1/31/2012
3/1/2012
3/31/2012
4/30/2012
FRM
TEOM-C
GRIMM
Beta
TEOM-UC

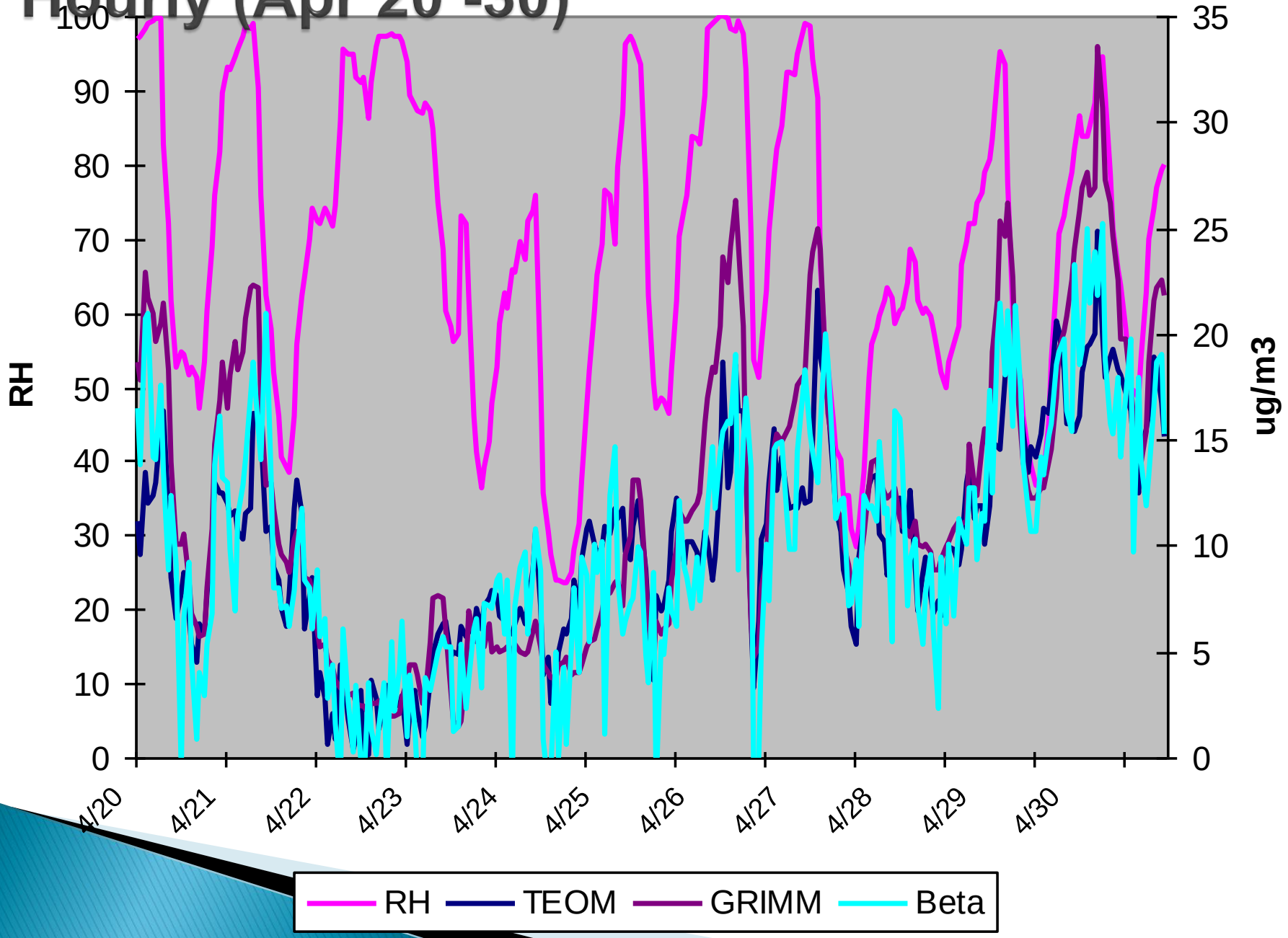

Daily Average – January
ug/m3
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1/1
1/11
1/21
1/31
FRM
TEOM-C
GRIMM
Beta
TEOM-UC


Daily Average – February
ug/m3
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
2/1
2/8
2/15
2/22
2/29
FRM
TEOM-C
GRIMM
Beta
TEOM-UC

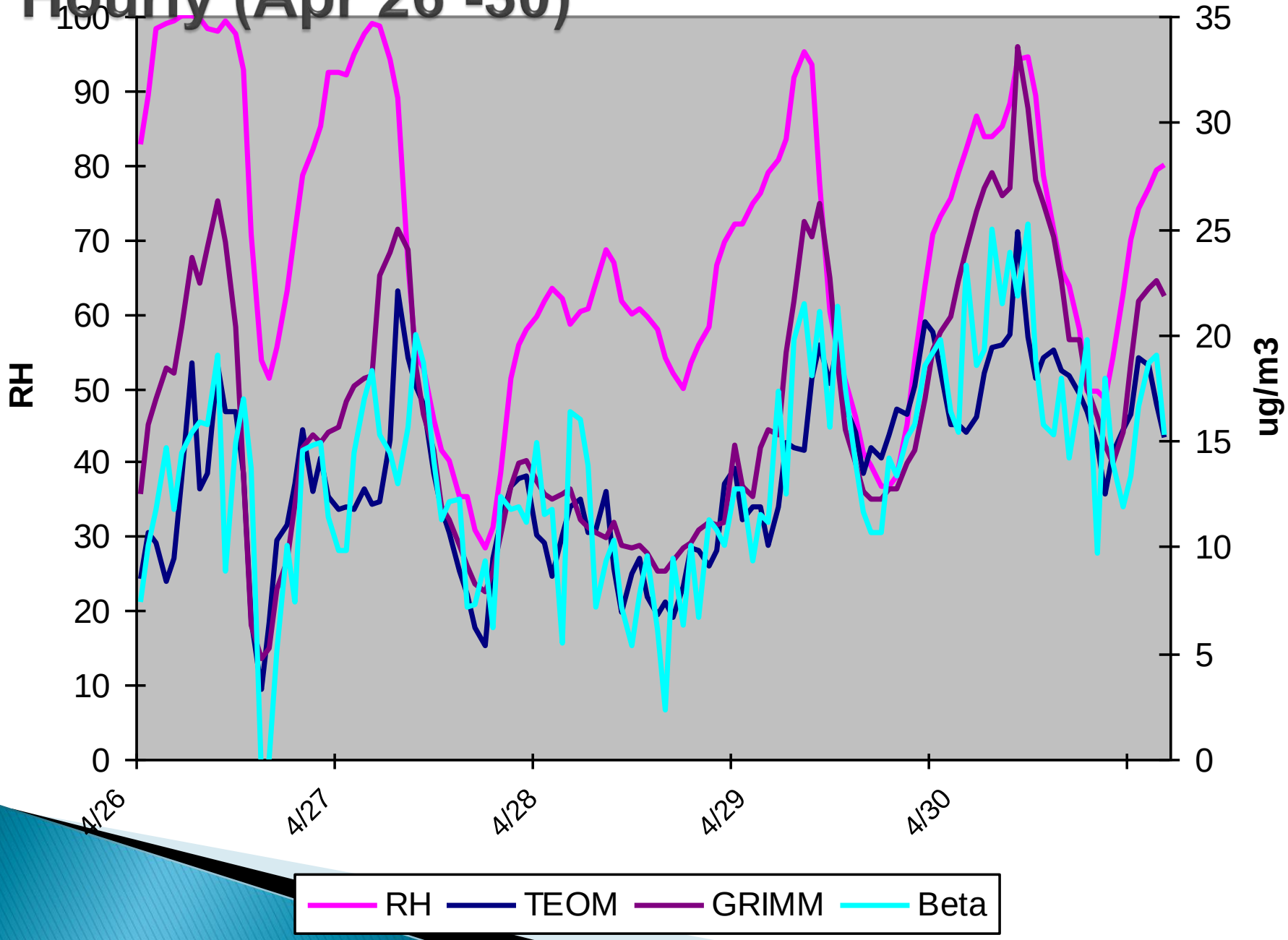

Daily Average – March
ug/m3
25.0
20.0
15.0
10.0
5.0
0.0
3/1
3/11
3/21
3/31
FRM
TEOM-C
GRIMM
Beta
TEOM-UC


Daily Average – April
ug/m3
25.0
20.0
15.0
10.0
5.0
0.0
Adj GRIMM
4/1
4/10
4/19
4/28
TEOM-C
GRIMM
Beta
TEOM-UC

Hourly (Apr 20 -30)



Hourly (Apr 26 -30)



Conclusions

All instruments seem reliable as a FEM
- Both TEOM-UC and Thermo-Beta results (hourly and daily) similar
- GRIMM data higher, even after "adjustment"
- Correlation excellent vs FRM
- Correlation excellent vs TEOM-C (FRM "like")

- Hourly data Important
  - Noisy Thermo-Beta output "issues"
    - Suggested solutions for firmware update not tested
    - RH threshold as suggested level already
  - TEOM-UC and GRIMM less noisy (sensitive?)
  - Concerns during higher RH periods with GRIMM
- Further testing will continue during summer months
  - Room for additional samplers

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