



NC Air Dispersion Modeling

Presented by

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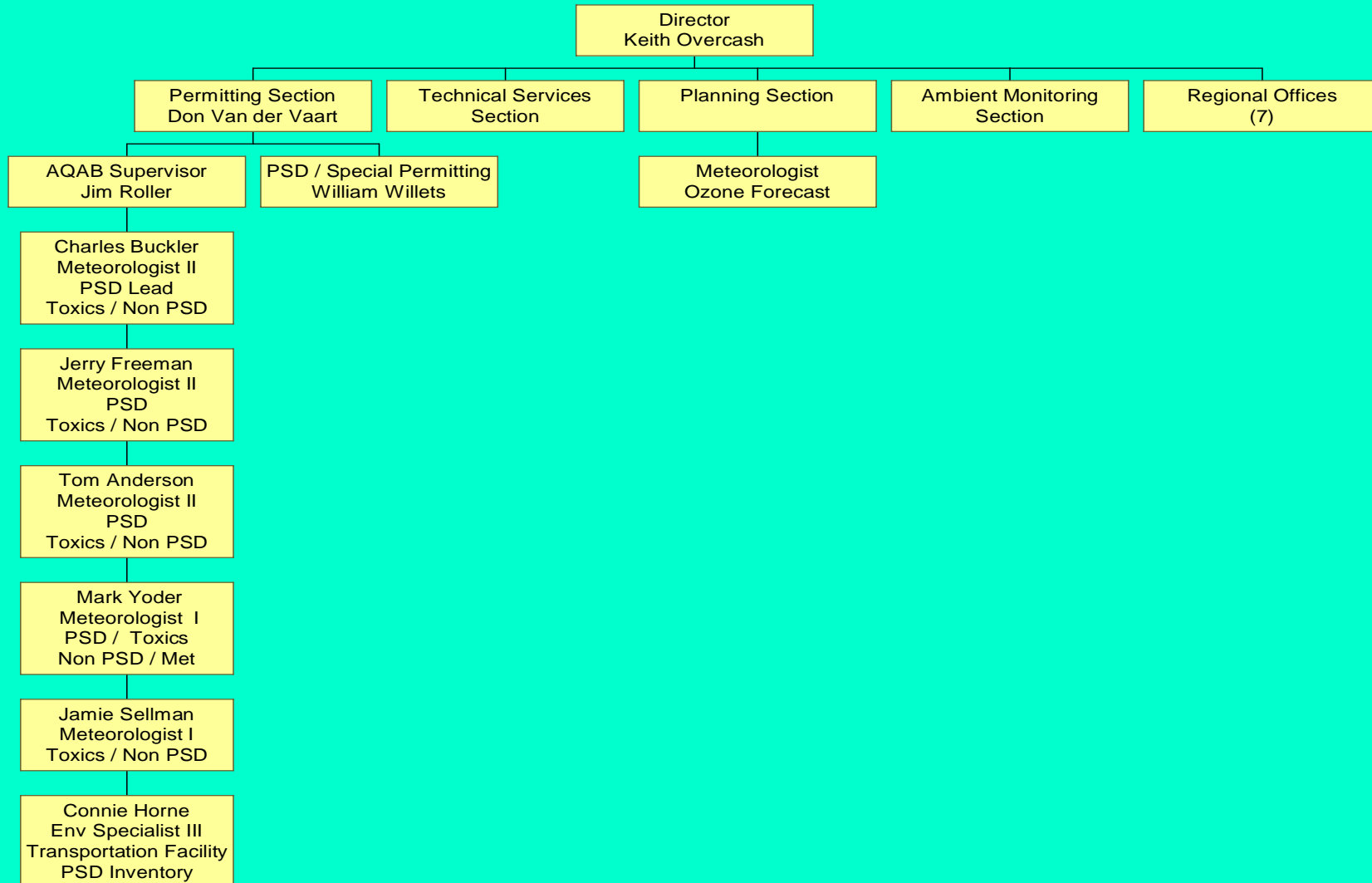
North Carolina Air Dispersion Modeling Overview

- Who we are
- Our mission
- Modeling Programs
- Modeling initiatives
- Modeling Issues
 - Meteorological Data Compatibility
 - AERMOD/AERMET/AERSCREEN
- Questions



ORGANIZATIONAL CHART

North Carolina Department of Environment and Natural Resources Division of Air Quality





Air Quality Analysis Branch (AQAB)

Mission

Provide meteorological services and atmospheric Dispersion modeling support to assist the Division of Air Quality in maintaining and improving air quality in North Carolina.



Modeling Programs

- NC Air Toxics (87 pollutants)
- Federal and State Criteria Pollutants (PM_{10/2.5}, CO, SO₂, NO_x, Lead, TSP)
- State Implementation Plan (SIP) modeling
- Special Modeling Studies
- Transportation Modeling (parking decks, intersections, airports)
- Meteorological Tower and Monitor placement



Modeling Initiatives

- **Quarries** (PM_{10} /TSP) / **Concrete Plants** (Arsenic)
Establish operating thresholds to define when modeling is required for permitting activities.
- **Boiler MACT** (Mn, HCL, Cl)
Conduct modeling review (e.g. Look-up tables/ISCST3/AERMOD) for individual facility risk assessment analyses.



Modeling Initiatives (con't)

- **BART**

- Modeling (CALPUFF) to ensure VISTAS-outlined modeling procedures are followed for exemption and or compliance.

- **Moncure, NC** ($\text{SO}_2/\text{PM}_{10}/\text{NC Toxics}$)

- To establish applicable local/regional NAAQS and or AAL compliance.

- **Mercury Deposition** (Hg)

- To support the NC Clean Smoke Stacks Initiative



Modeling Issues

- **AERMOD Meteorological Data Compatibility**
 - ASOS/AMOS data incomplete
 - Revert back to 1988-1992 data set
 - Need a solution for most current data

- **AERMOD Volume source**
 - Excessive runtimes
 - Cost issues
 - Example

AERMOD / ISCST3 RUN COMPARISON

- One hour of met data run.
- A point source, a volume source, and an area source run separately in each model.
- Goal: “observe” receptor-by-receptor AERMOD/ISCST3 calculations.

AERMOD, 1Hr, Point Source,

.1973217423799619890282088554388422731553864618862146207881344891.34 2.01 2.86 4.04 5.17 6.34 7.33 7.97 8.25 8.21 7.88 7.20 6.07 5.62
.214623728612991132578638705274777949940488486276821688877908.14 1.71 2.57 3.83 5.37 6.72 8.05 9.06 9.57 9.57 9.31 8.86 8.13 7.05 5.80
.23578263.2925263868941494658925458828504809686738543849678871.16 2.06 3.39 5.25 7.15 8.8510.301.181.370.990.369.58 8.61 7.54 6.34
.25828914926936734181880146442522320273895874395809.05908385387.41 2.69 4.90 7.3310.001.903.123.533.202.1711.109.96 8.75 7.48 6.23
.28003195964241597793855363968406853897443.101.20 1.081.08 1.24 2.09 4.137.4110.993.895.6216.285.884.722.991.329.98 8.57 7.21 5.96
.301784734017064294208375851788231.04 1.21 1.381.28 1.261.40 1.893.43 6.8611.425.778.839.699.398.185.913.3711.089.70 8.15 6.71 5.48
.321137404369813980608276874931.05 1.27 1.52 1.66 1.58 1.681.88 2.90 5.9811.647.552.6925.324.532.4620.006.913.7111.058.97 7.41 6.01 4.89
.33993993647356276785825811.01 1.25 1.55 1.93 2.35 2.26 2.31 2.62 4.7811.4420.2827.7827.733.4029.824.921.186.983.280.318.06 6.50 5.22 4.15
.3582422150718130252893529.17 1.46 1.86 2.40 3.15 4.00 3.82 4.17 7.4021.0734.483.726.1241.7033.2425.9020.485.471.709.007.01 5.61 4.50 3.48
.3793848153778601821721.04 1.32 1.70 2.21 3.00 4.15 5.86 7.72 8.9314.368.969.687.380.897.084.254.728.182.929.59 6.96 5.54 4.54 3.68 2.90
.394287063687897387439.12 1.45 1.93 2.58 3.61 5.48 8.5112.797.999.821.02104.95.970.486.1381.2021.194.420.026.93 4.73 3.63 3.45 2.83 2.22
.40889025959324921411.20 1.59 2.16 2.99 4.47 7.06 8.6919.009.3874.01159.142.99.2761.187.294.5115.901.058.05 4.98 3.40 2.50 2.27 2.05 1.61
.415489948117255285551.25 1.68 2.31 3.33 5.04 4.88 6.7516.132.16191.328.16784.786.727.897.7111.738.05 5.69 4.18 3.05 2.09 1.77 1.41 1.11
.417150388197266886779.26 1.70 2.35 3.43 4.33 4.74 6.7514.455.5657.160.96.402.4923.2113.8110.156.80 4.76 3.43 2.55 1.94 1.50 1.18935785348
.41820428147859685249.24 1.66 2.28 3.28 4.89 7.1910.342.959.403.970.654.499.377.59 6.19 4.28 3.56 2.72 2.06 1.58 1.2498067948853763669
.412089109981232721198.18 1.56 2.12 2.97 4.33 6.6710.5816.223.8930.126.6818.483.107.20 4.63 2.69 2.07 1.68 1.191.12911973738092608962716
.39431683650884585043.09 1.43 1.88 2.53 3.45 4.69 6.33 8.5211.182.942.159.96 8.43 4.91 2.97 1.84 1.451.239581846272489416629374388768
.375144438320841529547.00 1.26 1.61 2.03 2.53 3.16 4.05 5.14 6.21 6.80 6.63 6.36 5.77 2.90 2.101.391.13960187082779834568597922812625065
.3588222160296010733489679.09 1.32 1.55 1.85 2.29 2.83 3.40 3.87 4.15 4.35 4.48 3.26 1.96 1.541.24975479627163870955654388606388733048
.3406398546879544662678870578.05 1.19 1.41 1.70 2.06 2.40 2.62 2.84 3.10 3.131.92 1.40 1.231.108555840193948046852545057290366561281
.317486918298502589167758598847494918.11 1.30 1.52 1.74 1.87 2.09 2.28 2.23 1.43 1.069832846986635320857881161380485448279341429541
.2941338399012505818858426259897784389703.04 1.17 1.31 1.44 1.58 1.67 1.61 1.15995689636823666407254219040944130792919297997594
.2704807695018980450649949303586694792308315891488314.05 1.15 1.25 1.2494882945220458522951429088863434303527428600874625588
.24982611315995248893423847578896362594865316707670181213878942085478431671881803964339372732748056873025442615266323614

AERMOD, 1HR, Volume Source

.2004821184288677296472743615394942925622893523991985113843526989 .221.84 2.66 3.84 5.02 6.27 7.37 8.11 8.47 8.49 8.19 7.50 6.32 5.87
.2185242267698953338972641460582505095065938835068066734474381.05 1.57 2.39 3.63 5.19 6.62 8.08 9.21 9.82 9.89 9.67 9.22 8.46 7.33 6.01
.239786812993835087862261478793856012863782378138613839986809 .10 1.92 3.21 5.06 7.03 8.85 10.48 1.49 1.79 1.40 0.789.97 8.94 7.81 6.53
.262289648341877182974925593838122076084894987819 .06911784024 .35 2.55 4.71 7.19 9.99 12.08 3.49 3.99 3.71 2.69 1.53 0.349.04 7.69 6.36
.284792521371742594912968885677597874789842 .13 1.23 1.10 1.10 1.23 2.03 4.00 7.27 10.92 4.01 5.97 6.78 6.47 5.29 3.43 1.71 0.298.79 7.33 6.02
.30765438102975756618539570690678 .07 1.25 1.41 1.31 1.29 1.44 1.89 3.38 6.78 11.40 5.98 9.28 0.28 0.03 8.89 6.50 3.82 1.409.92 8.27 6.74 5.47
.32883831448162788243848589987 .08 1.31 1.57 1.70 1.63 1.73 1.94 2.95 5.99 11.70 7.86 3.34 2.25 4.02 3.29 0.79 7.49 4.08 1.279.08 7.42 5.95 4.80
.349410748668801699885207 .04 1.29 1.61 2.00 2.42 2.34 2.41 2.74 4.99 11.69 0.62 8.67 4.16 4.96 1.02 5.82 1.91 17.49 3.51 0.398.05 6.42 5.09 3.99
.36914358923563337771.96458 .21 1.53 1.95 2.53 3.32 4.17 4.02 4.43 8.02 21.97 5.68 5.78 3.78 4.51 26.73 1.03 5.77 1.778.95 6.89 5.48 4.33 3.29
.390546295568683485039 .07 1.37 1.78 2.35 3.20 4.45 6.22 8.20 9.63 16.20 1.69 3.20 1.36 4.60 9.25 5.42 5.31 8.47 2.989.49 6.79 5.34 4.34 3.48 2.70
.40628865890824581017 .17 1.52 2.03 2.77 3.92 5.93 9.17 14.02 0.24 5.14 67.44 11.103.74 7.14 7.98 2.05 1.51 4.469.89 6.74 4.52 3.42 3.23 2.63 2.04
.42056055816136088961 1.25 1.66 2.27 3.20 4.82 7.54 9.58 21.39 5.19 6.70 169.147.103.63 2.28 0.44 8.81 5.99 0.937.85 4.77 3.20 2.31 2.08 1.88 1.46
.4276915463202841896011 .30 1.75 2.43 3.54 5.34 5.34 7.71 19.92 7.99 330.420.177 88.08 1.62 8.43 7.89 1.75 7.98 5.57 4.01 2.86 1.94 1.62 1.28 1.00
.42956194838679398 .01 1.32 1.78 2.47 3.63 4.62 5.23 7.76 18.18 2.67 2.99 244.120.48 6.82 5.34 4.58 0.446.91 4.77 3.39 2.48 1.86 1.42 1.10866569245
.429061773632778529174 .29 1.73 2.40 3.47 5.20 7.79 11.68 27.18 0.04 133.91.68 2.52 1.57 8.26 6.62 4.49 3.64 2.75 2.06 1.56 1.219533864962285101
.4216604746154758385073 .23 1.63 2.22 3.14 4.63 7.22 11.83 19.38 29.41 36.02 1.36 2.03 4.52 7.66 4.86 2.80 2.14 1.71 1.21 1.12915323748045601641969
.405328303843812488871 .14 1.49 1.98 2.69 3.74 5.22 7.22 9.76 12.70 14.59 3.64 1.42 9.30 5.20 3.12 1.92 1.50 1.2697698588832484923532447137801
.386245865504866782687 .04 1.32 1.70 2.18 2.78 3.50 4.49 5.67 6.82 7.46 7.35 7.18 6.17 3.06 2.20 1.45 1.179844887128928418891498941849355
.368343415175620767572999 .14 1.41 1.68 2.01 2.49 3.09 3.72 4.22 4.55 4.86 4.87 3.43 2.06 1.60 1.29 1.00815972968802962764858669894533579
.34812074798669268178184958211 .13 1.27 1.51 1.83 2.23 2.62 2.86 3.13 3.40 3.31 2.00 1.46 1.27 1.138778855995048120757545424337969991739
.324487698394815180667067804280368 .01 1.17 1.39 1.63 1.89 2.03 2.28 2.43 2.32 1.48 1.10 1.0186976831544486678177284685739298244128838
.3005945829924622535281006622840083195152 .11 1.25 1.41 1.55 1.69 1.76 1.66 1.19 1.02817689885788881842864088847631039935299127806
.27663150859410046675221959361968835872884694508 .05 1.12 1.23 1.31 1.27 9248131.735689698041435929382472806327632614275585792
.254928743241.16358044043647036138562982556880846681688631.9344989788528068848628824800405877933153086875385603626268423827

CONCLUSION

- Many more calculations being made in AERMOD
 - most noticeable in volume and point sources
- On some quarry sites, with numerous operational equipment & haul road volume sources, a single met year has taken 6 hrs to run.
- Some in industry have claimed longer runtimes.



Modeling Issues (con't)

- **AERSCREEN**

 - “Draft” or “Beta version” for sometime

 - Need a viable and accurate follow-on to SCREEN3

- **AERMET processing**

 - Need standardization / consistency

 - Sectors: how many (1-12)

 - Sfc parameters: annual / seasonal, regionally representative (e.g., Bowen ratio, Albedo) / site specific (sfc roughness)



Questions?