



2005 Progress on Emissions Inventories

Attribution of Haze Workgroup Meeting

January 24, 2006

Scope of regional technical effort

- **Analyze significant regional components of haze**
 - **Large, regionally ubiquitous sources and impacts**
 - **Provide consistent, comparable, and reproducible regional analyses**
 - **Interstate consultation regarding the emissions contributions of states and tribes to each Class I area**
 - **Assessment of the visibility improvement from adopted and proposed control strategies at each Class I area within and downwind of the WRAP region**

WRAP Region Emissions Inventories

- **2004-05 comprehensive, quality-assured EI-building efforts to support regional haze planning – work completed 12/05**
 - **Point and area**
 - **Mobile**
 - **Fire**
 - **Dust**
 - **Biogenics/Ammonia**
- **Time periods**
 - **2002**
 - **2000-04**
 - **2018 base case**
- **Using EIs for all source categories as provided by other RPOs east of WRAP as is, no effective way to independently QA, followup work needed to better understand CENRAP data**

Emissions Issues to Consider

- **What and where are the contributing emissions?**
- **Natural vs. anthropogenic emissions**
 - **How are those related to baseline monitoring data?**
 - **How will the temporal and spatial patterns change by 2018?**
 - **What are the changes in emissions by source category: 2002 to 2018?**
- **What have we achieved in terms of completeness and representativeness of the emissions inventories?**
- **How are we doing on tribal emissions inventories?**
- **What are the limitations/problems/remaining challenges with the emissions?**

Progress on Emissions Inventories

- **There are standard methods for some source categories – WRAP has improved/QAed**
 - **Point, area, on- and off-road mobile, biogenics**
 - **First regional EI for oil and gas production and distribution**
 - **Area sources are generally poorly resolved**
- **Inventory methods have been developed by WRAP for some categories. Have received broad review and application**
 - **Fire**
 - **Ammonia**
 - **Windblown dust**
 - **Commercial marine and off-shore shipping**
 - **More than 25 tribes now have EIs**

WRAP Region EIs

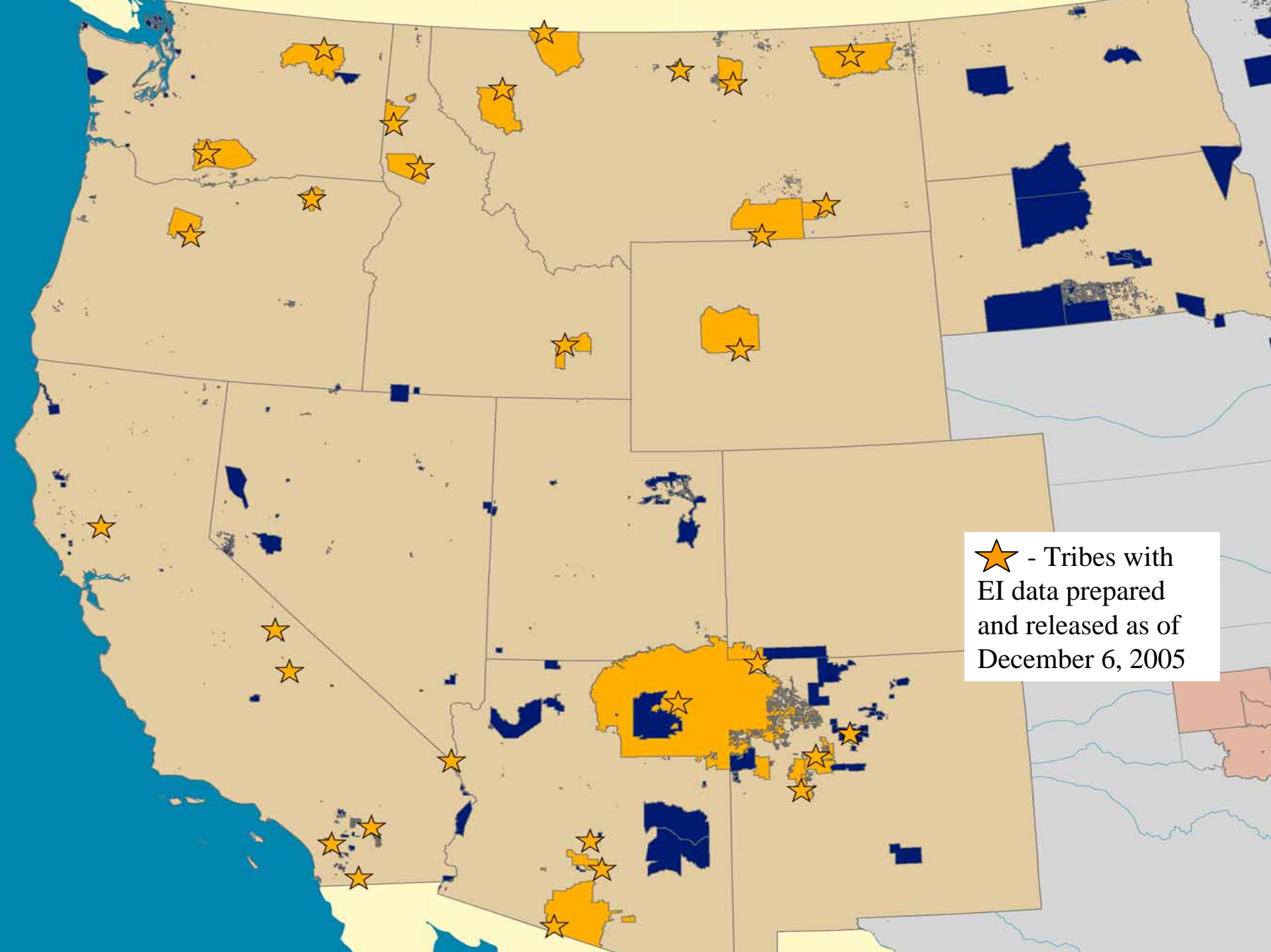
- **Point and area sources – 2002 & 2018 (SSJF/EF/TDDWG project)**
 - Based on state/local/tribal 2002 EIs prepared to date –
 - QA by ERG (contractor), then review by agency preparing those data
 - 2002 data are most complete and representative of 2000-04 regional haze baseline period
 - Covers all criteria pollutant EIs from permitted sources
 - Point vs. area source thresholds vary by state
 - Important in developing first regional oil & gas NO_x EI
 - Area sources include ag and construction dust
- **Point and area sources – 2018**
 - Projected from QAed 2002 data by ERG, again reviewed by agency
 - Includes new sources projected by EGAS model, accounts for population and economic growth, source retirements, and permits/consent decrees on the books by the end of 2004
 - Does not include future BART emissions reductions/other control programs

WRAP Region EIs

- **Mobile Sources – 2002 – represents 2000-04 period**
 - **On-road EIs prepared using Mobile 6.1, using state/local VMT data**
 - **Off-road EIs prepared using NONROAD2004, using state/local activity data**
 - **Planes/trains/port activities using regionally-consistent methods**
 - **Off-shore shipping uses CARB/Corbett methods**
- **Mobile Sources projected to 2008, 2013, and 2018 from 2002 EIs**
- **Accounts for all federal/state/local mobile control programs on the books through the end of 2004**

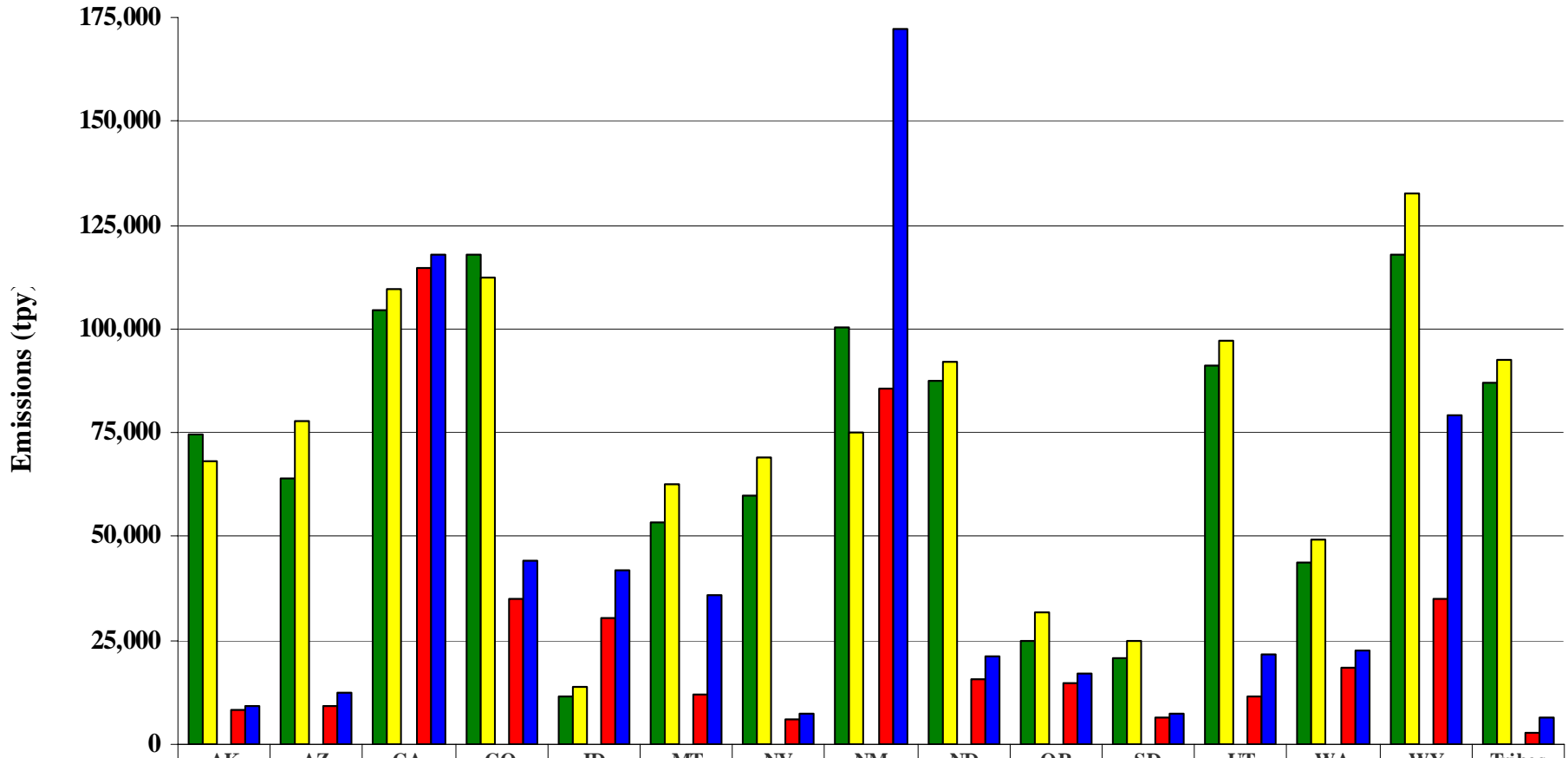
WRAP Region EIs

- **Fire Emissions – different scenarios to address the spatial and temporal variability in fire emissions**
 - Phase I/II – 2-step project to QA/develop ACTUAL fire emissions for 2002 – used in model performance evaluation
 - Phase III – uses Phase II EI to develop 2000-04 fire EIs that are “typical/representative/average”, keeps fires at same locations but scales back emissions to 5-year averages
 - Phase IV – projects fire scenarios in 2018 from Phase III fire EI, based on present fuel loading conditions and FLM fire use plans/projections
- **Dust Emissions - point/ag/construction dust in point/area EI project**
 - Road dust 2002 and 2018 based on regionally consistent method, using VMT data from states/locals
 - Windblown dust developed for 2002 only, estimated using winds in regional air quality model, held constant to 2018
- **Biogenics/Ammonia**
 - Estimated from BEIS3 and WRAP ammonia emissions models, respectively, both use meteorology in regional air quality model, held constant to 2018
 - Point/area/all mobile source ammonia emissions estimated in those projects



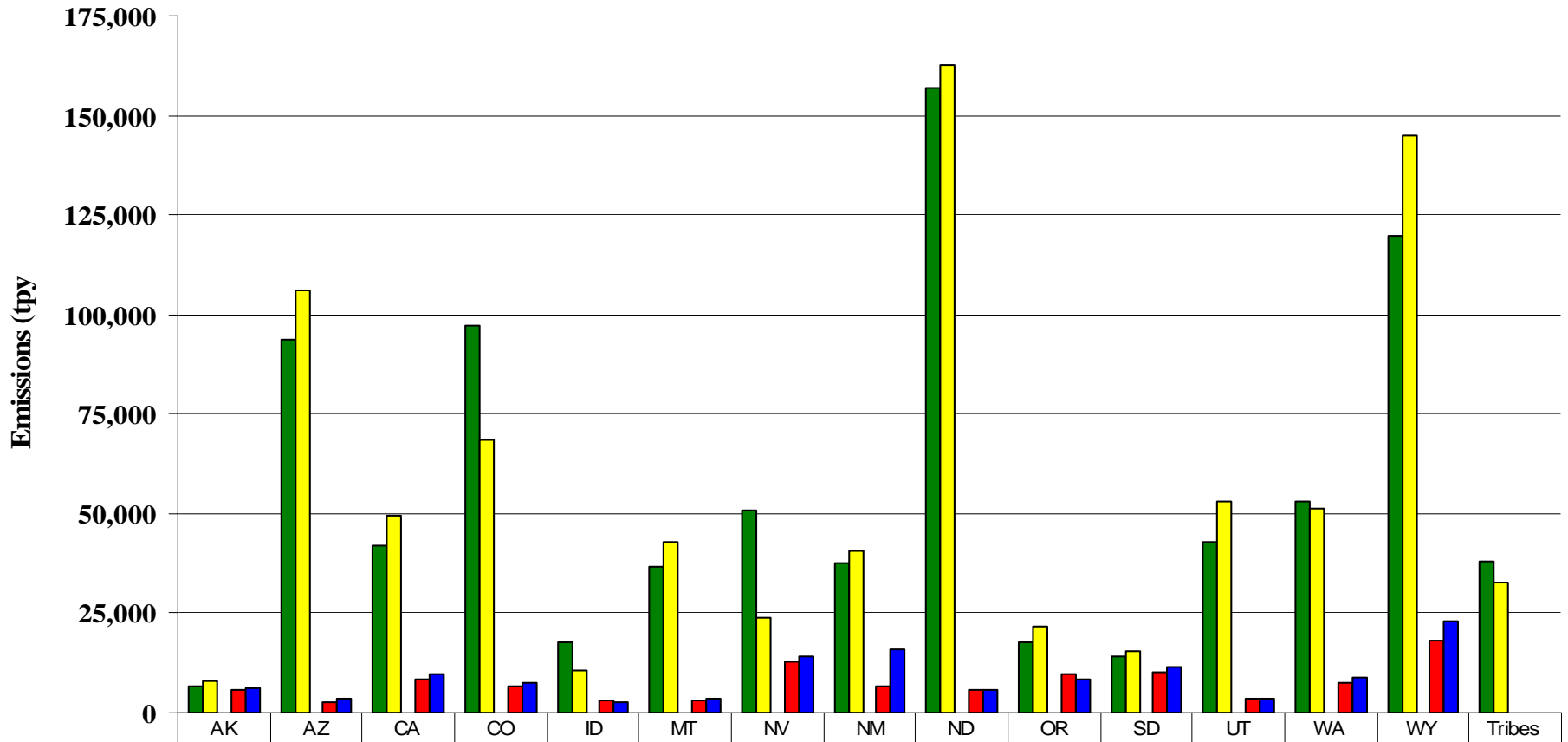
★ - Tribes with
EI data prepared
and released as of
December 6, 2005

Point and Area Source 2002 and 2018 NOx Emissions



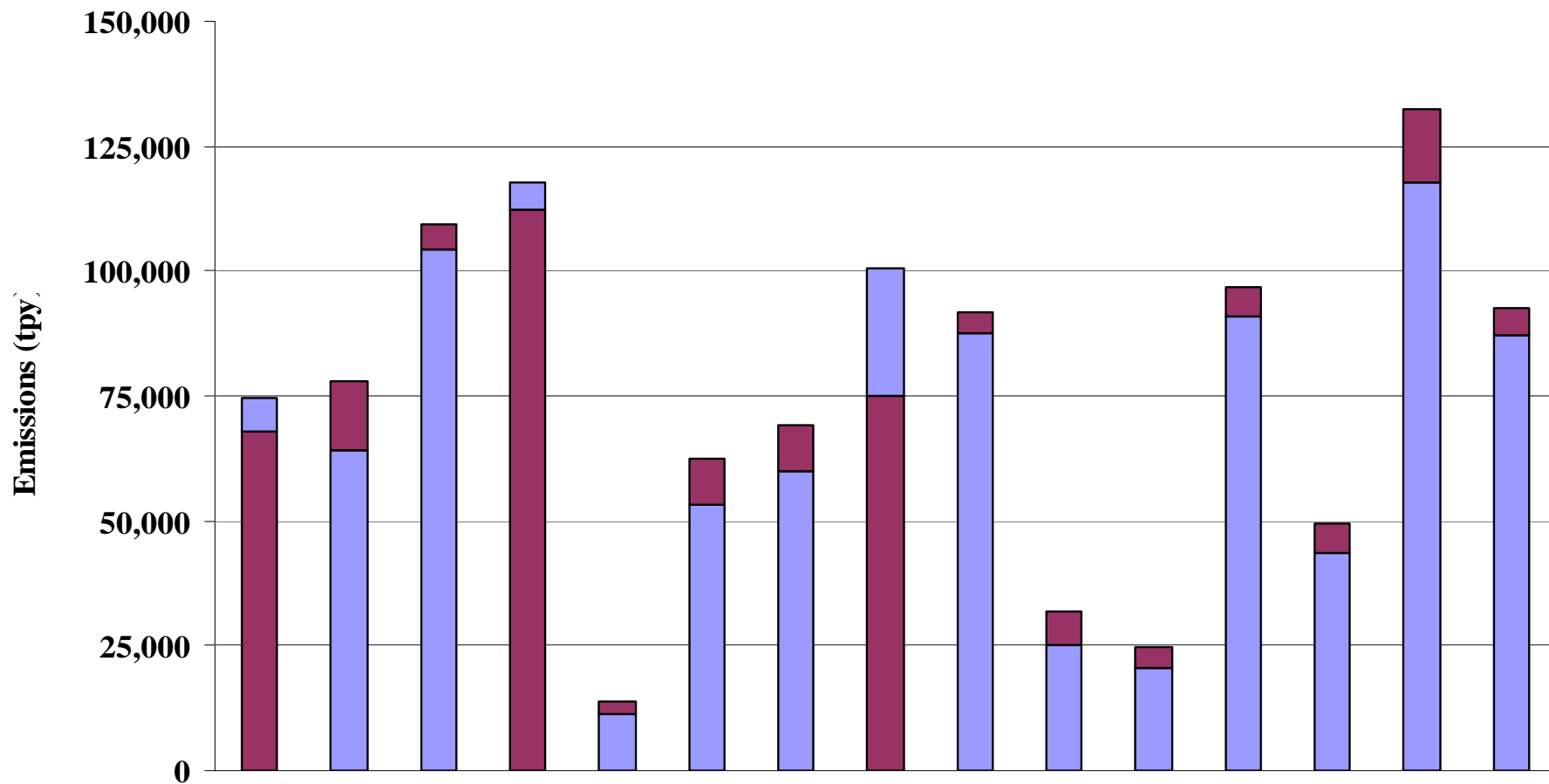
| | AK | AZ | CA | CO | ID | MT | NV | NM | ND | OR | SD | UT | WA | WY | Tribes |
|--------------|--------|--------|---------|---------|--------|--------|--------|---------|--------|--------|--------|--------|--------|---------|--------|
| ■ 2002-Point | 74,472 | 64,084 | 104,435 | 117,869 | 11,487 | 53,415 | 59,775 | 100,352 | 87,425 | 24,959 | 20,698 | 91,044 | 43,631 | 117,883 | 87,215 |
| ■ 2018-Point | 67,959 | 77,737 | 109,515 | 112,153 | 13,946 | 62,583 | 69,016 | 74,874 | 91,895 | 31,761 | 24,726 | 96,974 | 49,397 | 132,591 | 92,580 |
| ■ 2002-Area | 8,488 | 9,049 | 114,471 | 34,846 | 30,318 | 12,072 | 5,787 | 85,576 | 15,457 | 14,825 | 6,345 | 11,335 | 18,355 | 34,891 | 2,932 |
| ■ 2018-Area | 9,293 | 12,559 | 117,717 | 44,041 | 42,068 | 36,053 | 7,488 | 172,319 | 21,129 | 17,027 | 7,207 | 21,636 | 22,746 | 79,196 | 6,639 |

Point and Area Source 2002 and 2018 SO2 Emissions



| | AK | AZ | CA | CO | ID | MT | NV | NM | ND | OR | SD | UT | WA | WY | Tribes |
|--------------|-------|---------|--------|--------|--------|--------|--------|--------|---------|--------|--------|--------|--------|---------|--------|
| ■ 2002-Point | 6,809 | 93,752 | 42,120 | 97,011 | 17,597 | 36,879 | 50,722 | 37,436 | 156,668 | 17,587 | 14,021 | 42,838 | 52,969 | 119,645 | 38,208 |
| ■ 2018-Point | 7,777 | 106,113 | 49,632 | 68,476 | 10,813 | 43,055 | 24,041 | 40,825 | 162,705 | 21,687 | 15,268 | 52,953 | 51,355 | 145,100 | 32,895 |
| ■ 2002-Area | 5,531 | 2,677 | 8,314 | 6,559 | 2,916 | 3,299 | 12,954 | 6,559 | 5,748 | 9,932 | 10,167 | 3,581 | 7,388 | 17,902 | 49 |
| ■ 2018-Area | 6,044 | 3,410 | 9,772 | 7,499 | 2,721 | 3,432 | 14,194 | 15,753 | 5,856 | 8,422 | 11,667 | 3,587 | 8,667 | 23,109 | 2 |

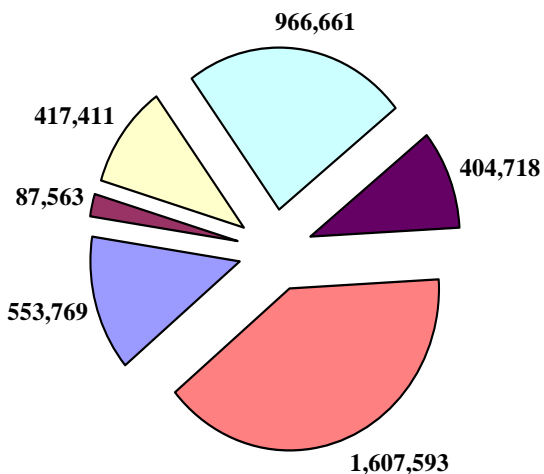
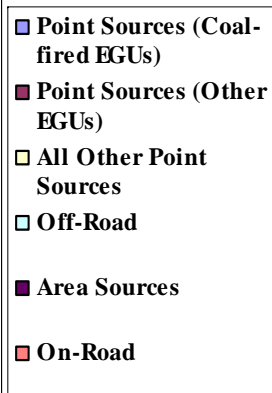
Point Source 2002 & 2018 NO_x Emissions By State



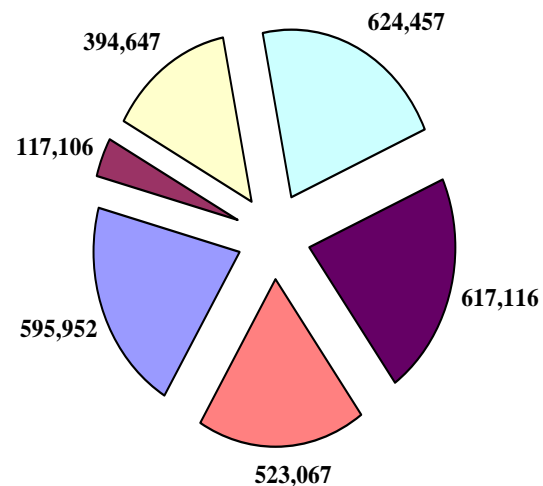
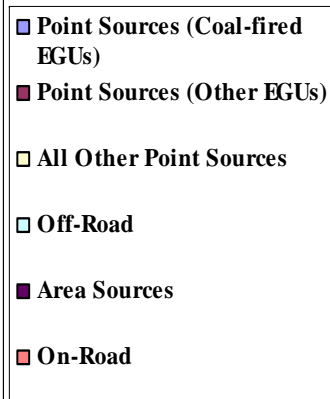
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| % Change | -9% | +21% | +5% | -5% | +21% | +17% | +15% | -25% | +5% | +27% | +19% | +7% | +13% | +12% | +6% |

WRAP Region NOx Emissions 2002 to 2018 Base Case

2002 WRAP Region NOx Emissions (tons/year)



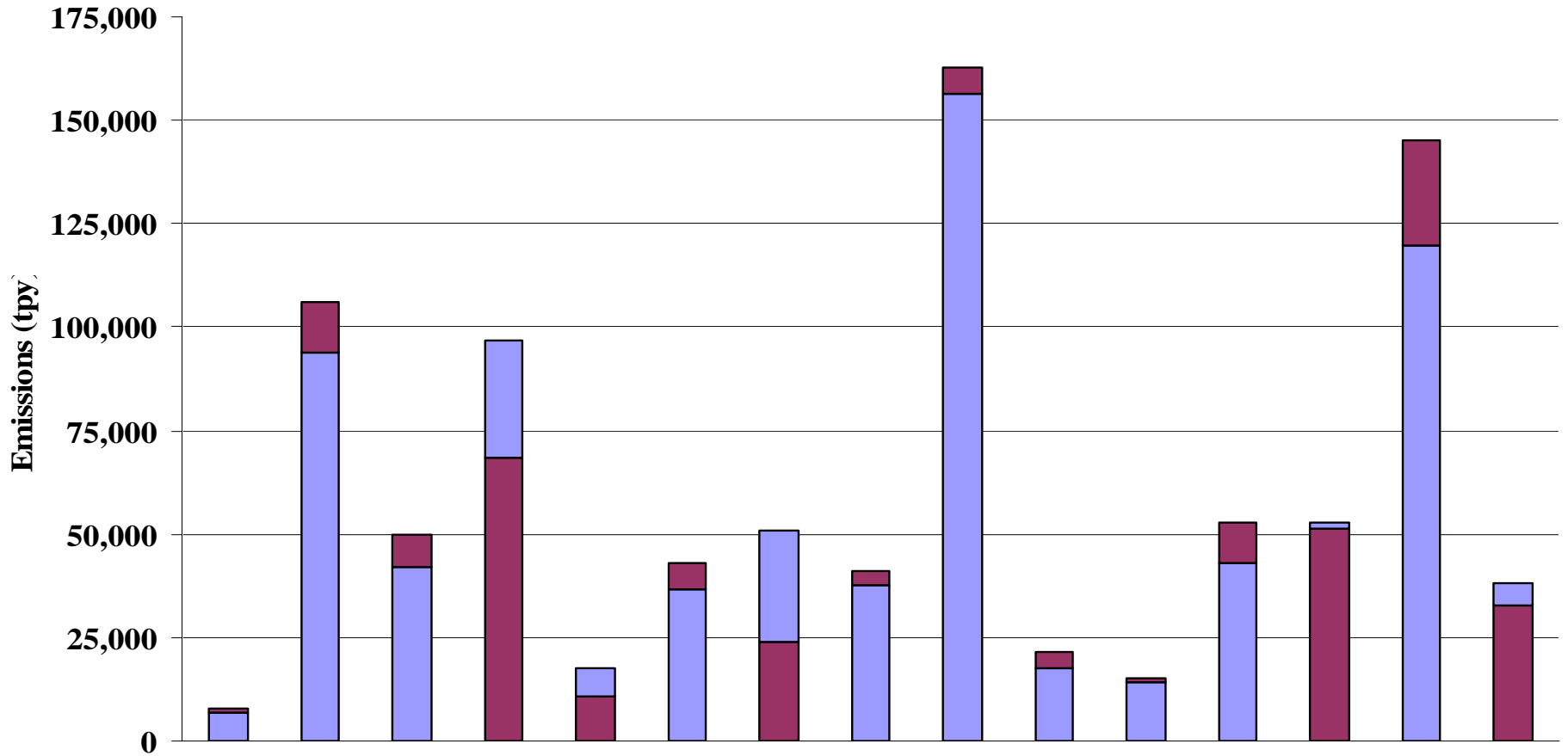
2018 WRAP Region NOx Emissions (tons/year)



Total: 2002 = 4,037,715

2018 = 2,872,346

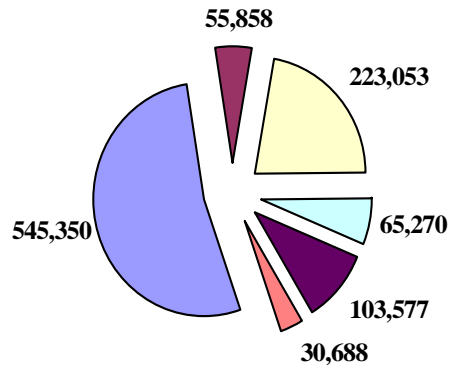
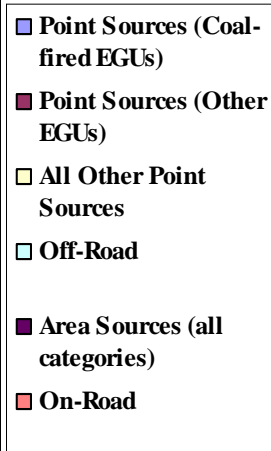
Point Source 2002 & 2018 SO₂ Emissions By State



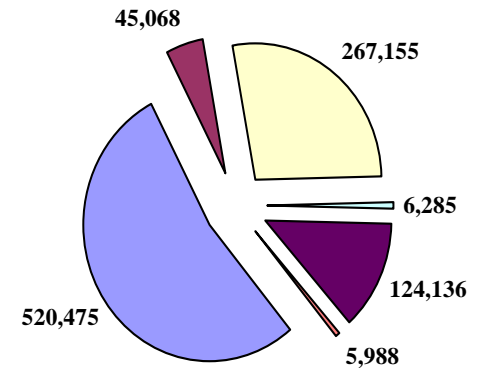
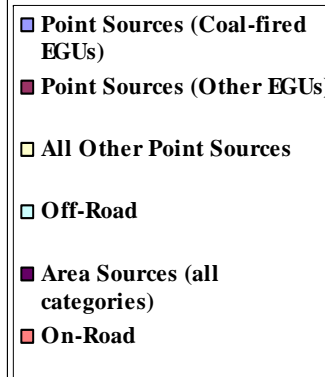
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|----------|-------|---------|--------|--------|--------|--------|--------|--------|---------|--------|--------|--------|--------|---------|--------|
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| % Change | +14% | +13% | +18% | -29% | -39% | +17% | -53% | +9% | +4% | +23% | +9% | +24% | -3% | +21% | -14% |

WRAP Region SO2 Emissions 2002 to 2018 Base Case

2002 WRAP Region SO2 Emissions (tons/year)



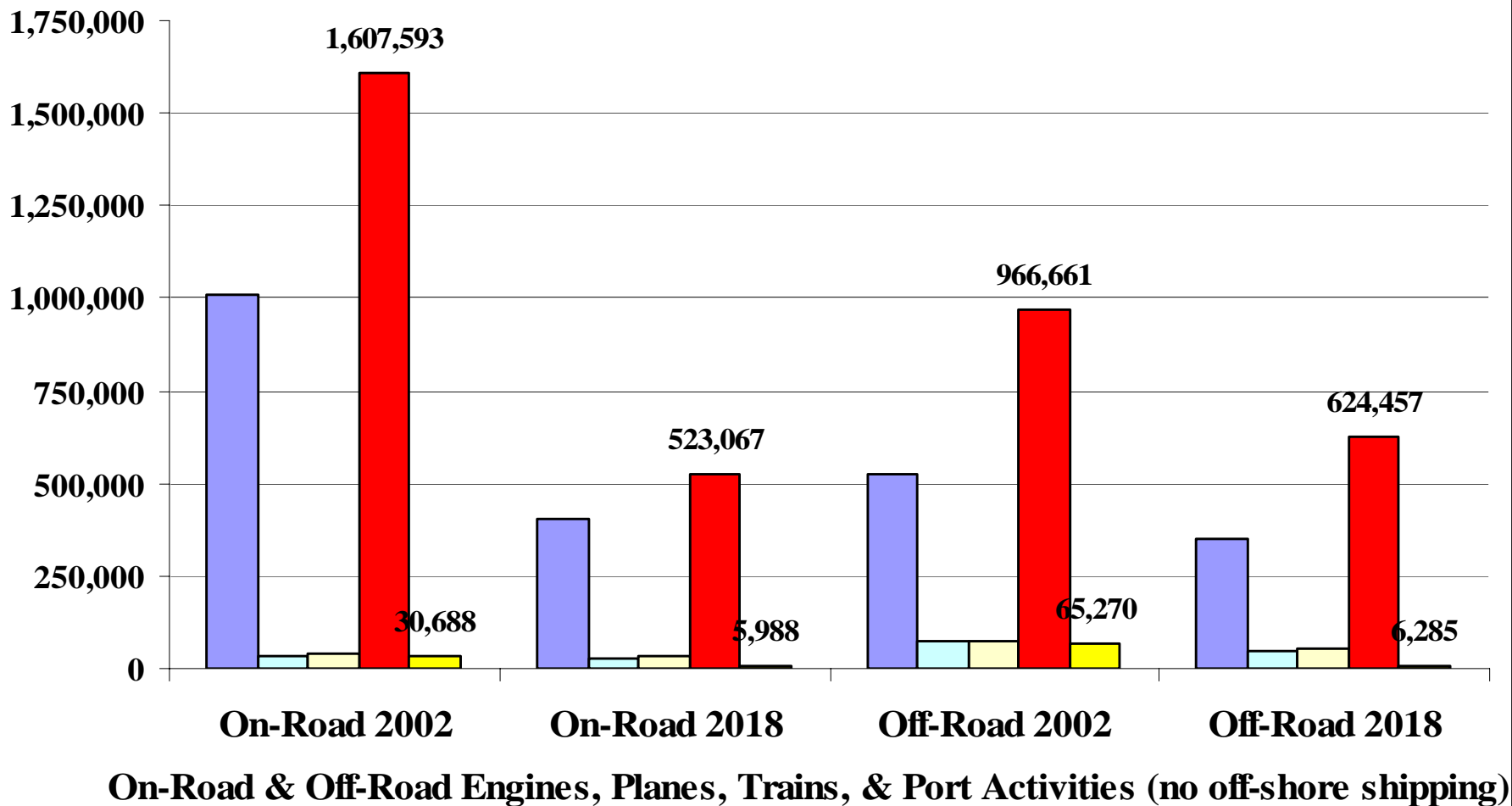
2018 WRAP Region SO2 Emissions (tons/year)



Total: 2002 = 1,023,797

2018 = 969,107

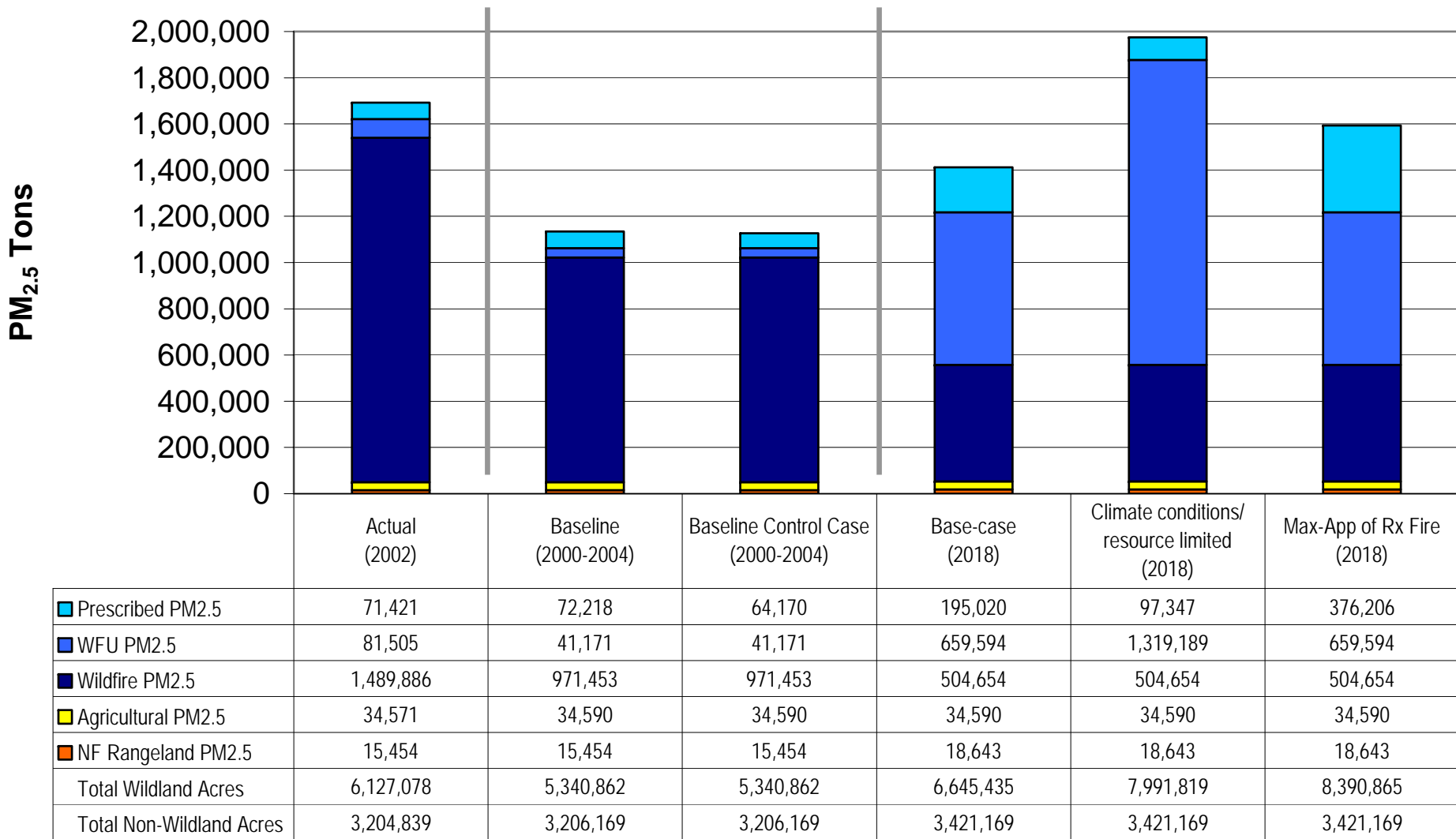
WRAP Region Mobile Source Emissions (tons/year)



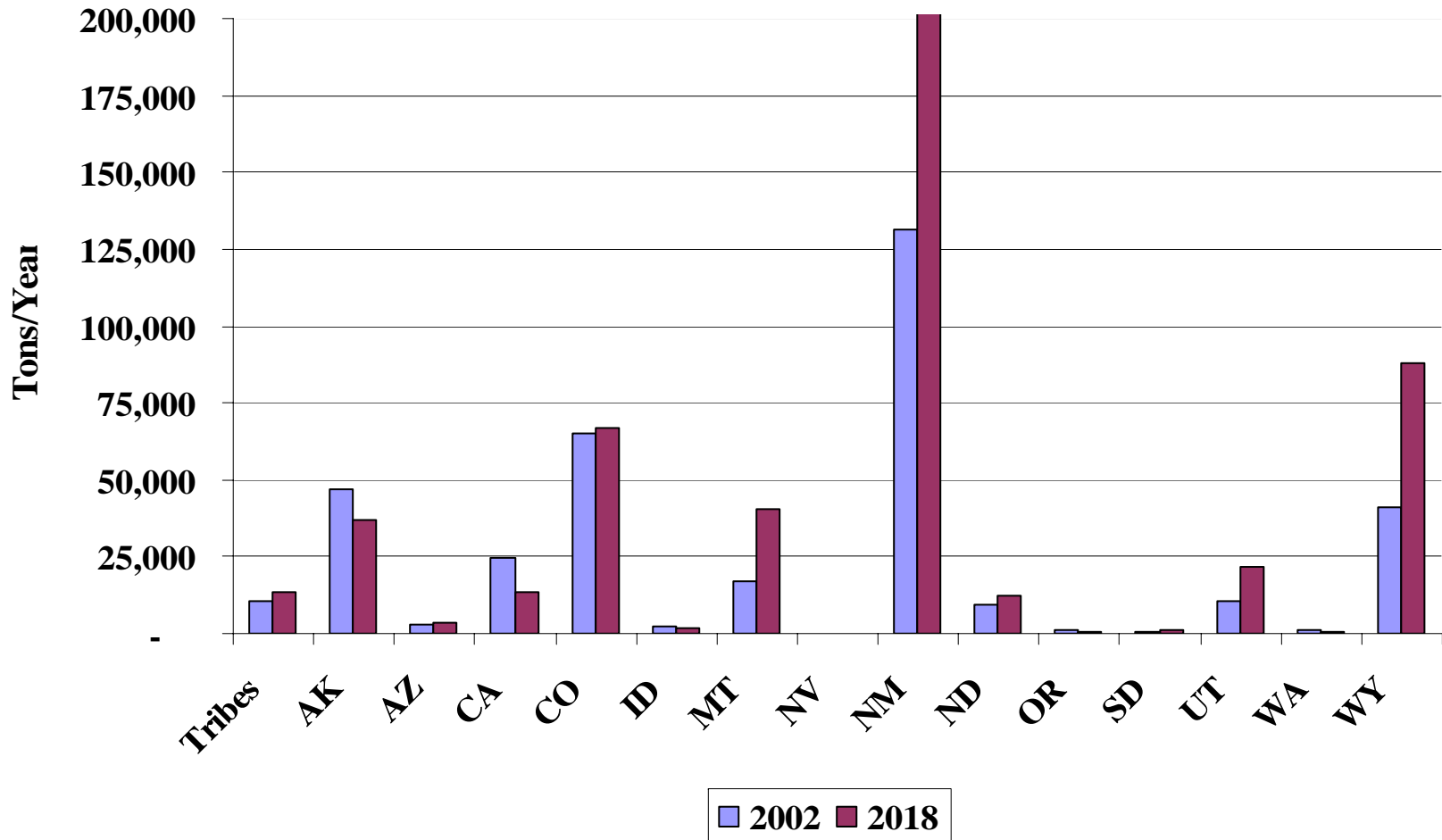
■ VOC ■ PM2.5 ■ PM10 ■ NOx ■ SO2

WRAP/FEJF Fire Emission Inventory Summary

PM_{2.5} Emissions for Actual, Baseline, and Projection Scenarios

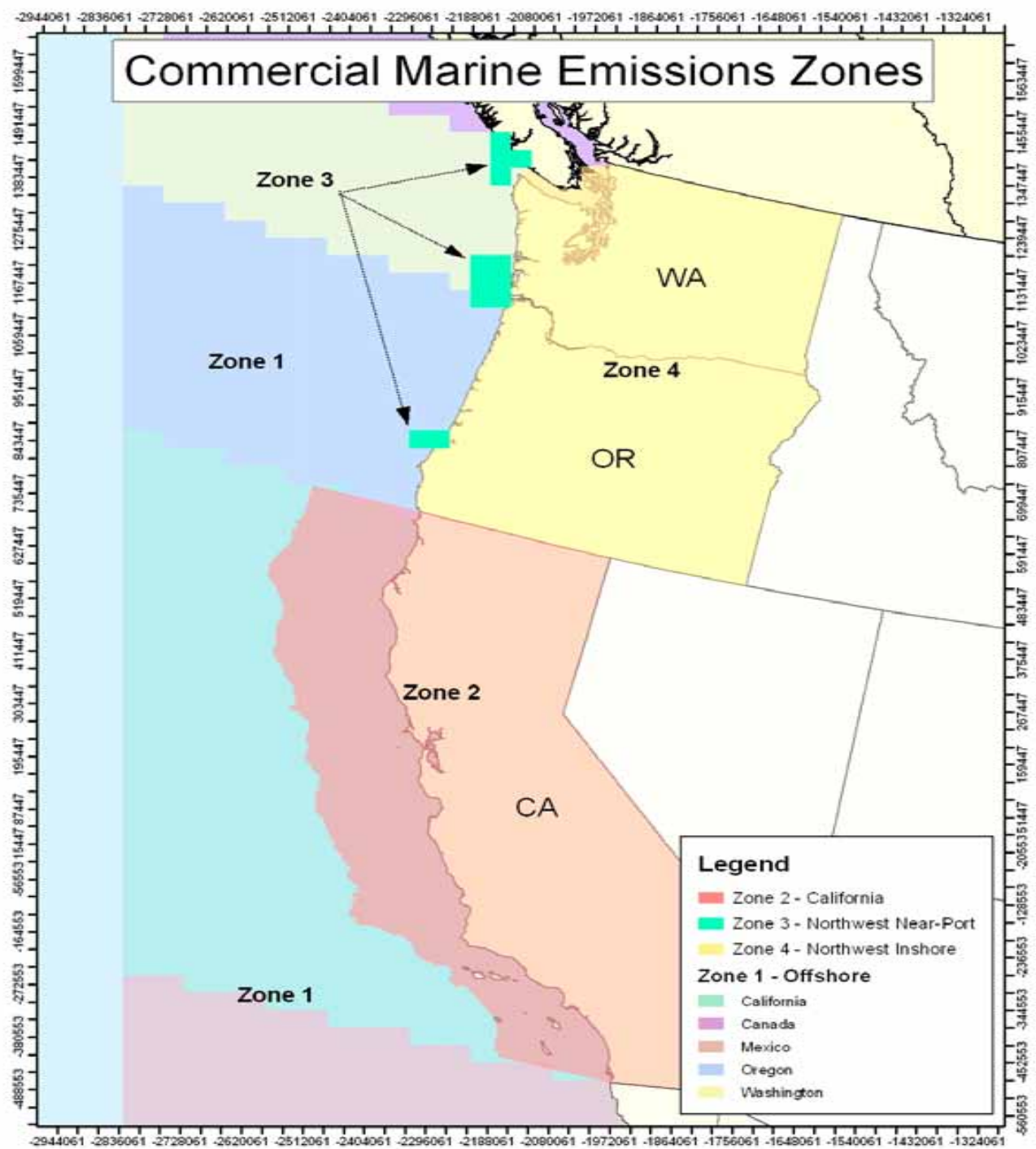


Oil & Gas Production & Distribution NOx Emissions



WRAP Region: 2002 Total = 365,000 and 2018 Total = 540,000

Port Activity and Off-Shore Commercial Marine Shipping



2002 to 2018 % Change in Coastal States' Mobile Emissions

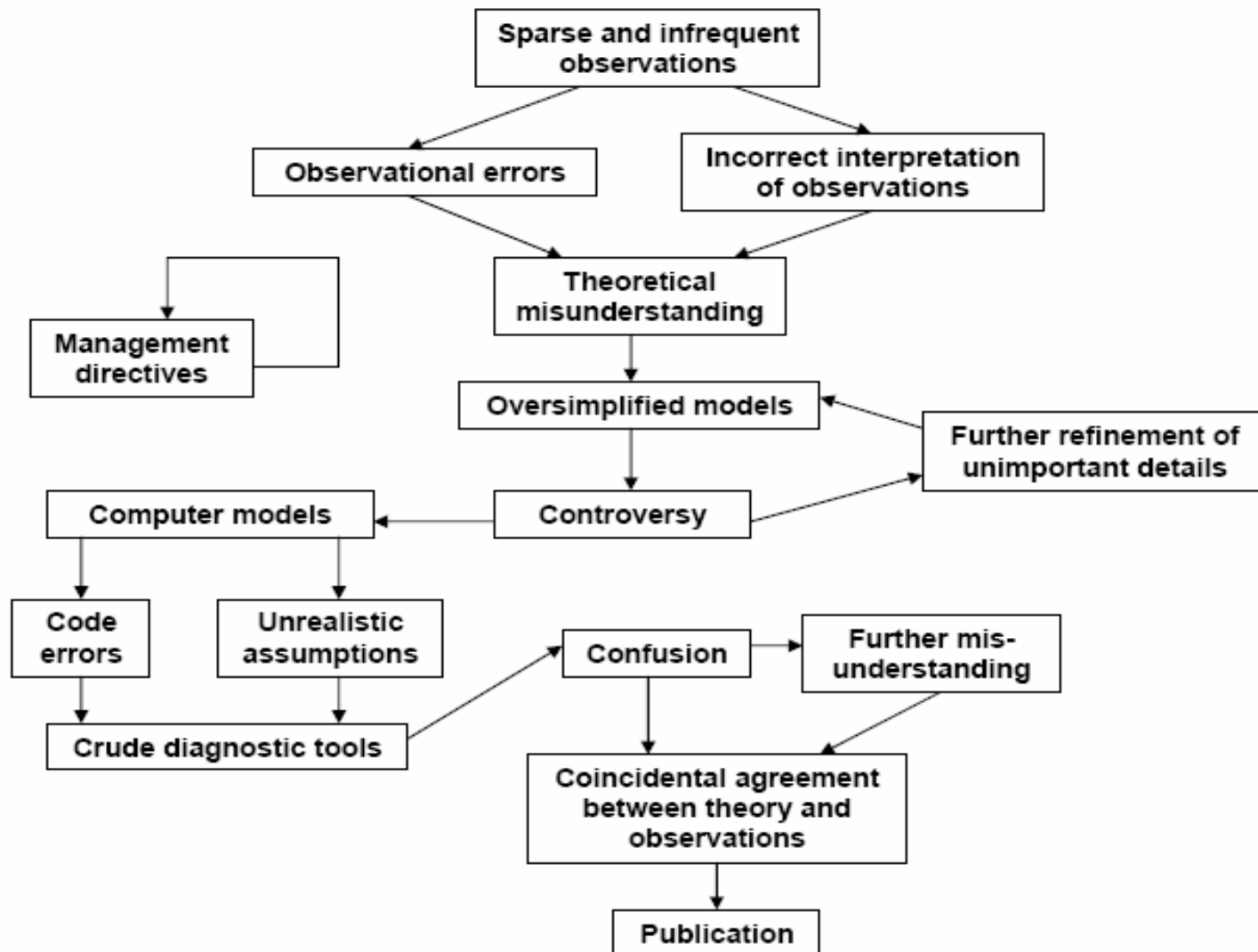
West Coast NOx Emissions - % change from 2002 to 2018

| State | Commercial Marine | | | | | ONROAD | NONROAD | Aircraft | Locomotive |
|------------|-------------------|-------------------|--------------------------------|--------------------|------------------|--------|---------|----------|------------|
| | Total | Offshore - Zone 1 | Coastal/In-Shore - Zones 2,3,4 | | | | | | |
| | | | Total | Near-Port (Zone 3) | Inshore (Zone 4) | | | | |
| California | 97% | 114% | | NA | NA | -65% | -62% | 104% | -34% |
| Oregon | 114% | 114% | 114% | 114% | 114% | -62% | -47% | 27% | -20% |
| Washington | 114% | 114% | 114% | 114% | 114% | -72% | -46% | 21% | -20% |
| Total | 102% | 114% | 81% | 114% | 114% | -66% | -58% | 93% | -29% |

West Coast SO2 Emissions - % change from 2002 to 2018

| State | Commercial Marine | | | | | ONROAD | NONROAD | Aircraft | Locomotive |
|------------|-------------------|-------------------|--------------------------------|--------------------|------------------|--------|---------|----------|------------|
| | Total | Offshore - Zone 1 | Coastal/In-Shore - Zones 2,3,4 | | | | | | |
| | | | Total | Near-Port (Zone 3) | Inshore (Zone 4) | | | | |
| California | 126% | 140% | 104% | NA | NA | -53% | -25% | 69% | -99% |
| Oregon | 140% | 140% | 140% | 140% | 140% | -87% | -99% | 26% | -99% |
| Washington | 140% | 140% | 140% | 140% | 140% | -88% | -99% | 22% | -99% |
| Total | 131% | 140% | 110% | 140% | 140% | -77% | -94% | 59% | -99% |

AIR QUALITY MODELING FLOW CHART



Picture Analogy for Regional Modeling Results

Unknown Reality

Perfect Model Lower Detail

Measurement Overall Size Only

Raw Predictions Possibilities

A

B

C

(photo of Winston Churchill)



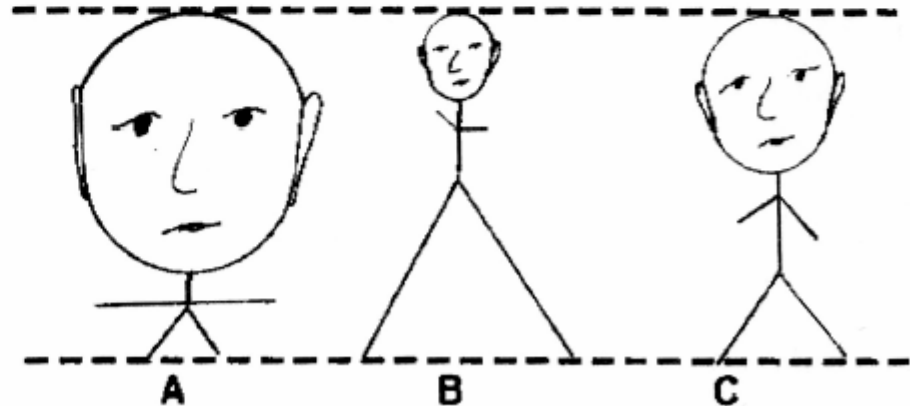
Scaling To Force Overall Size Agreement With Measurements

Head Represents Regional Influence

Body Represents Local Influence

Scaling Links Uncertainty in Local Influence with Regional Influence

Features (eyes, mouth, arms, legs, etc) Represent Sources



Less Uncertainty in Relative Regional Source Influence than in Absolute Source Influence