Chemical Transformation & Long-Range Transport

Overview and Introduction

- ***Why CT & LRT?***
- ***Our Strategy***
- ***Our Capabilities and Tools***
- ***Examples of Our Findings***

David Parrish
Chemical Sciences Division

Chemical Transformation & Long-Range Transport: NOAA's Mission

Issues:

Climate Change and Air Quality

Focus:

Ozone and Aerosols In the troposphere

- **important in Climate Change and *Air Quality***
- **formed in and removed from the atmosphere by Chemical Transformations**
- **Lifetimes allow Long-Range Transport over Intercontinental distances**

HAPS*

***Hazardous Air Pollutants** (benzene, carbon tetrachloride, chloroform, methylene chloride, tetrachloroethylene, ….)*

- ***Transported globally***

Changes AQ perspective from local to regional-global

- ***Changes realm of impact***
- ***Defines local boundary conditions***

Chemical Transformation & Long-Range Transport: ESRL's Strategy

Integrate:

- **Long-term, Regional to Global Monitoring**
- **Field Process Studies: airborne, ground-based, and ship-based intensive field campaigns**
- **Laboratory Process Studies**
- ***Insightful analysis* (i.e. modeling) of the results**

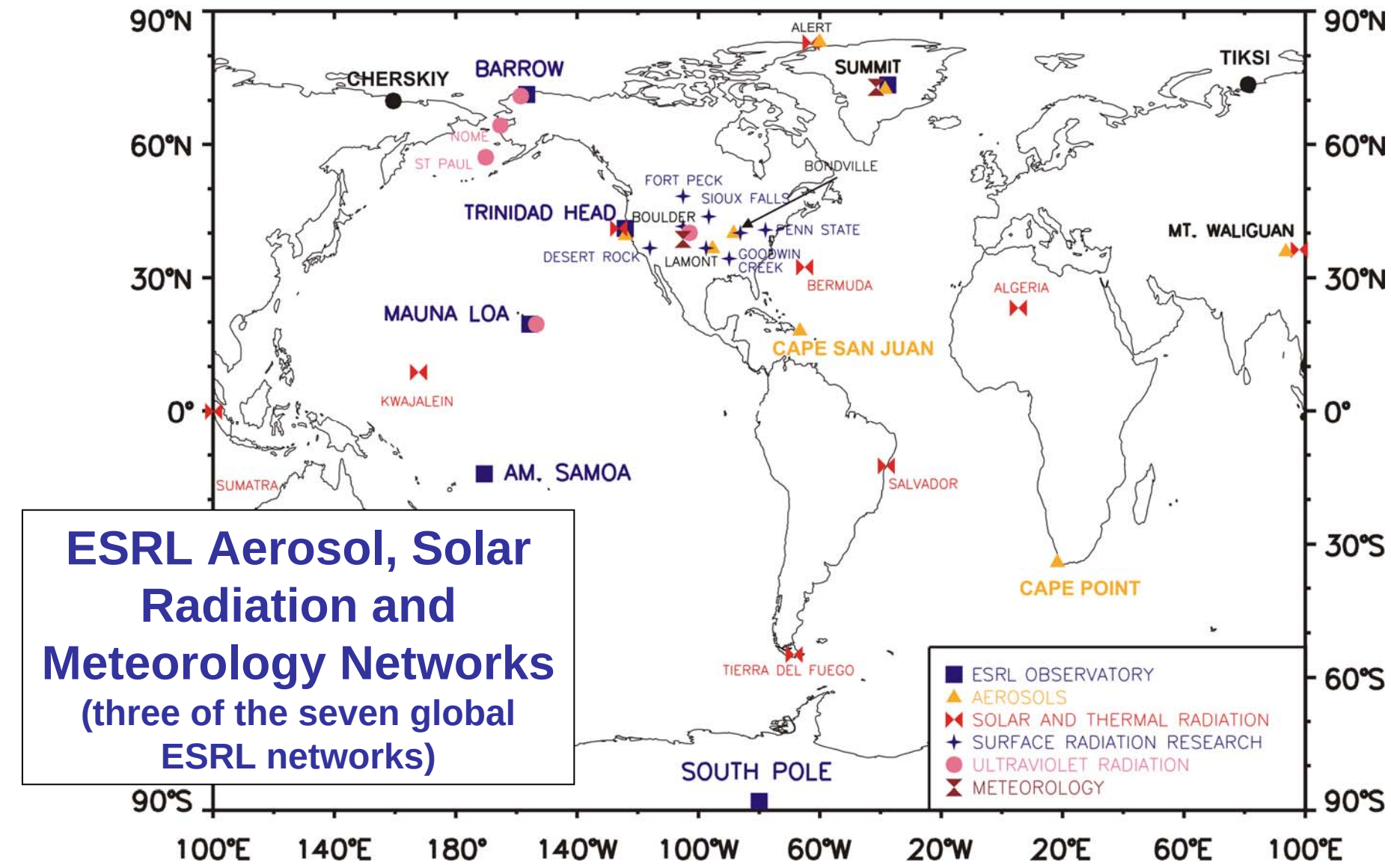
4 Complementary Activities

Goal:

- **Develop the detailed process understanding that must be incorporated into climate and chemical transport models on hemispheric to global scales.**
- **Models ultimately synthesize and integrate our Air Quality and Climate Change understanding**

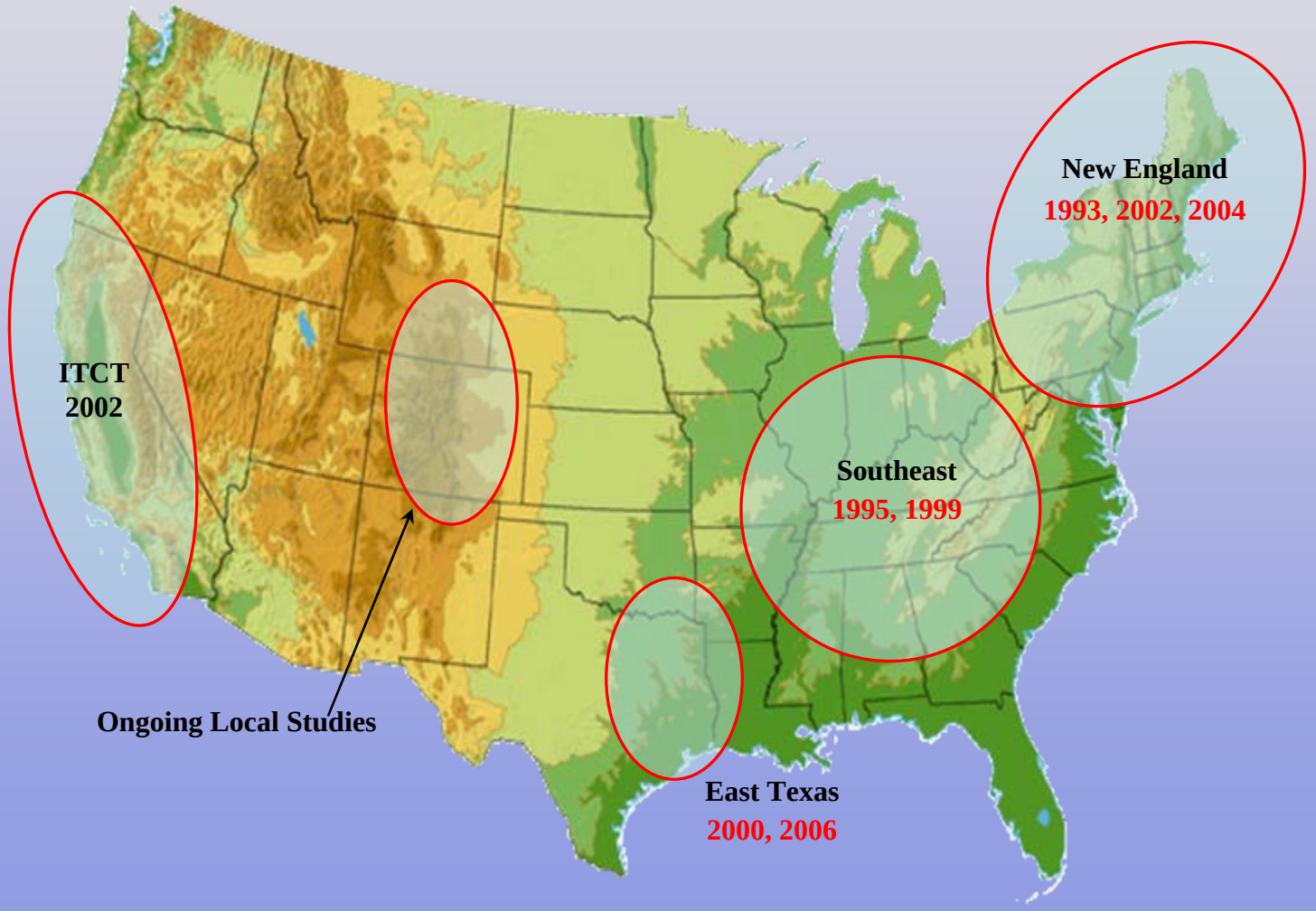
Provide predictive Capability

NOAA's Global Monitoring Network

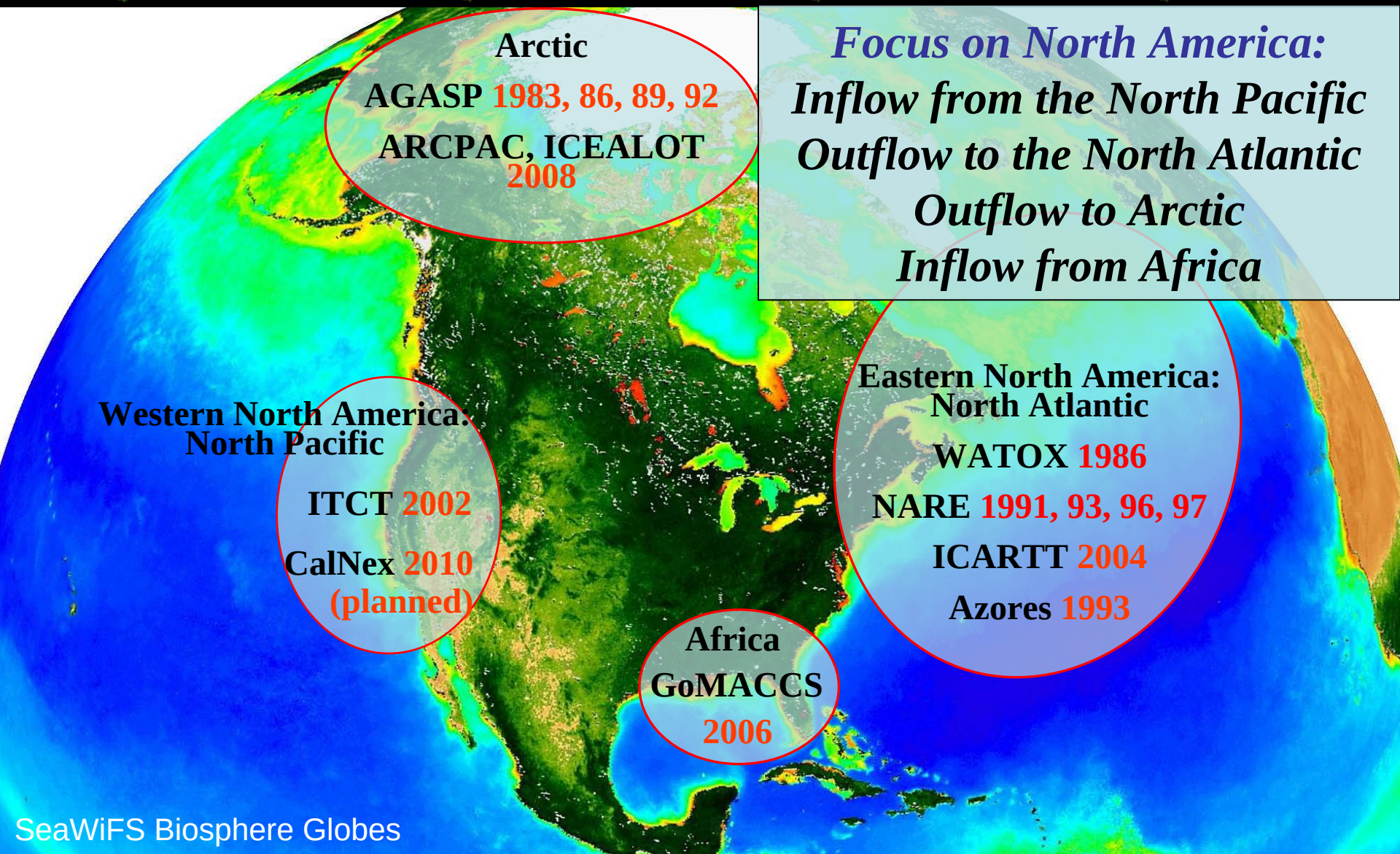


ESRL Aerosol, Solar Radiation and Meteorology Networks
(three of the seven global ESRL networks)

ESRL Regional Air Quality Field Studies



NOAA's Intensive Field Campaigns



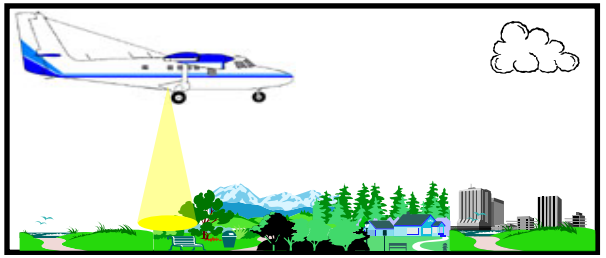
SeaWiFS Biosphere Globes

NOAA's Field Observation Tools

NOAA WP-3D Aircraft - emissions verification, regional and inter-regional transport, day/night O_3/PM chemistry, aerosol optics, other LRT Capabilities

NOAA R/V Ronald H. Brown - marine chemistry, marine emissions, coastal emissions, chemistry in the land/bay/sea breeze recirculation, aerosol - physics, - chemistry, - optics and satellite validation.

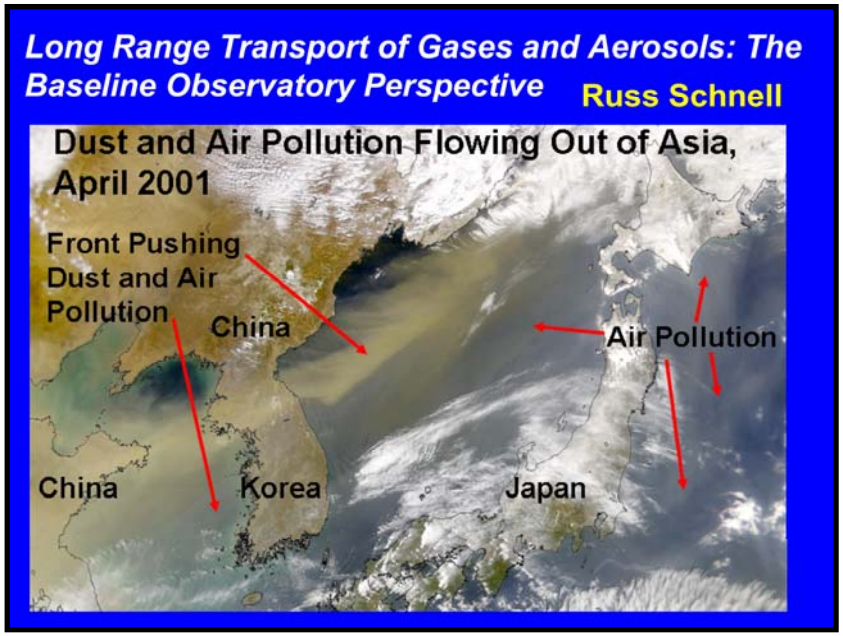
NOAA LIDAR Aircraft - regional distribution of O_3 and PM, regional and inter-regional transport, boundary layer evolution and variability.



Long-term Monitoring:

- **Surface Sites**
- **Sondes**
- **Light Aircraft**

ESRL Chemistry: *Examples* of Findings



Long-term, Regional to Global Monitoring

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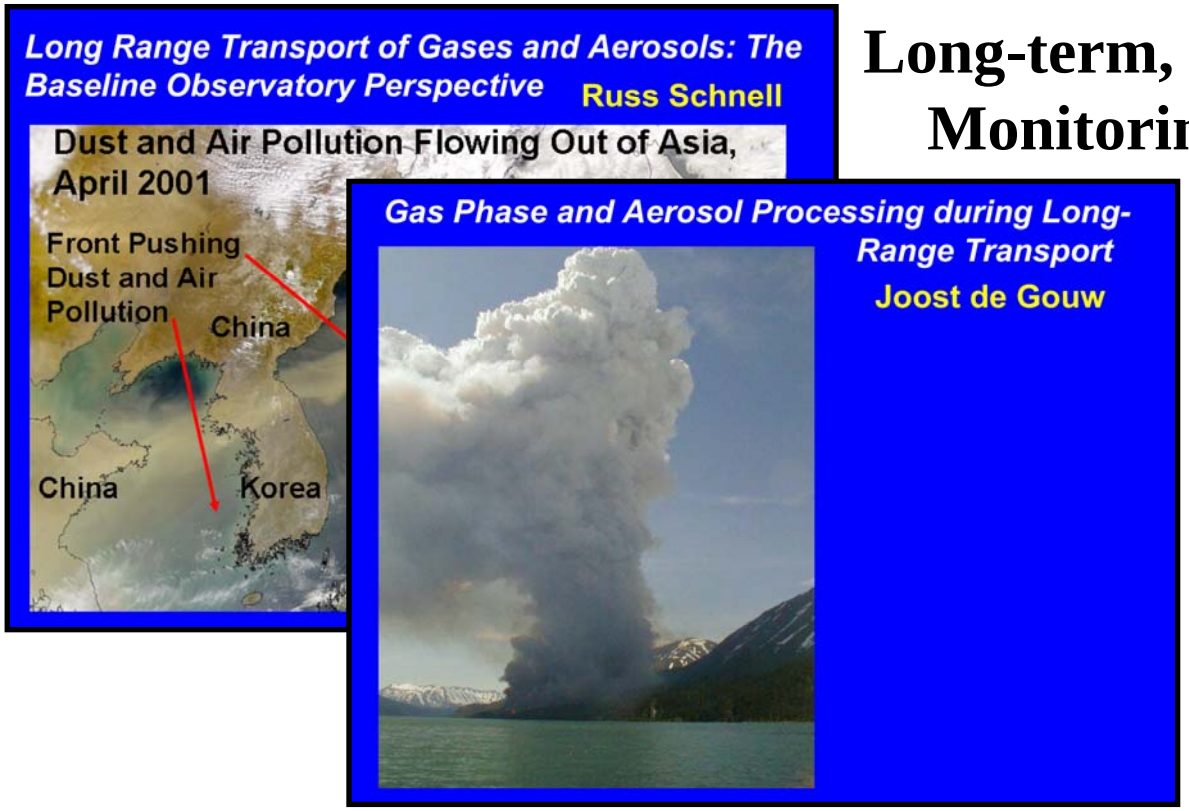


Long-term, Regional to Global Monitoring

Field Process Studies

ESRL Chemistry: *Examples* of Findings

Long-term, Regional to Global Monitoring

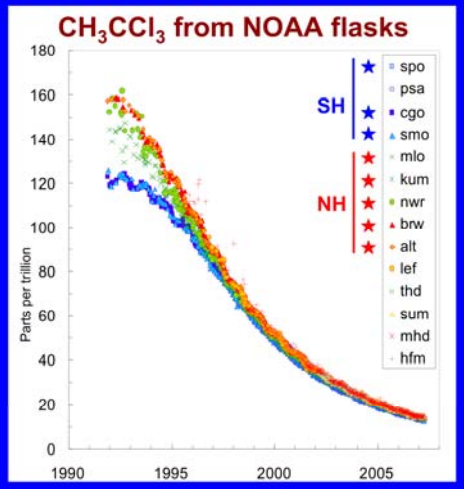
Field Process Studies

Modeling of Results

Long Range Transport of Gases and Aerosols: The Baseline Observatory Perspective — Russ Schnell

Gas Phase and Aerosol Processing during Long-Range Transport — Joost de Gouw

Interannual Variability in Atmospheric Hydroxyl as Inferred From Measurements of CH_3CCl_3, CH_4, and Other Trace Gases — Steve Montzka



ESRL Chemistry: *Examples* of Findings

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Modeling of Results

Laboratory Process Studies

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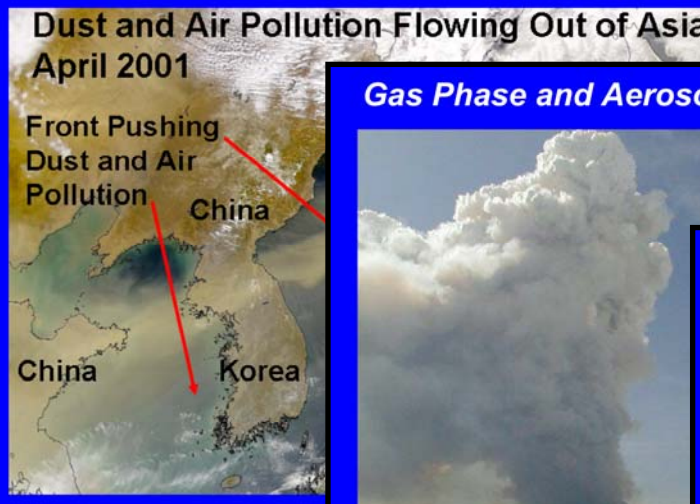

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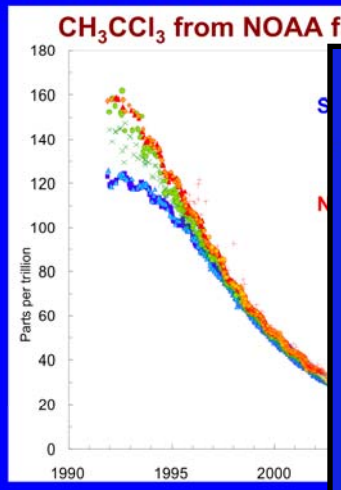

Laboratory Studies of Atmospheric Chemical Processes: Kinetics and Photochemistry of Acetone — Ranajit Talukdar