

Methane (CH₄)

Ed Dlugokencky

ESRL

Global Monitoring Division

Carbon Cycle Group

Why is CH₄ important?

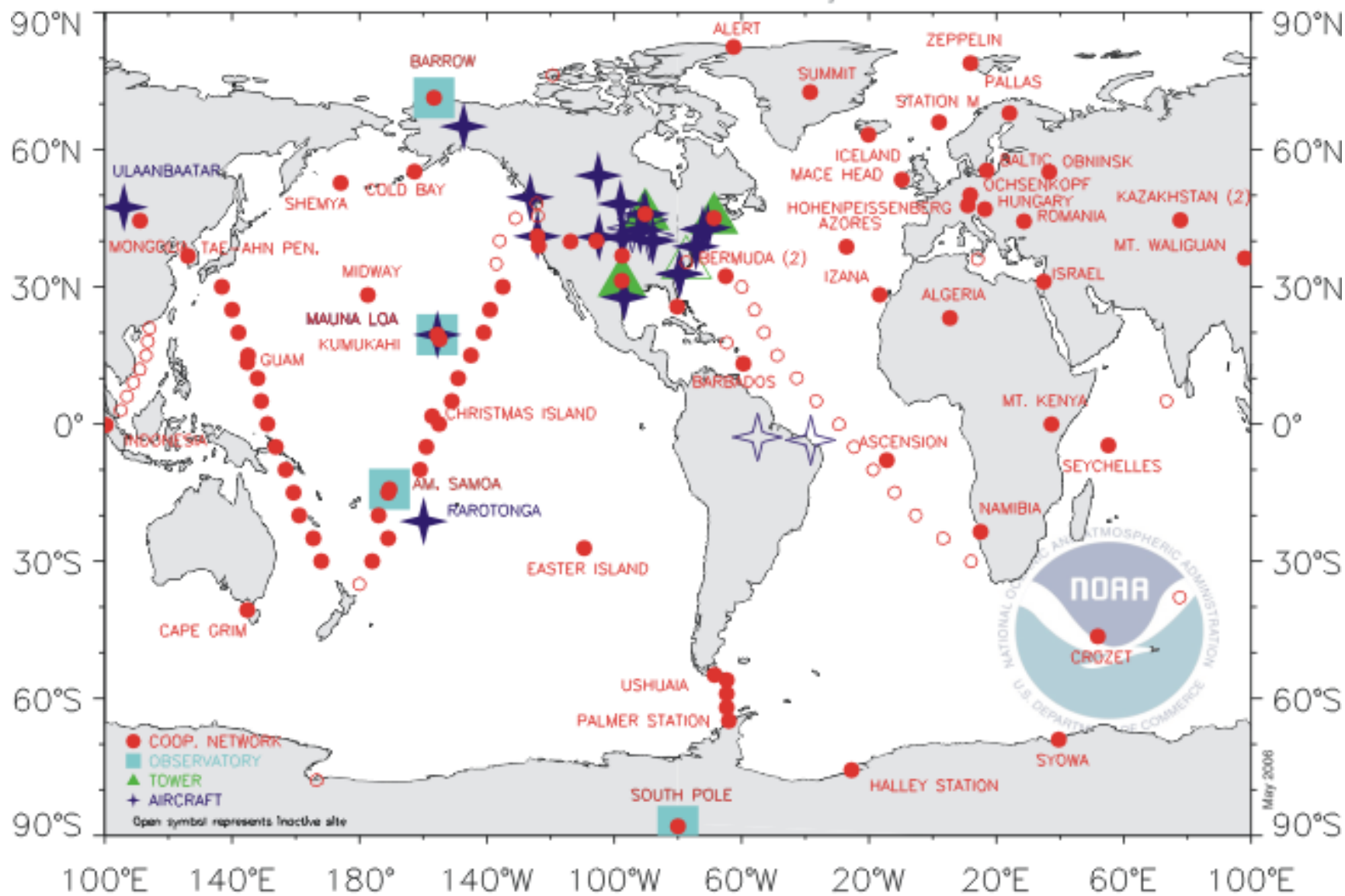
- 2nd-largest anthropogenic GHG RF
- Important in atmospheric chemistry
 - Affects cleansing capacity (OH) – GHG lifetimes
 - Source of stratospheric H₂O – indirect RF
 - Source of tropospheric O₃ – indirect RF
- Potential large climate feedbacks in Arctic
- Good target to reduce RF short-term
 - Quick response (lifetime ≈ 10 years)
 - Cost effective
- Uncertainties on budget still large

Goals of Research

- Measure spatial/temporal distribution of CH₄ abundance (and its isotopic composition)
 - Input for RF calculation
- Determine emission rates
 - Verify national emissions estimates
 - Assess compliance with treaty obligations
- Understand processes
 - Develop predictive capability
 - How will emissions respond to changing climate?

Measurement Programs

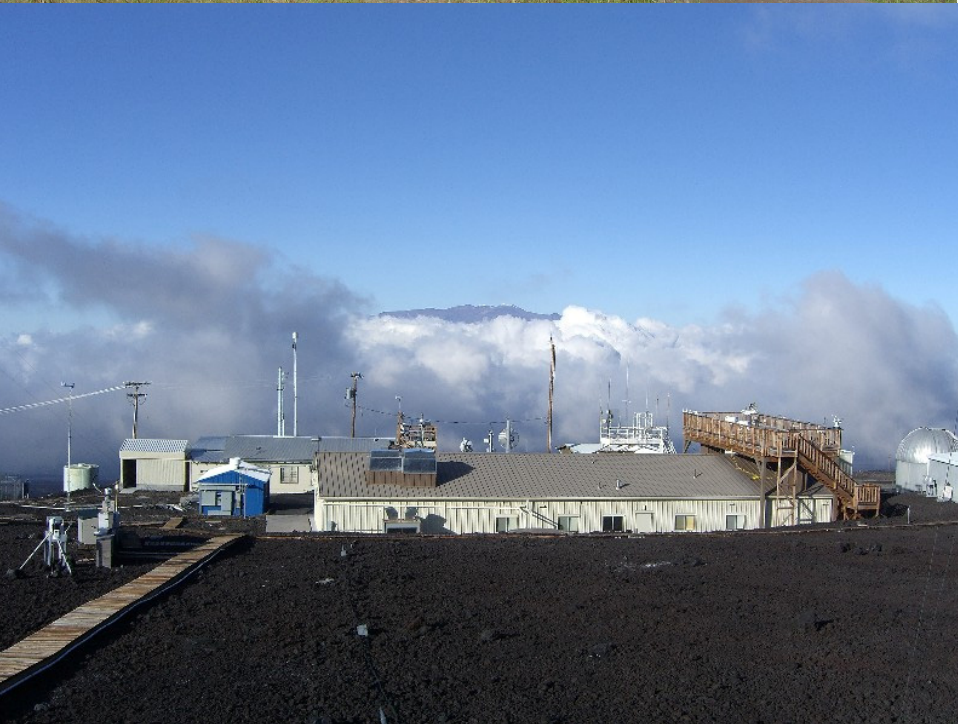
NOAA ESRL GMD Carbon Cycle

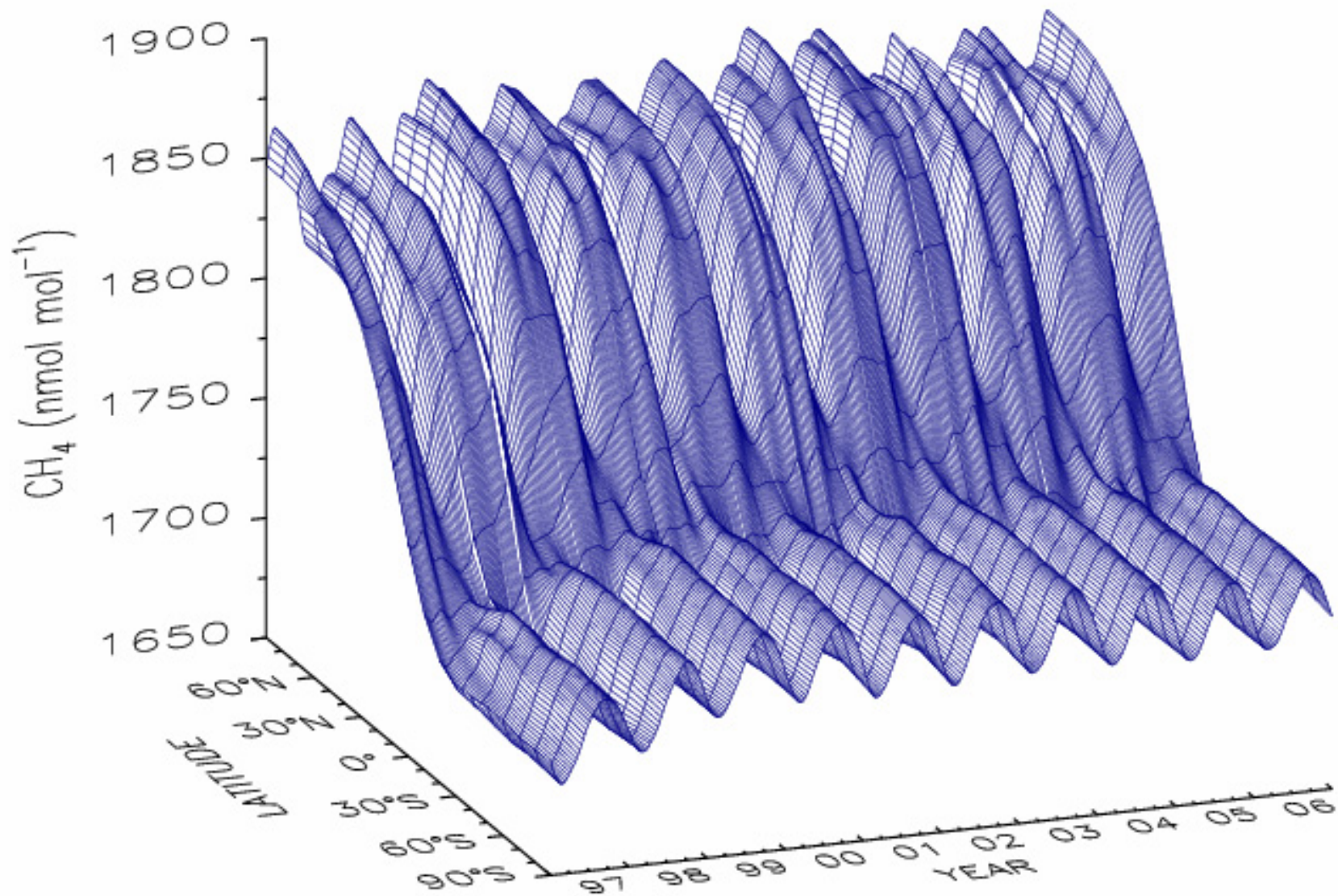


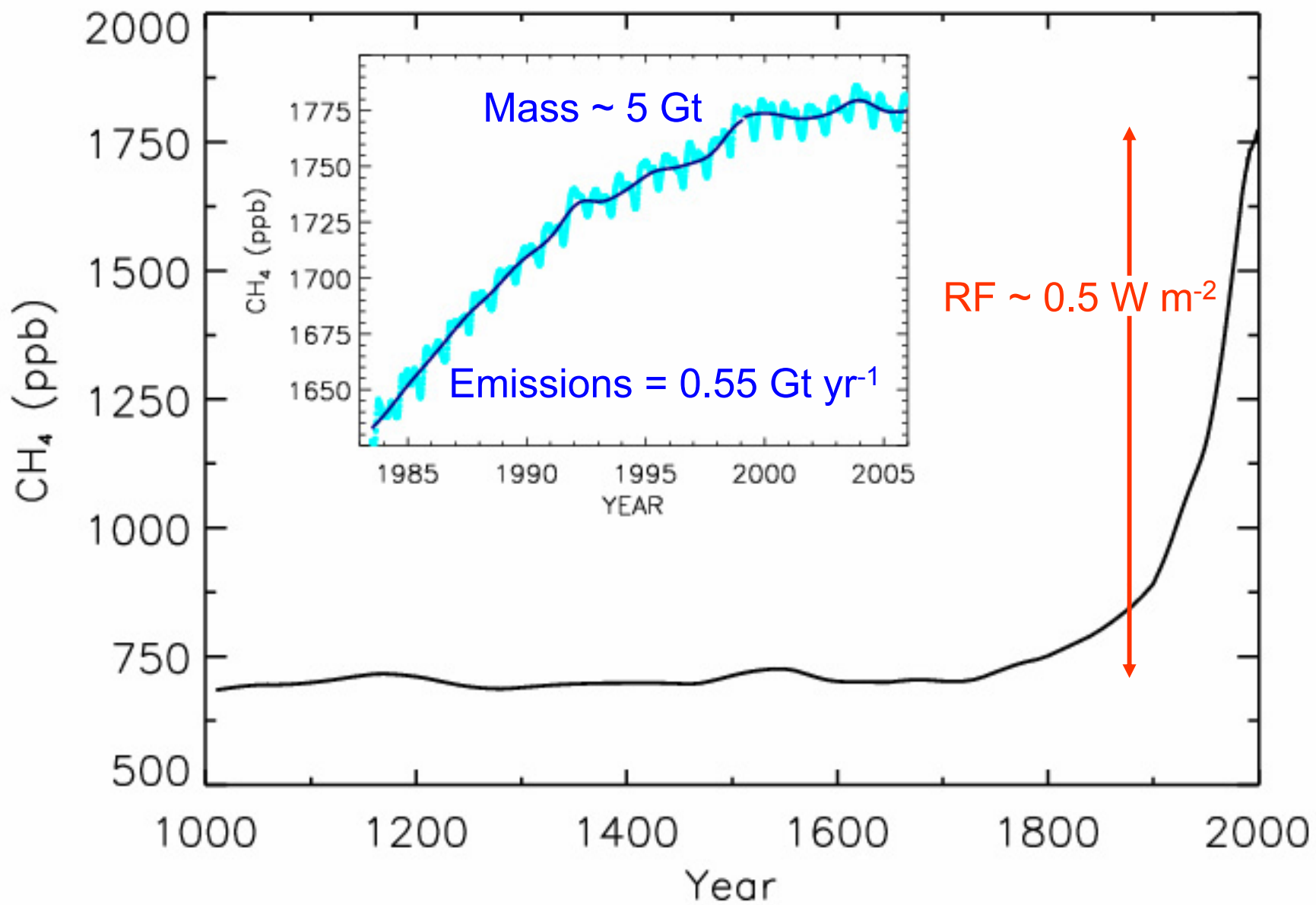
Air sampling platforms



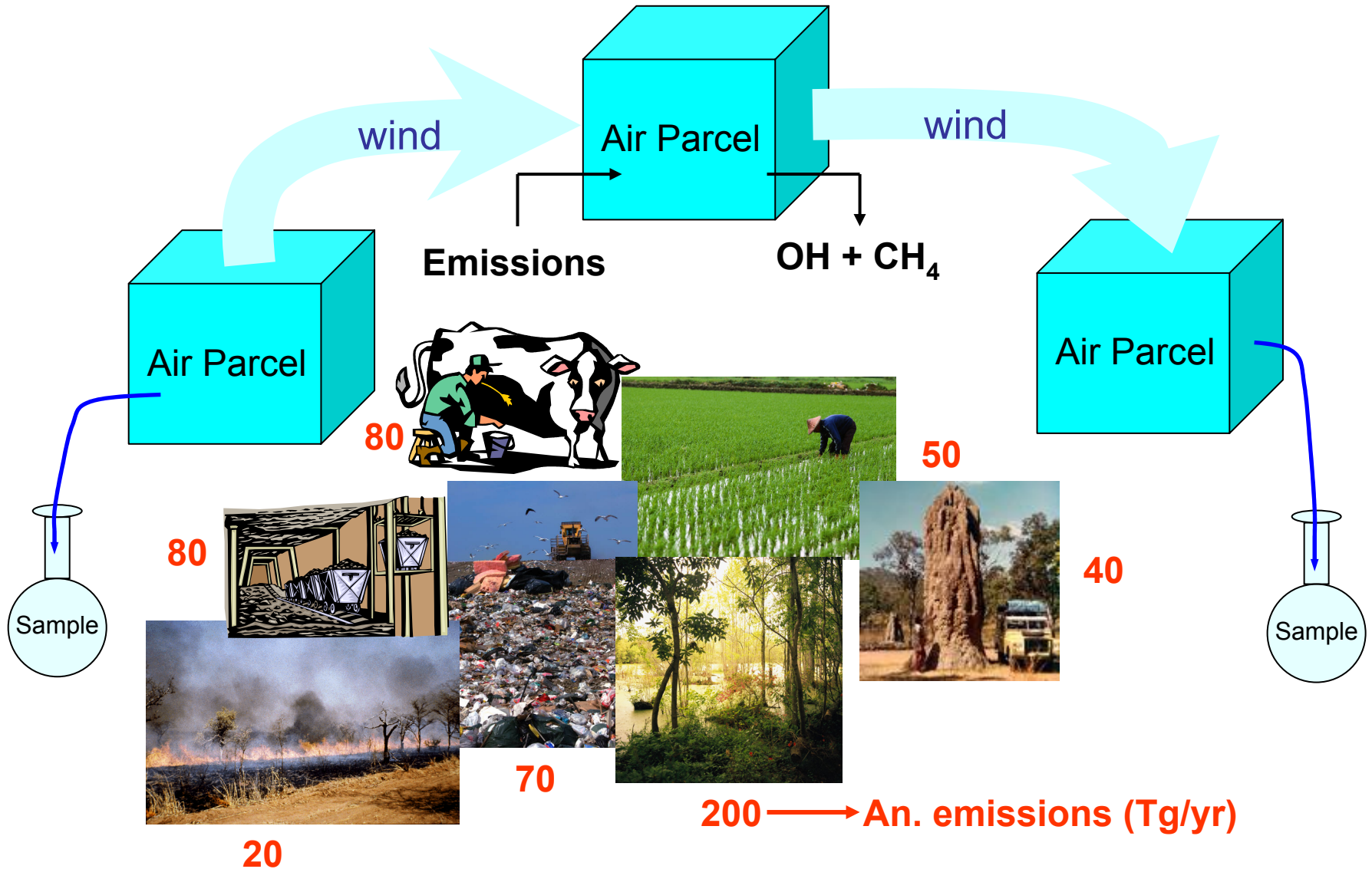
Samples returned to Boulder







Emissions by Source: Inverse Modeling



Future Work

- Reduce uncertainties in emissions estimates
 - Enhance sampling network
 - Improvements to models
- Identify changes in Arctic CH₄ emissions
 - Measurements planned for Cherskii and Tiksi
 - Discussions with USGS for Yukon Basin
- Verify North American emissions
 - CH₄ measurements from tall towers

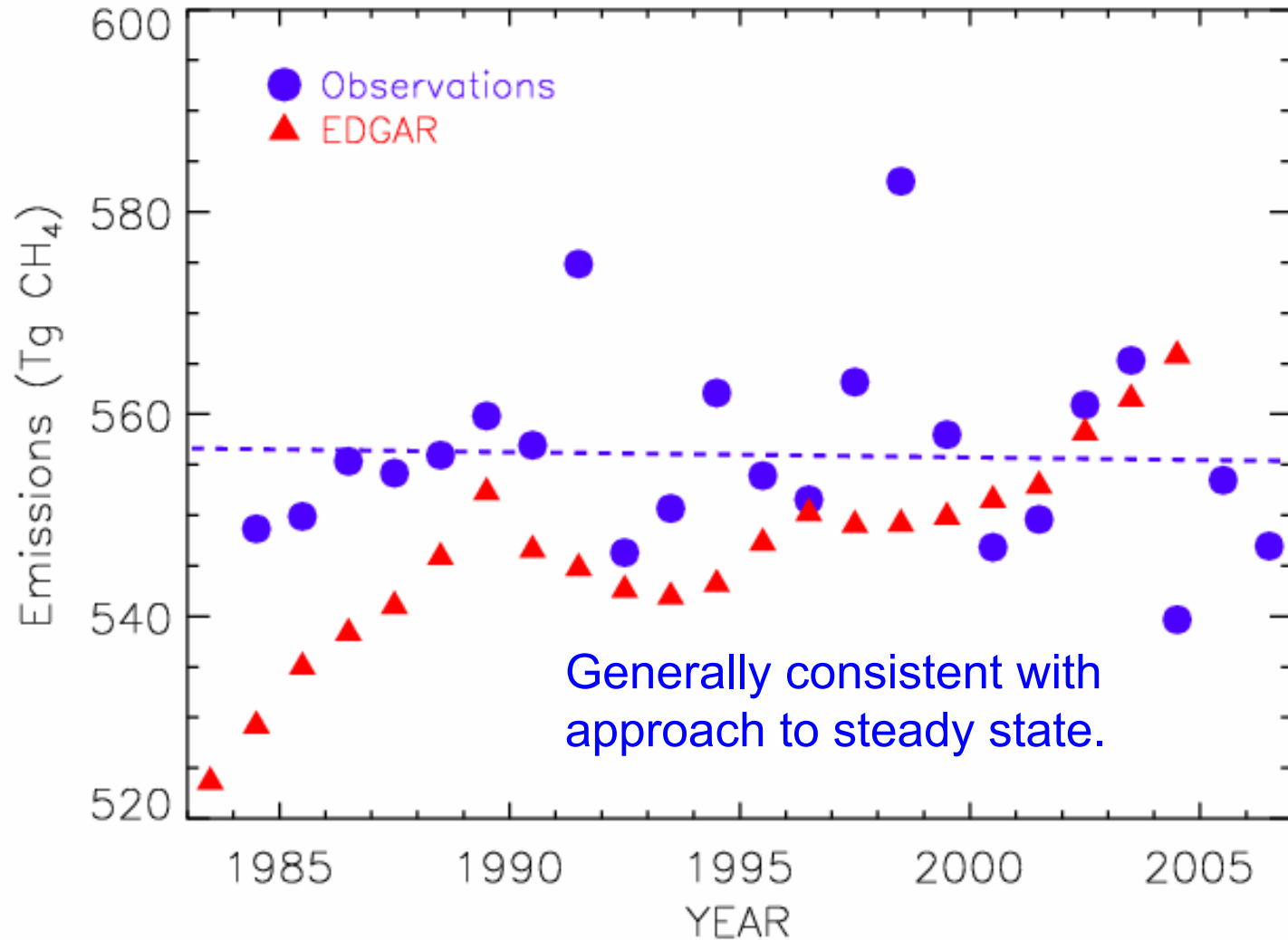
Total Global Emissions

$$Q = d[\text{CH}_4]/dt + [\text{CH}_4]/\tau$$

Where Q = emissions

τ = CH₄ lifetime = 8.9 years

$$Q = 556 \pm 10 \text{ Tg CH}_4 \text{ yr}^{-1}$$



Average Emissions = 556 ± 10 Tg CH₄ yr⁻¹

For 1990-2006: Trend in Emissions = -0.7 ± 0.6 Tg CH₄ yr⁻²

Distribution of Emissions

- **Observe N to S Difference ≈ 82 ppb**
- **$E_s = -f(N-S) + [CH_4]_s/\tau$**
where **$f = 1 \text{ yr}^{-1}$**
- **$E_s \approx 160 \text{ Tg CH}_4 \text{ yr}^{-1}$ or**

S. hemisphere emissions $\approx 30\%$