

CO₂ Emissions and Capture Effects in Global and Regional Ambient Concentrations

Quamrul Huda, Bob Myrick

Alberta Environment and Parks

Arturo Sanchez-Azofeifa

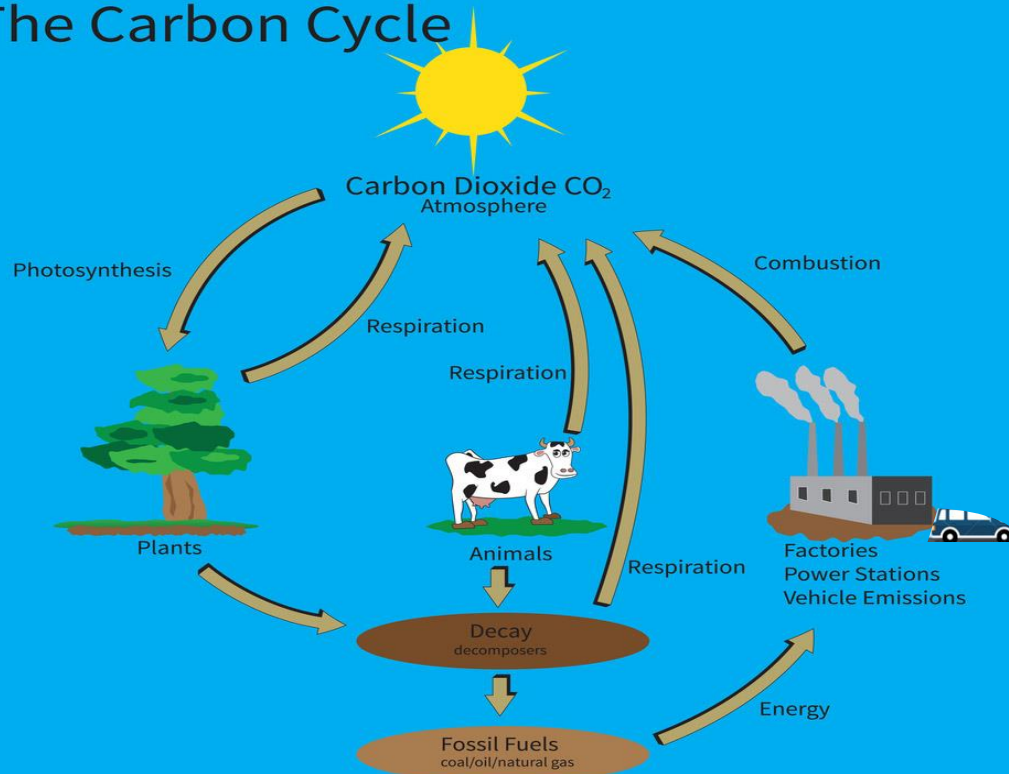
Earth & Atmospheric Sciences, University of Alberta

Presentation Layout

- **CO₂ in Air; (Why) Do we care?**
- **Historical and Present Levels**
- **Global Baseline Monitoring Stations**
- **CO₂ Monitoring in Canada and Alberta**
- **Regional and Seasonal Variations**
- **Conclusions**

CO₂ in Ambient Air

The Carbon Cycle



source: www.edinburghgardenschool.com

Carbon Emissions:

Human Sources

- Electricity, Heating, etc.
- Industry
- Land use changes

Natural Sources

- Oceanic exchange
- Plant, animal respiration
- Soil respiration, decomposition
- Volcanic eruption

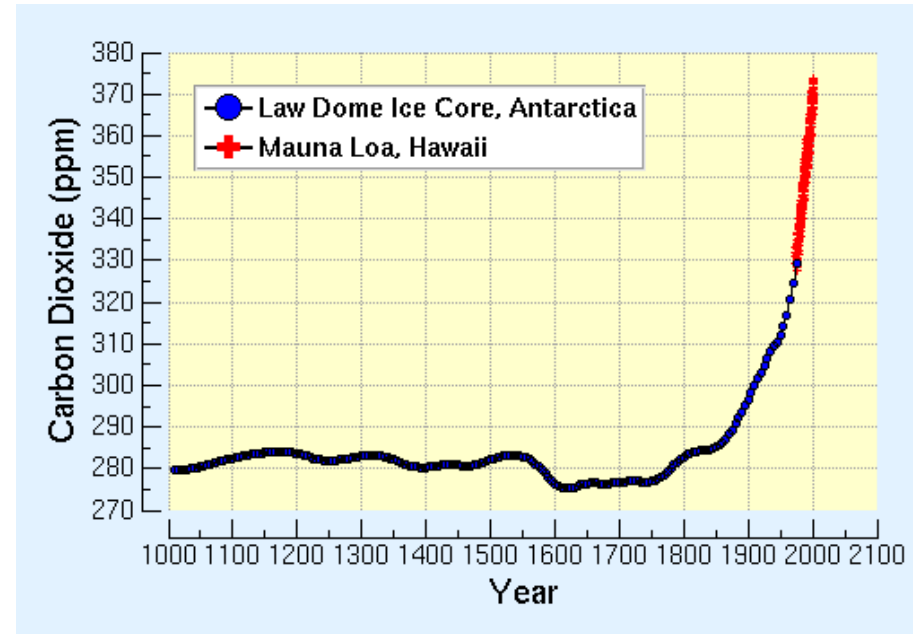
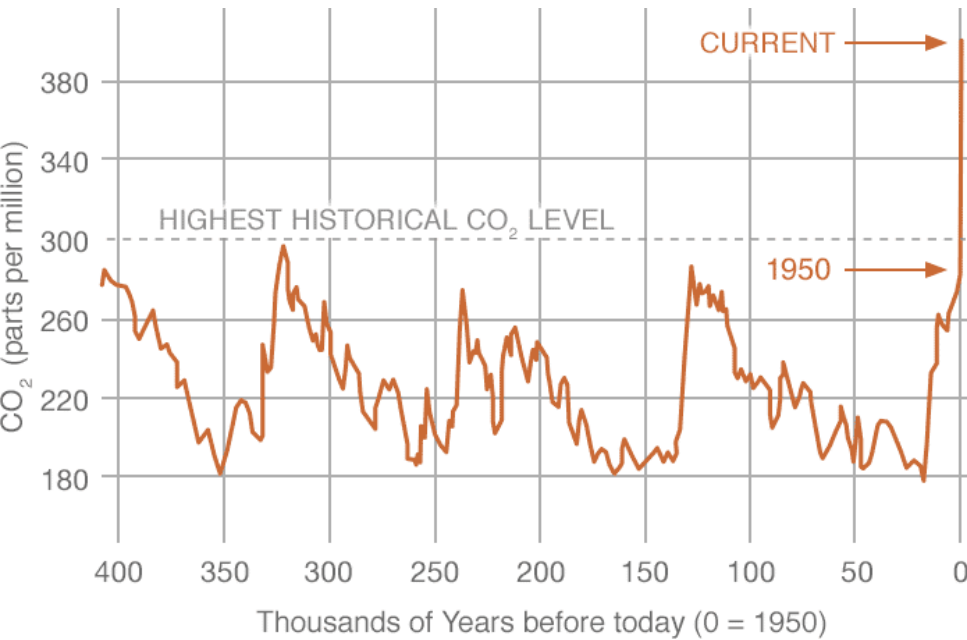
Carbon Capture:

Carbon Capture & Sequestration

- Quest, ACTL, etc.

Plant Photosynthesis

Historical Levels of CO₂



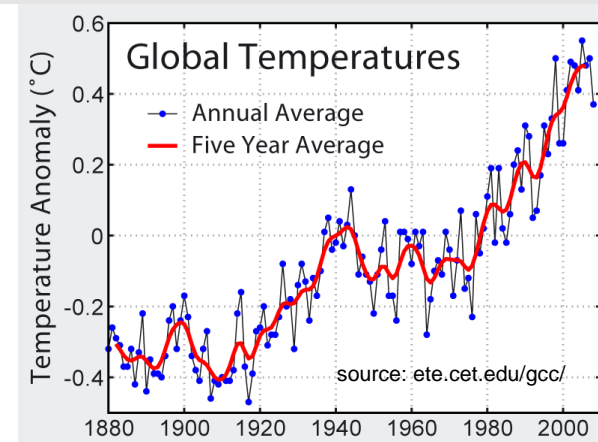
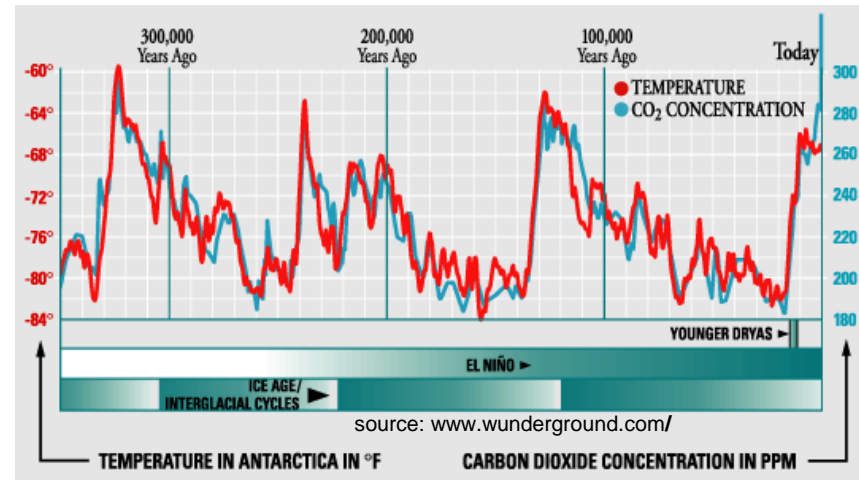
<https://www.esrl.noaa.gov/>

<https://climate.nasa.gov/>

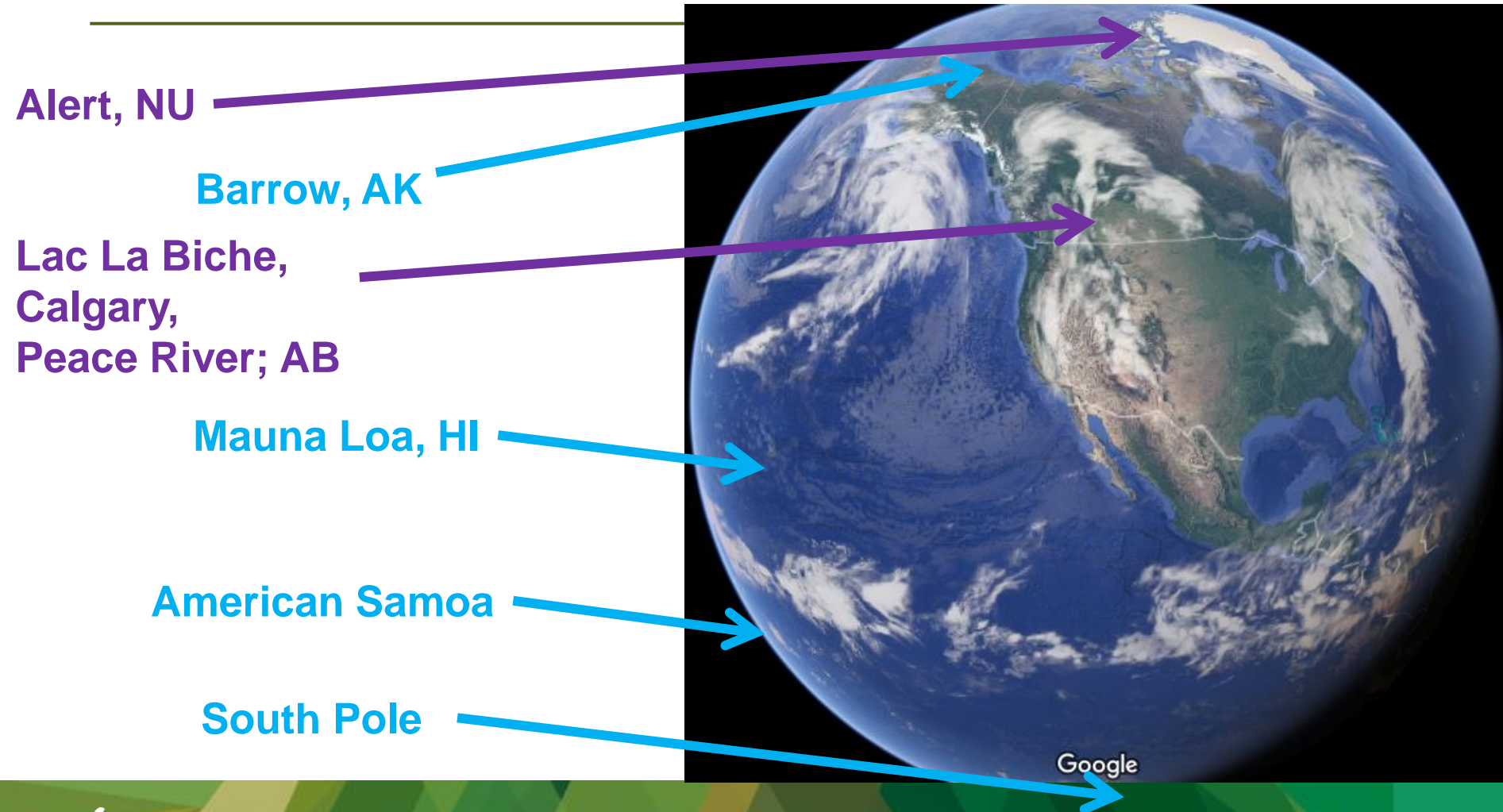
CO₂: The Global Thermostat



**CO₂ influences
the thermal cycle
on earth's surface**

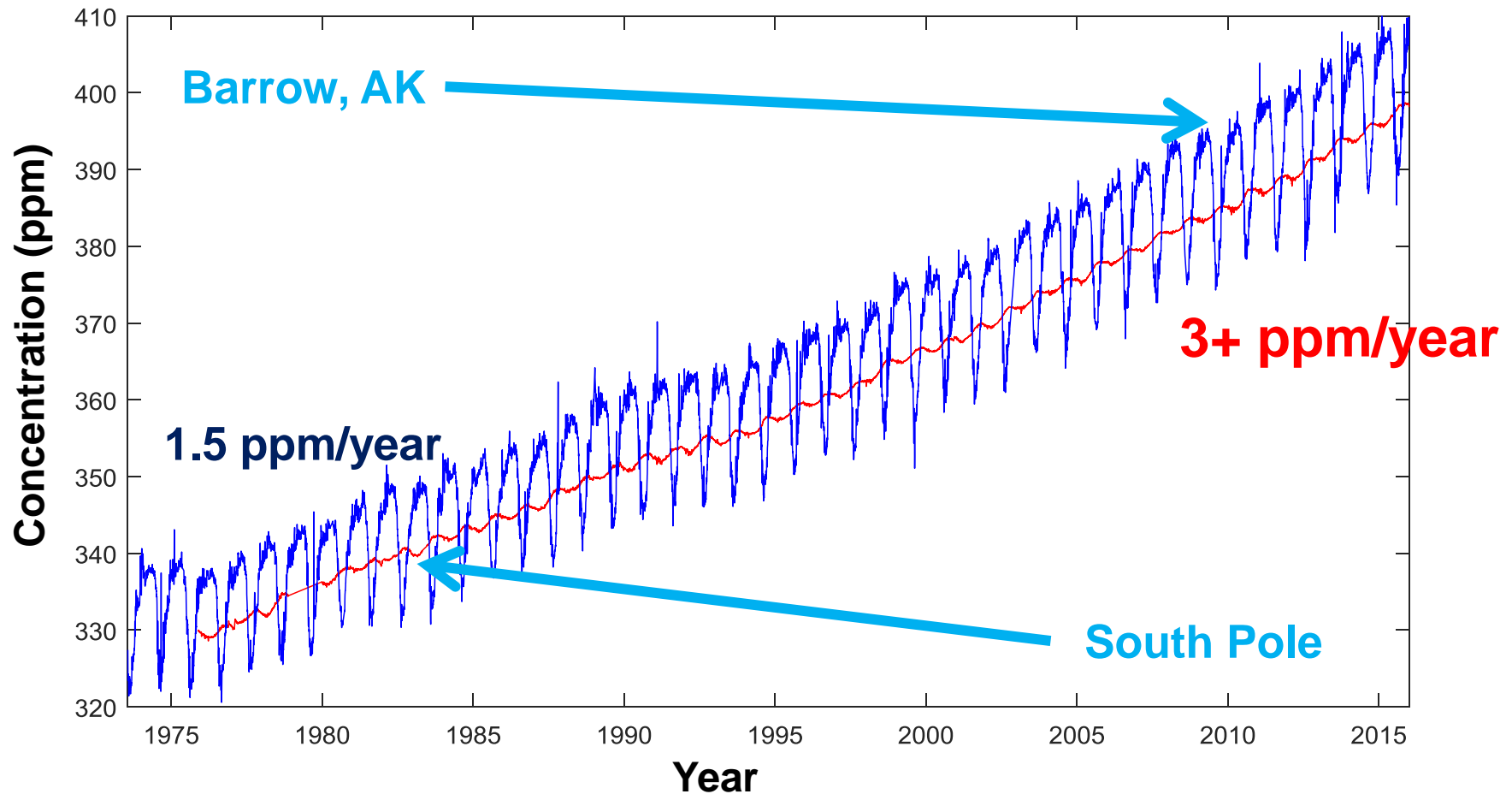


Global Baseline Monitoring Stations

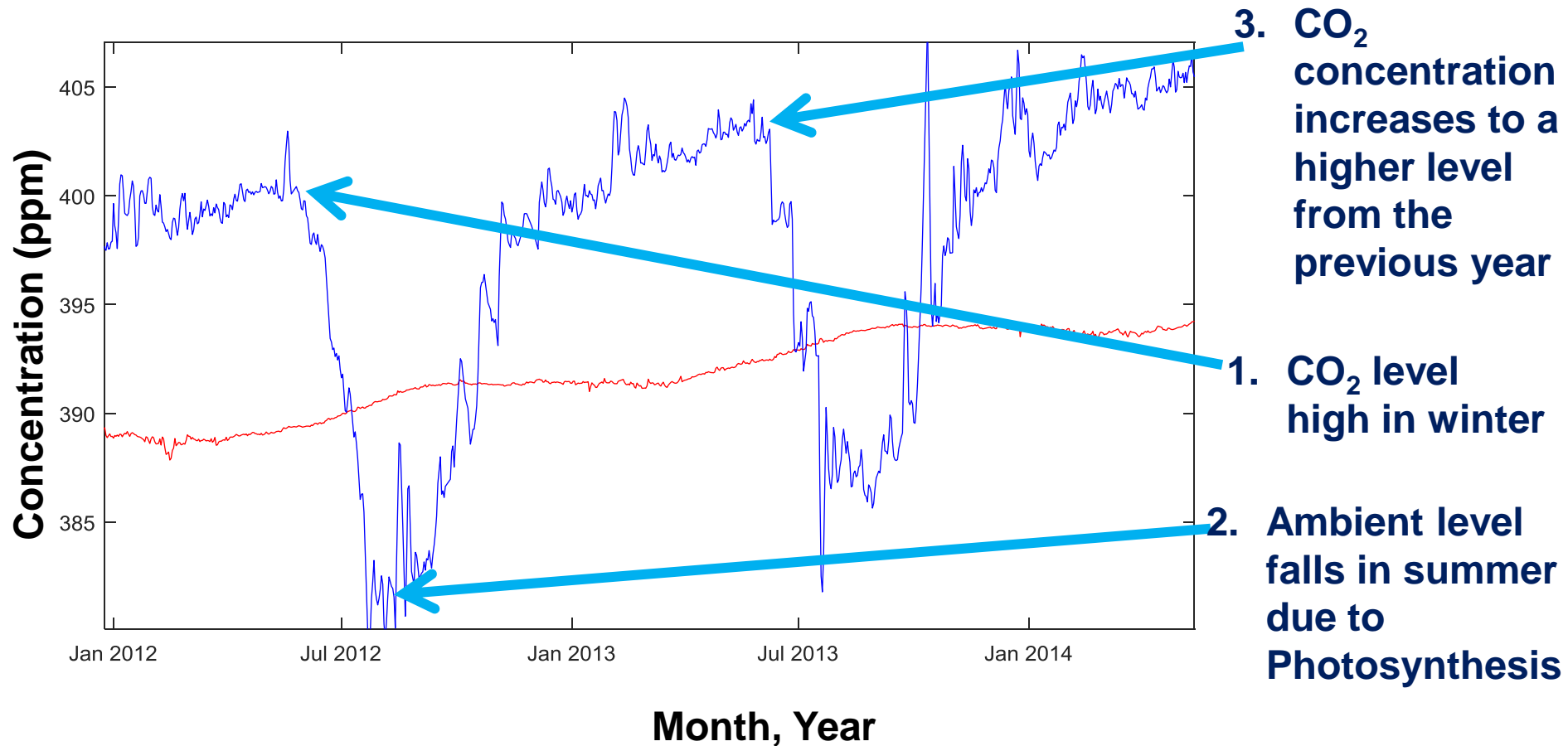


Alberta

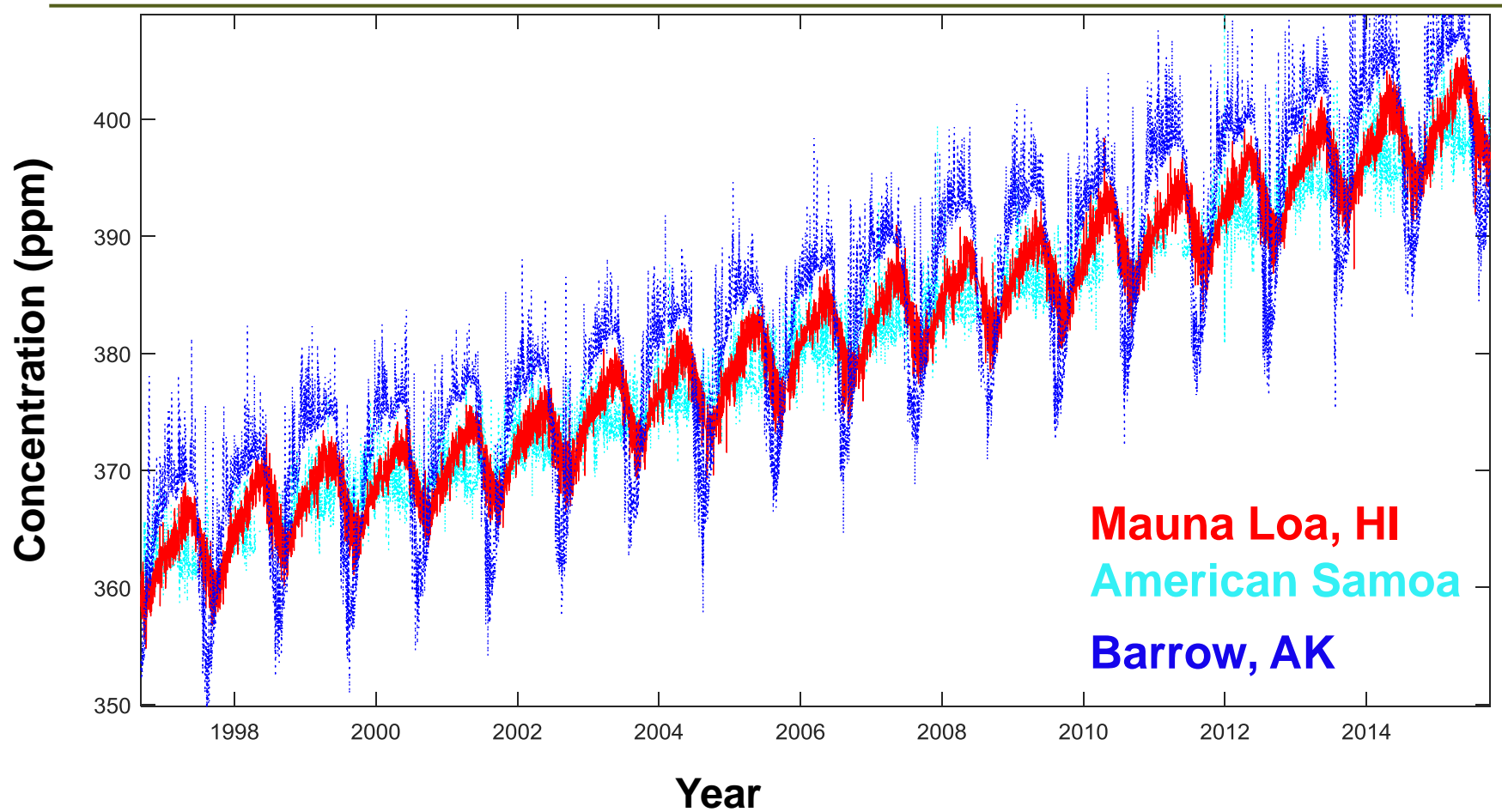
Daily averaged CO₂ at South Pole and Barrow, AK



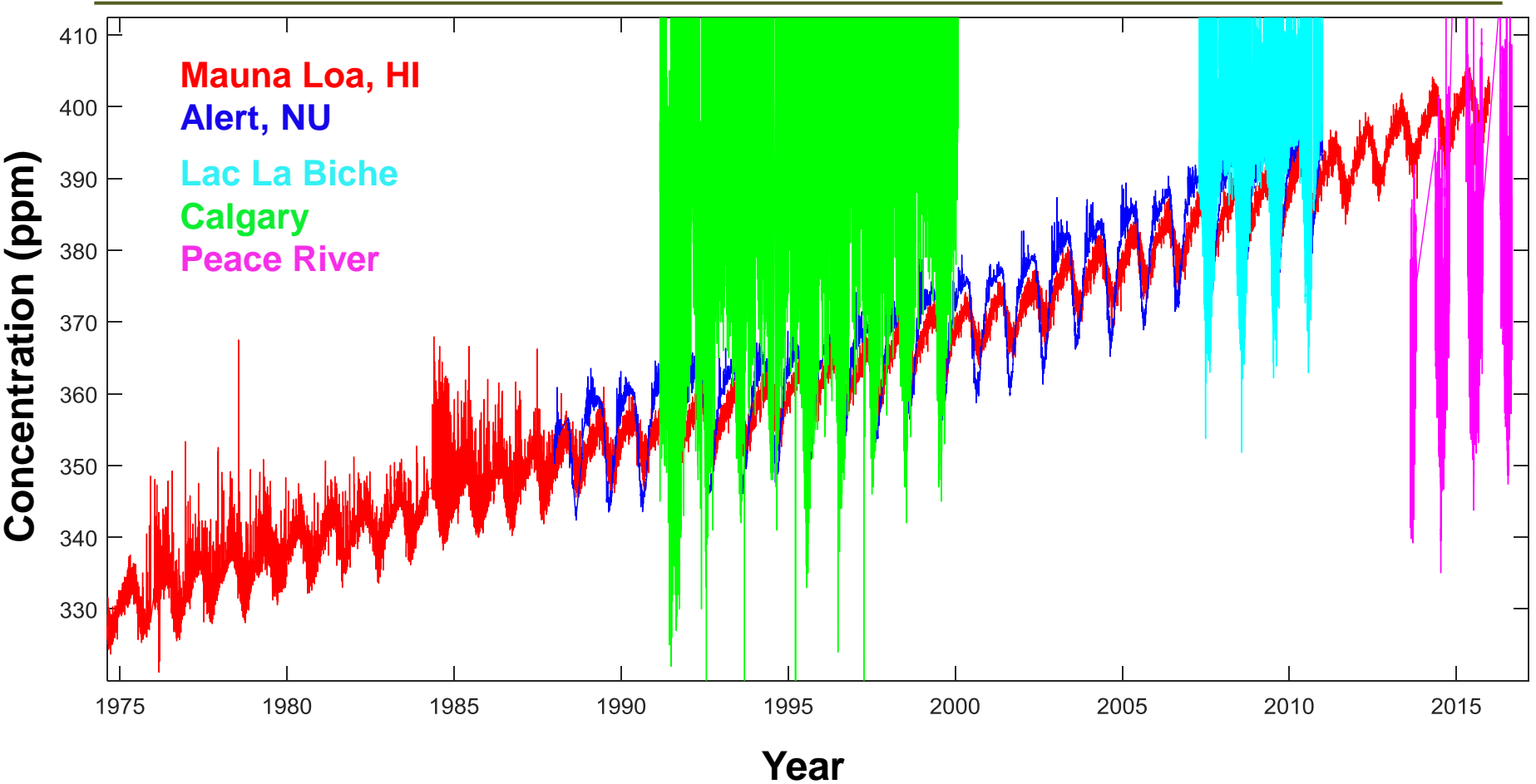
Seasonal Effects in Ambient CO₂



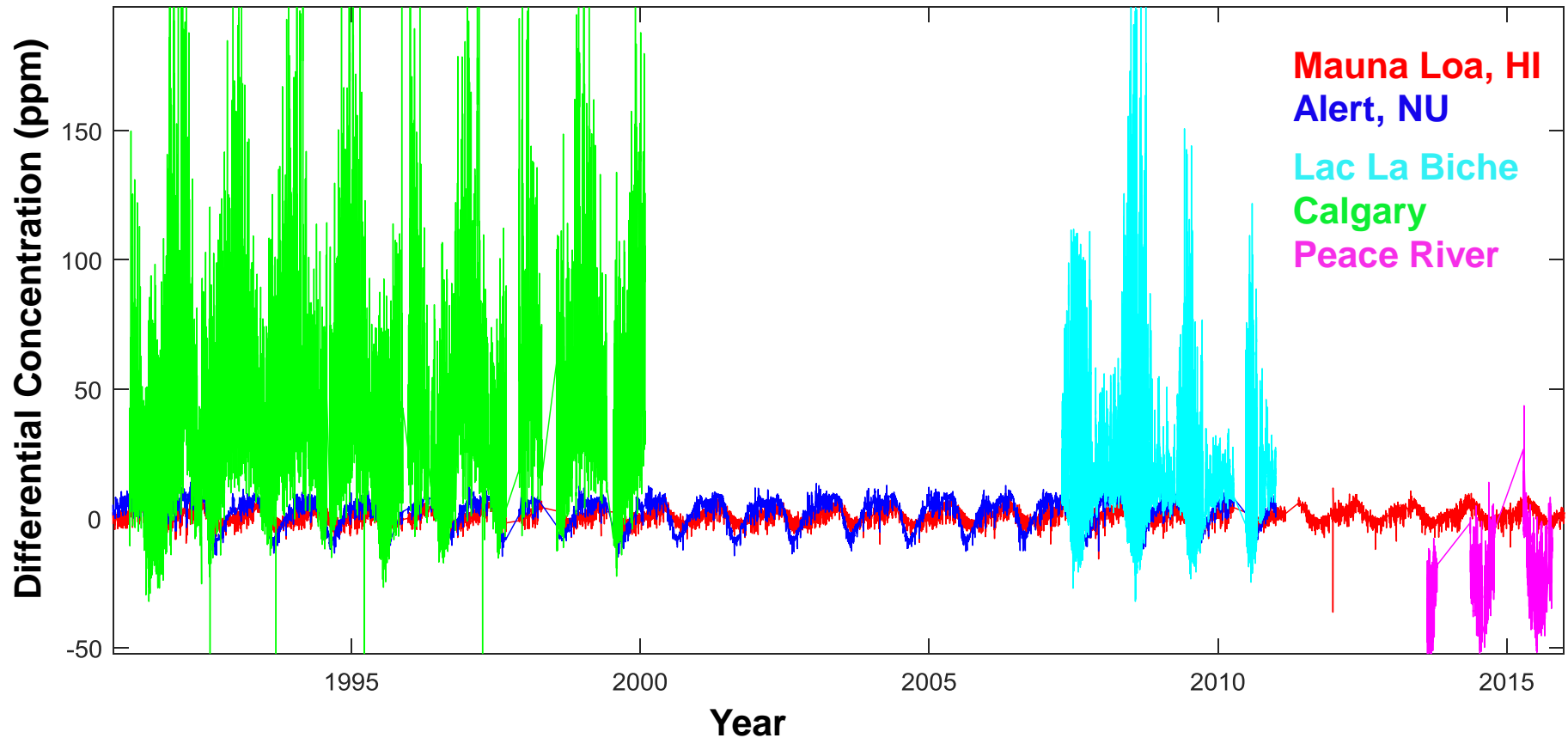
Hourly averaged CO₂ at Mauna Loa (HI), American Samoa and Barrow (AK)



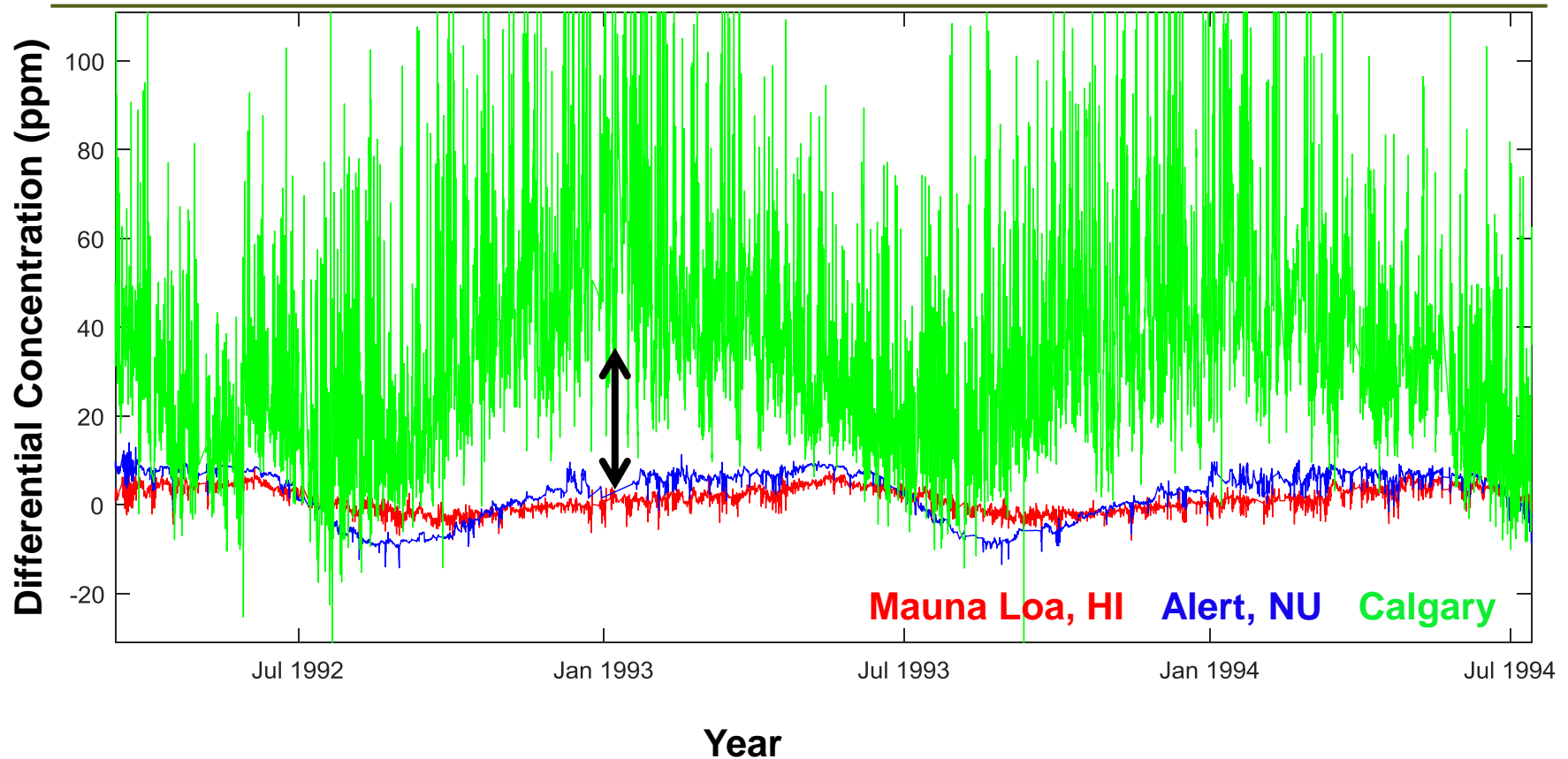
Ambient CO₂ at locations in the Arctic and Alberta



CO₂ concentrations without the Global Trend

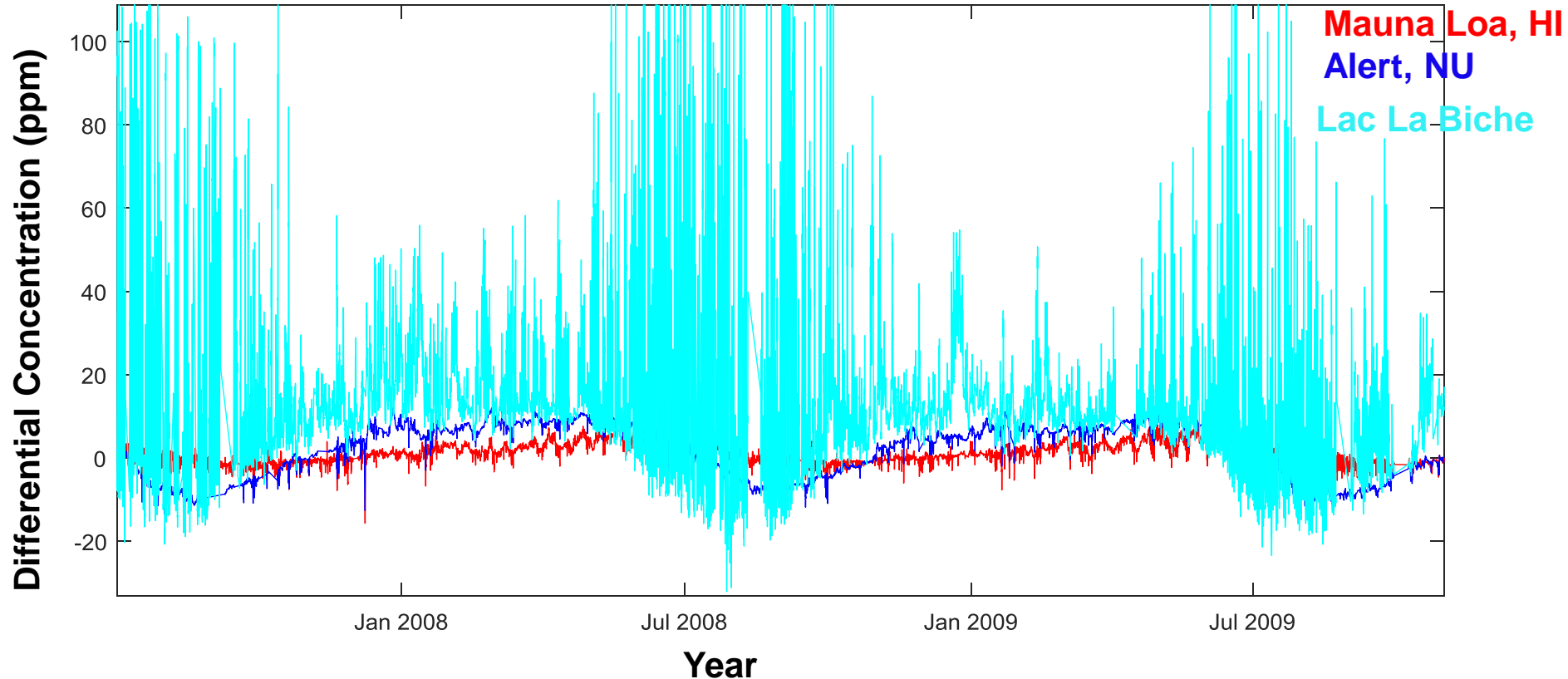


Seasonal Variations, Calgary



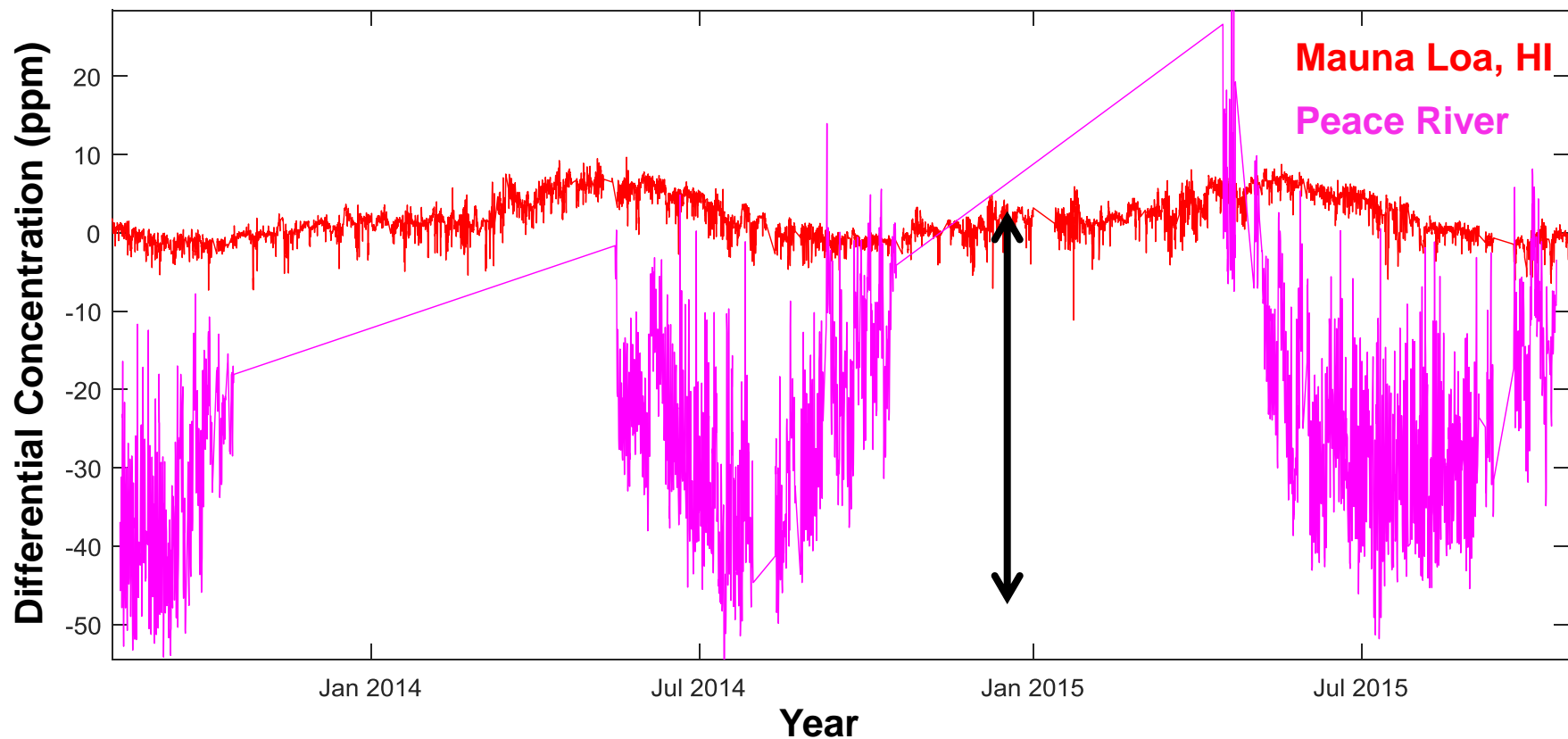
Calgary has higher levels of CO₂ especially in winter seasons

Seasonal Variations, Lac La Biche



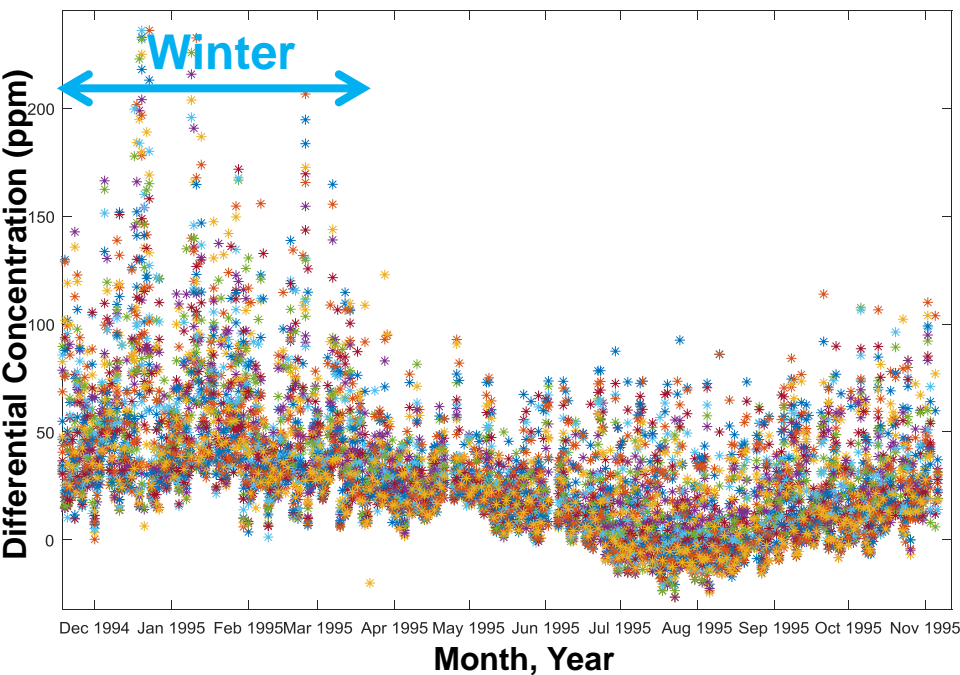
Lac La Biche has similar levels of CO₂ as Alert, NU in winter

Seasonal Variations, Peace River

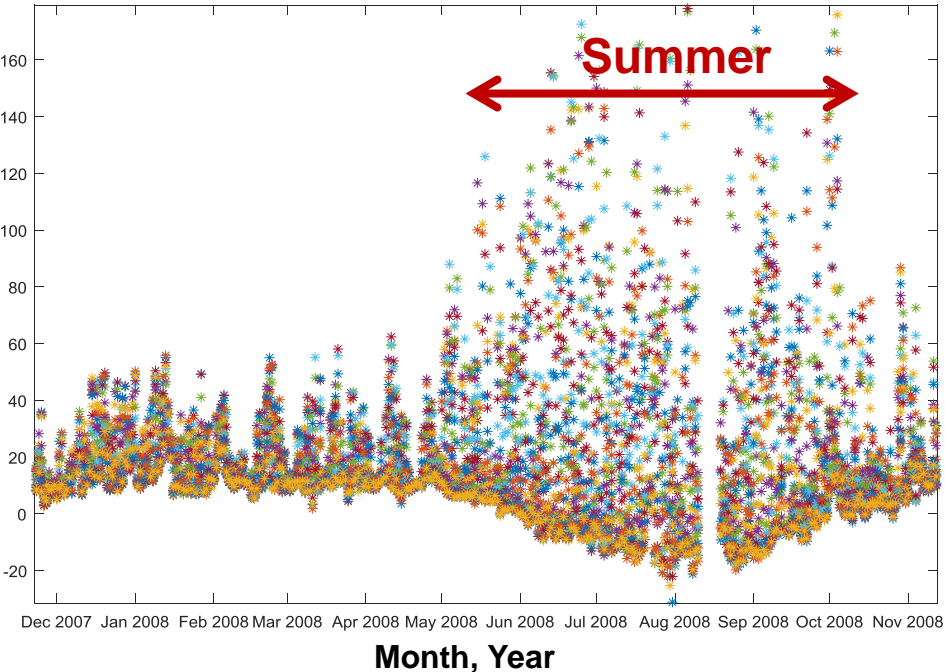


Peace River has strong reduction in ambient CO₂ concentration in summer

Hourly CO₂ Concentration Distributions



Calgary

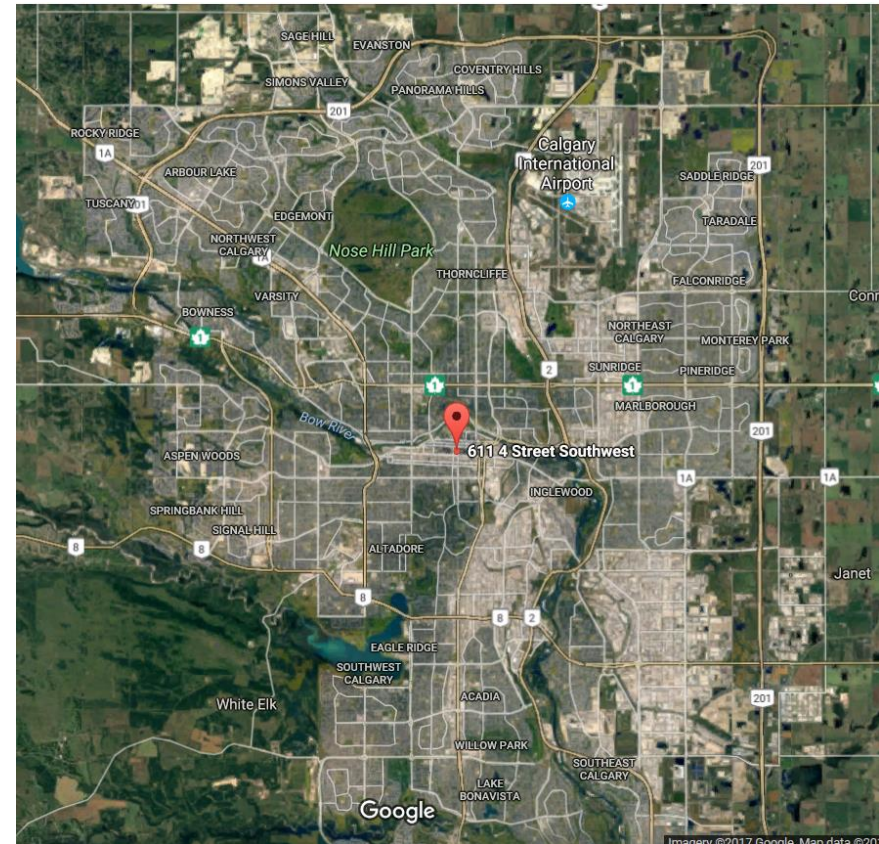
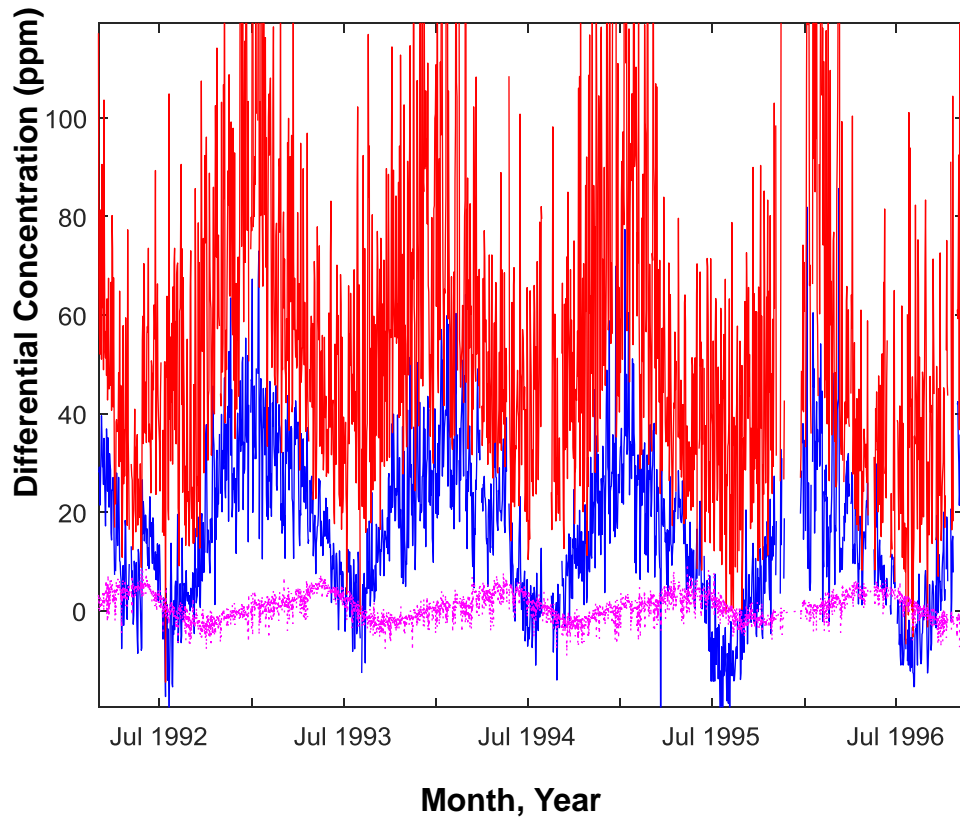


Lac La Biche

Higher concentrations occur in Calgary mostly in winter. Higher concentrations were observed at Lac La Biche during summer

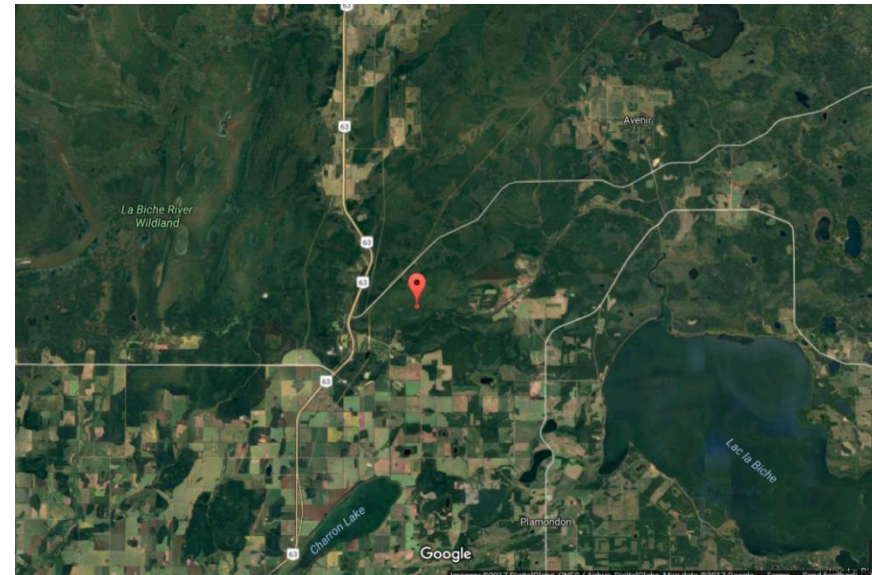
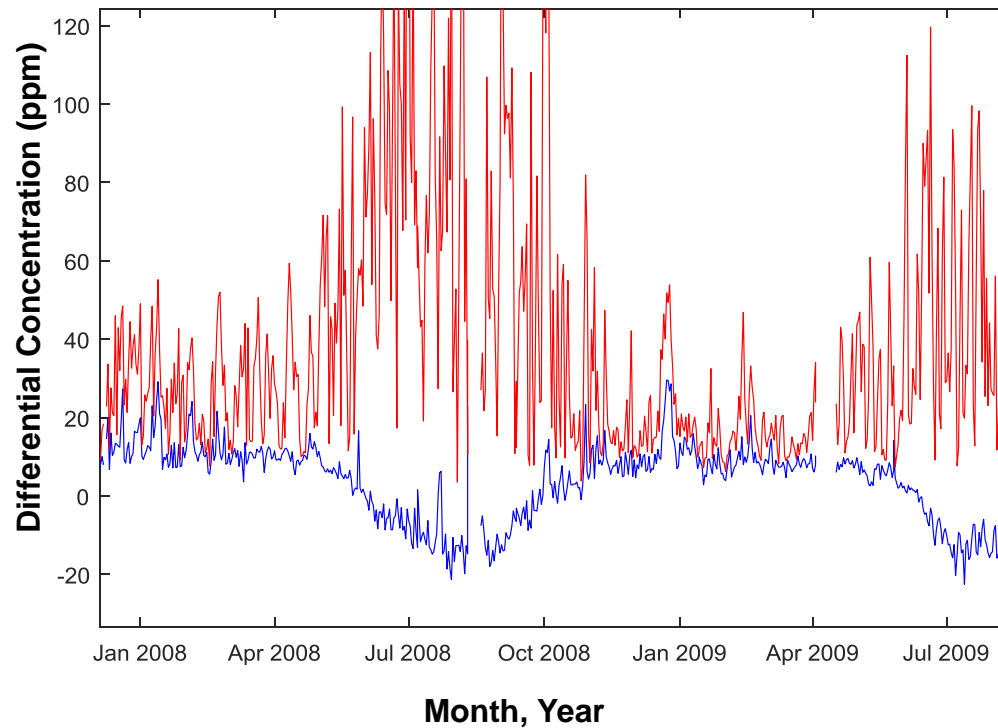
Percentile Distribution, Calgary

10th Percentile 90th Percentile



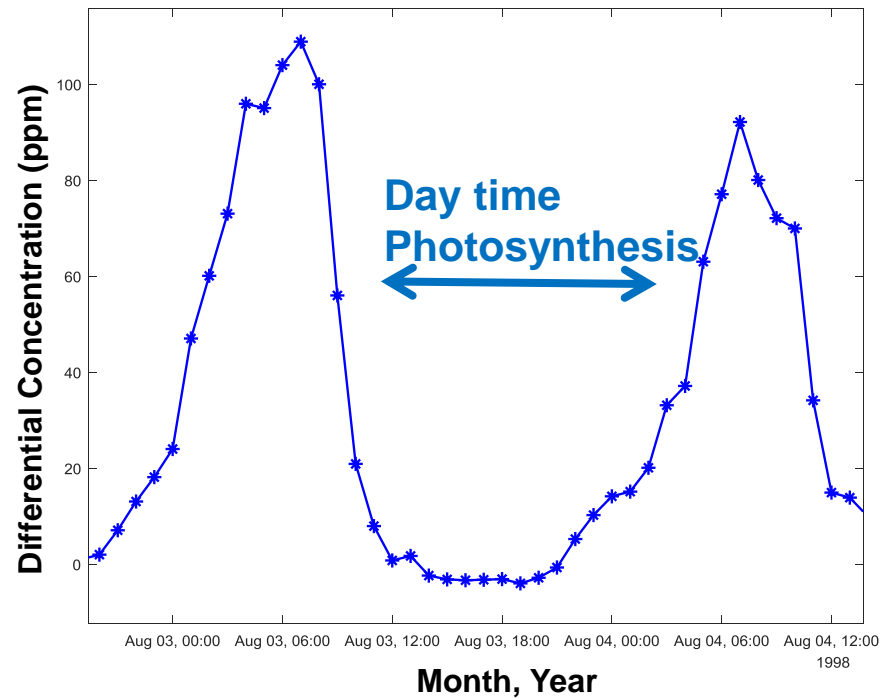
Percentile Distribution, Lac La Biche

10th Percentile 90th Percentile

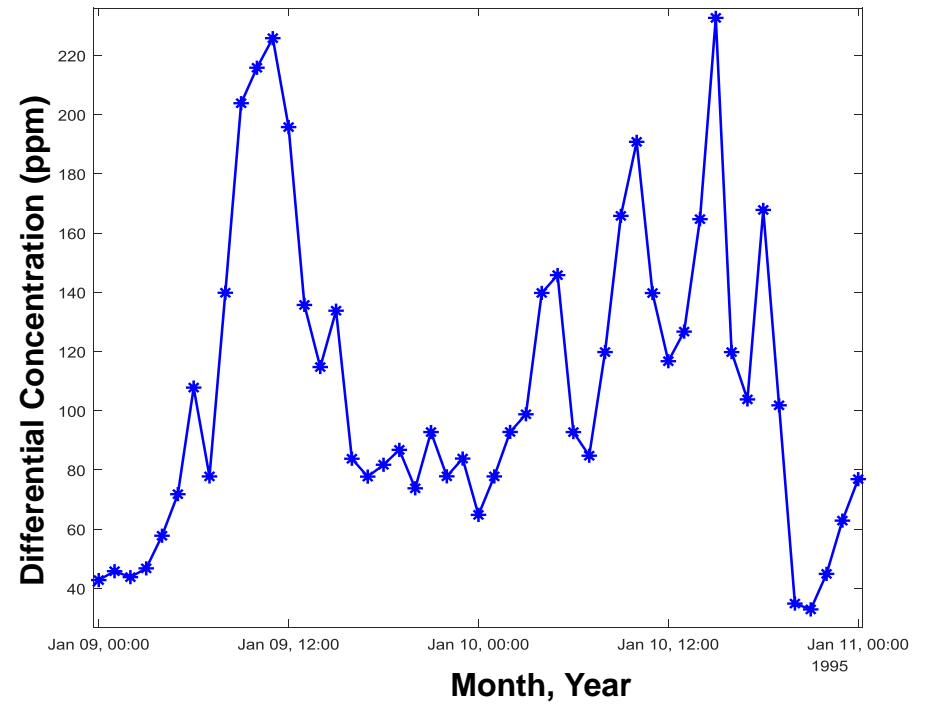


Diurnal Variations, Calgary

Summer

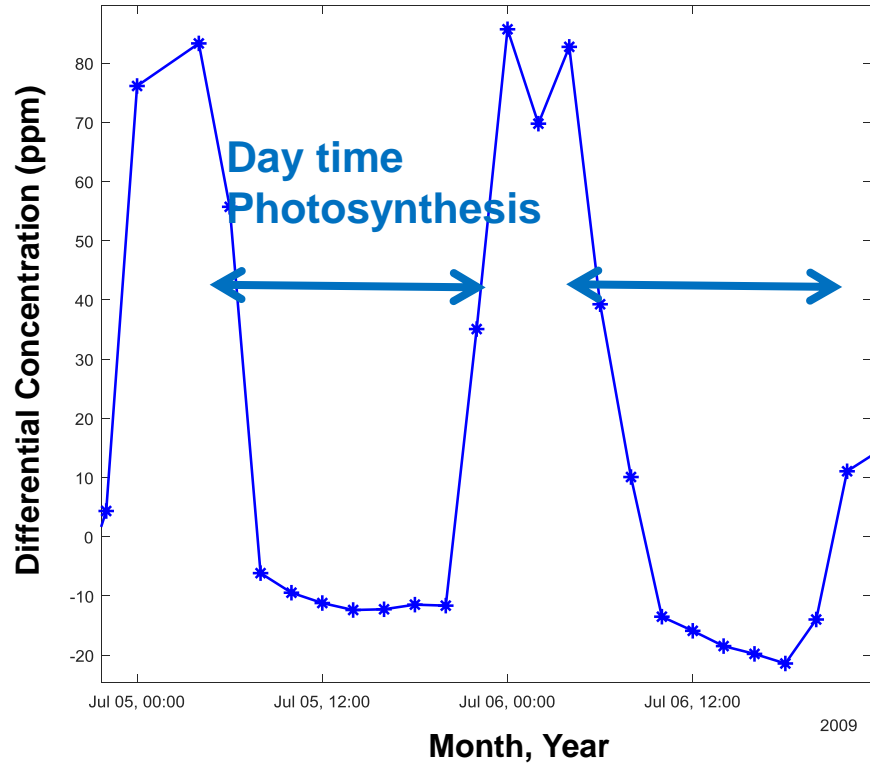


Winter

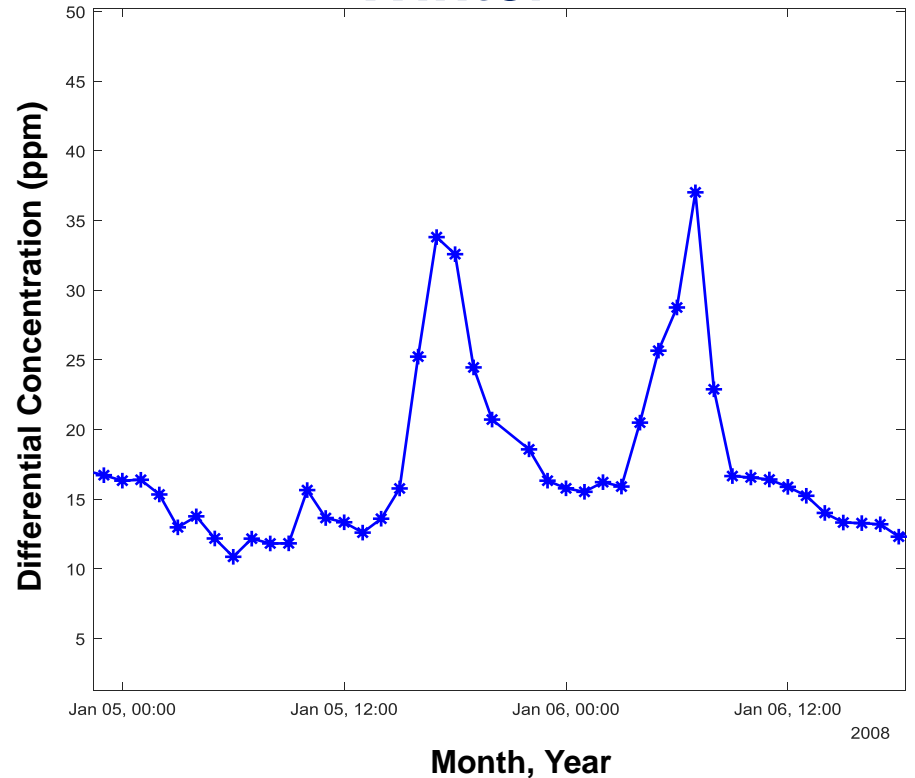


Diurnal Variations, Lac La Biche

Summer

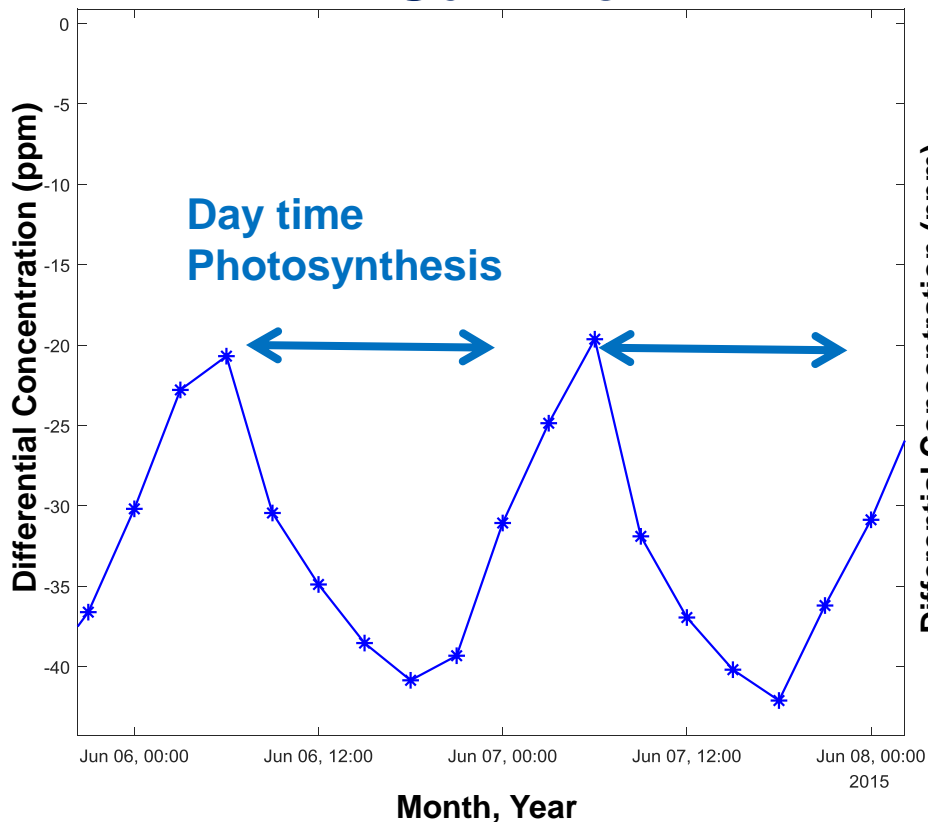


Winter

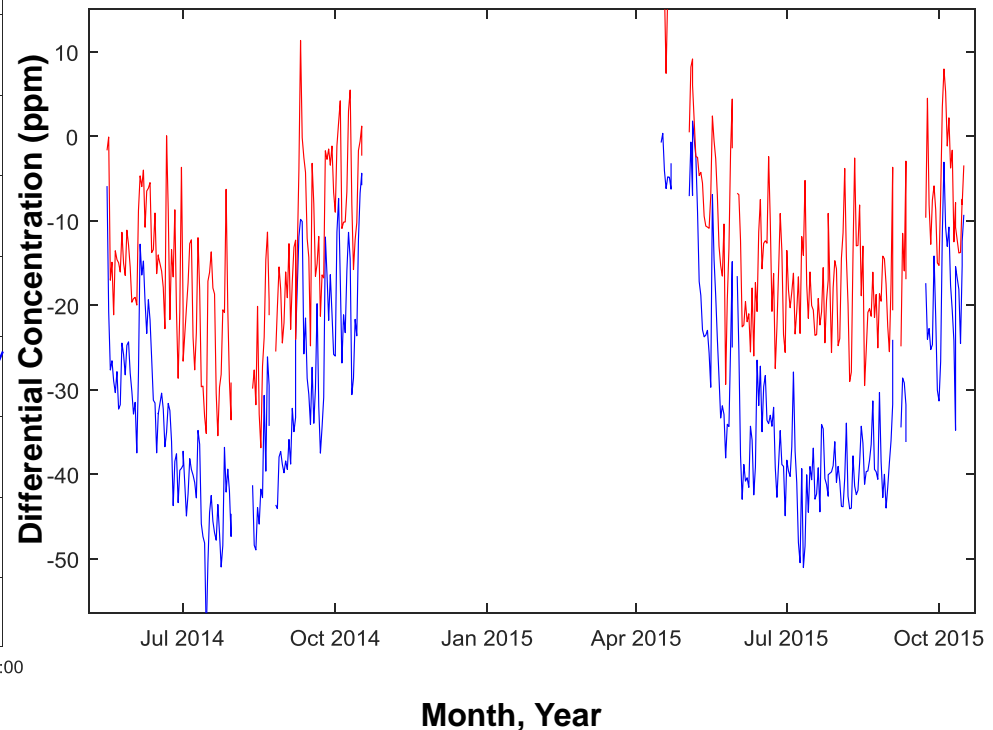


Diurnal Variations, Peace River

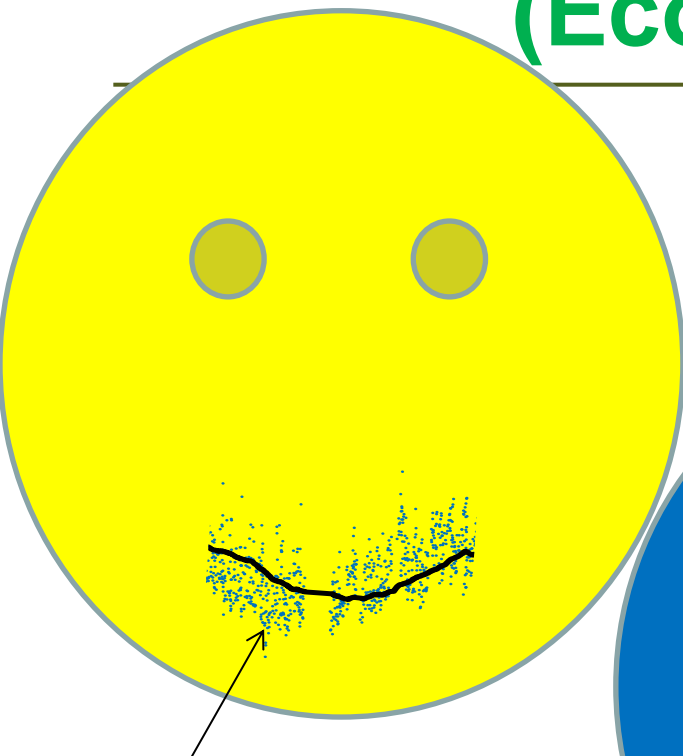
Summer



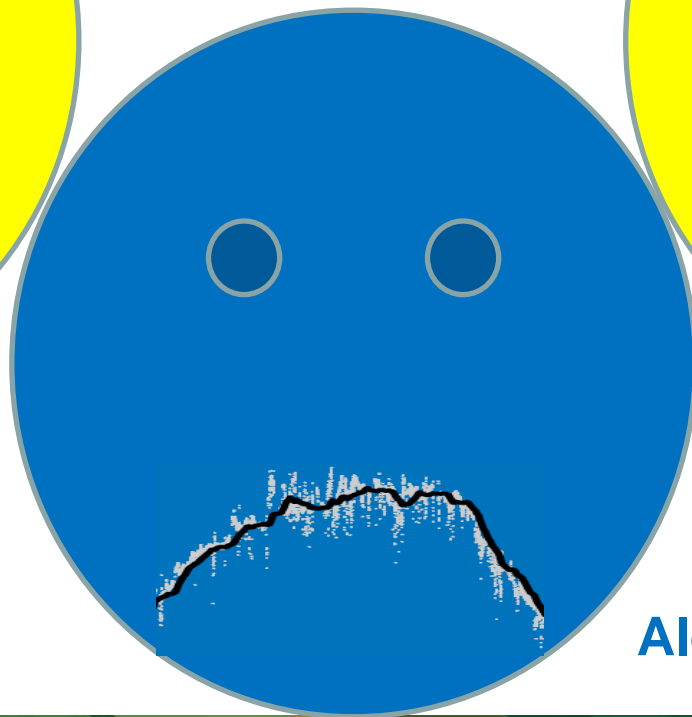
10th Percentile 90th Percentile



CO₂: The Thermometer (Ecosystem Health)



Peace River
Summer 2014



Peace River
Summer 2015

Alert, NU, Winter 1994

Conclusions

- Ambient CO₂ concentration varies regionally.
- CO₂ concentration reaches at its highest level in winter.
- Plant photosynthesis can be a significant source of CO₂ absorption.
- Winter time elevated levels of CO₂ in ranges of up to 400 ppm was monitored at the city of Calgary.
- Summer time elevation in ranges on the order of 150 ppm was observed at Lac LaBiche.
- Summer time reduction of CO₂ level by 50 ppm was monitored in a pristine forest location at Peace River.
- CO₂ is a thermometer for ecosystem health.

Thanks!

