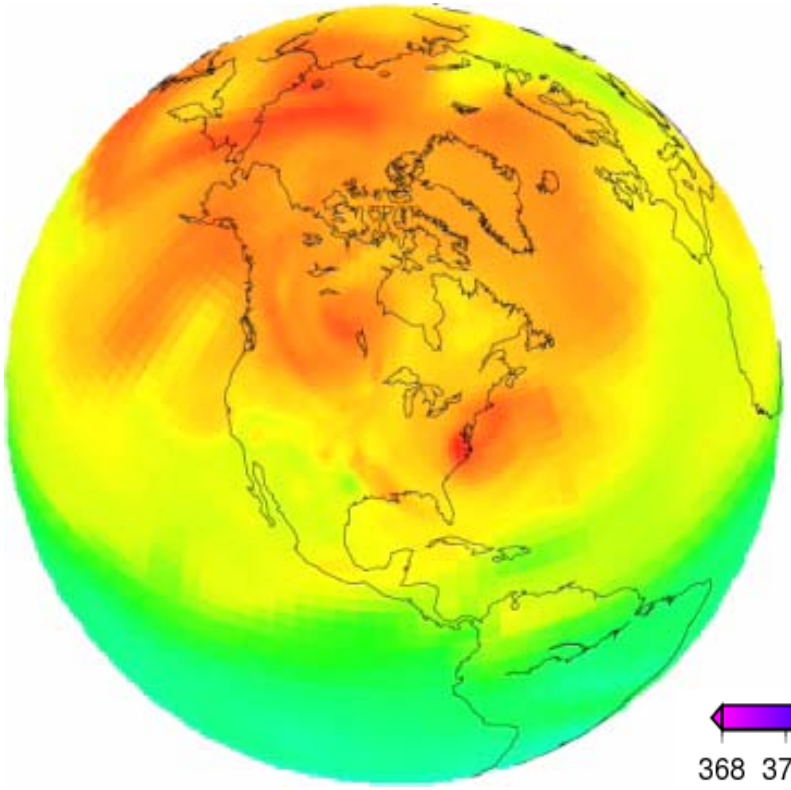
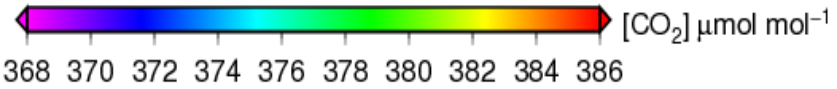
The CarbonTracker Modeling Effort



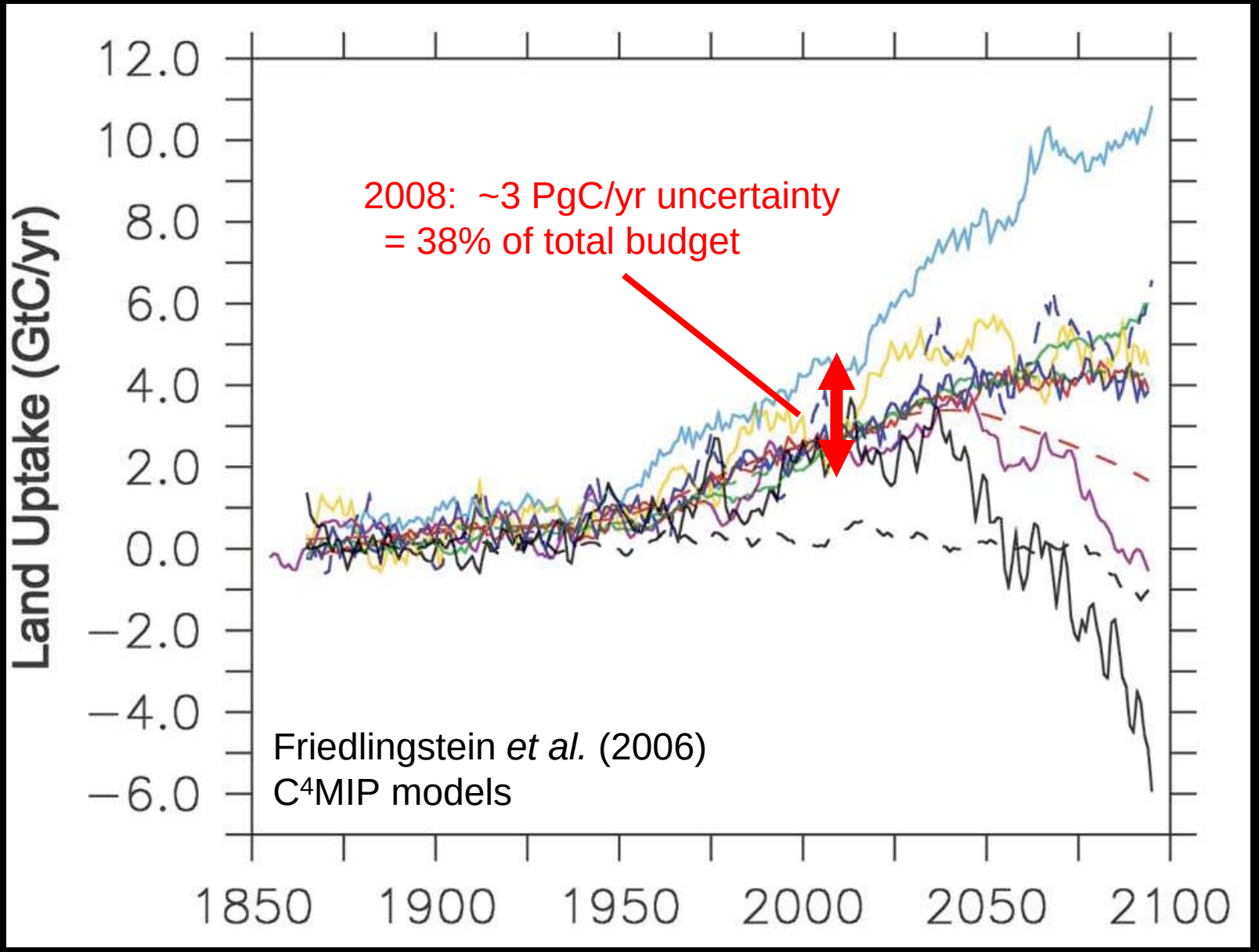
CarbonTracker
free troposphere
CO_2 mole fractions

May, 2005 – August 2005



Andy Jacobson
for the CarbonTracker team
carbontracker.noaa.gov
carbontracker.team@noaa.gov

What is the need?



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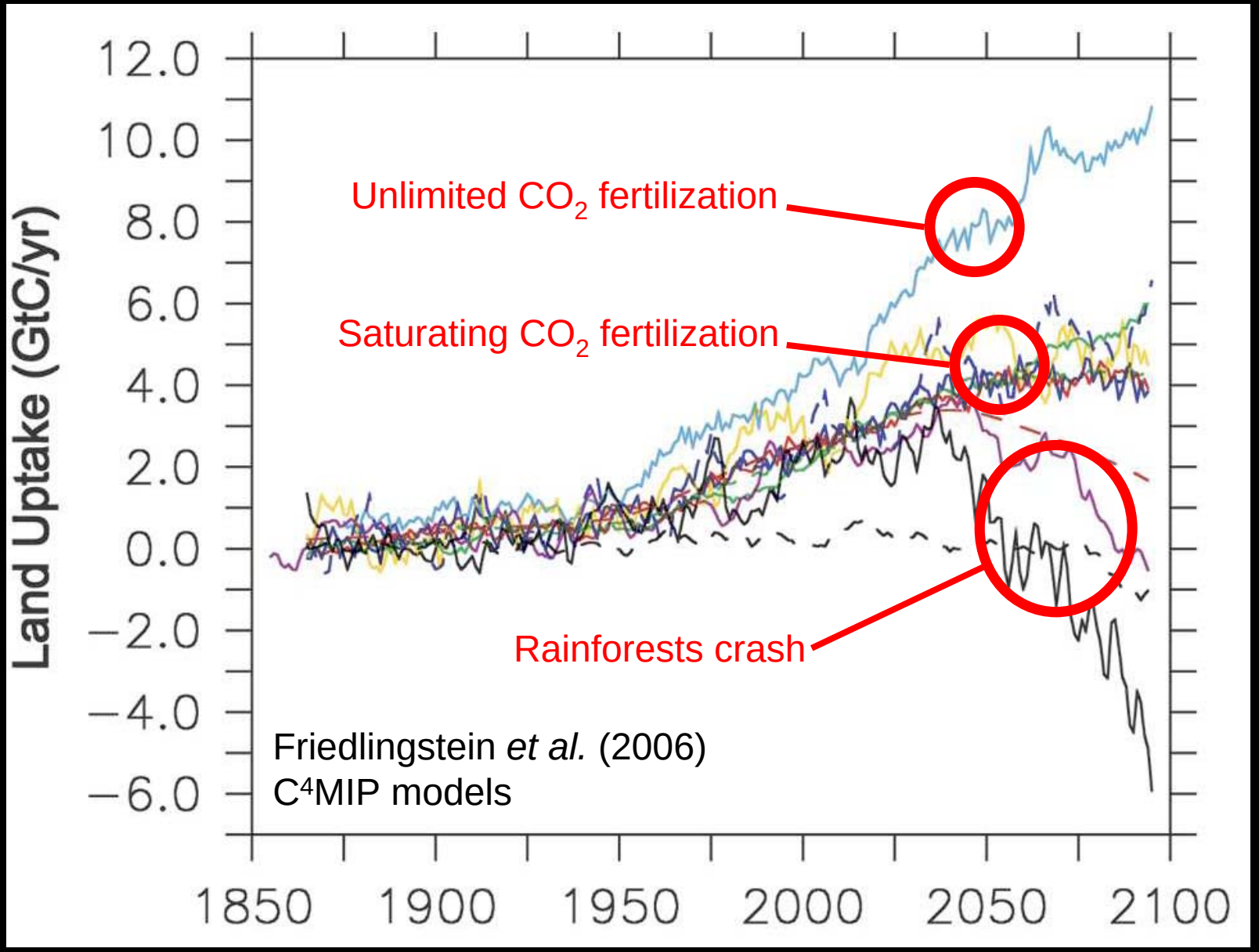
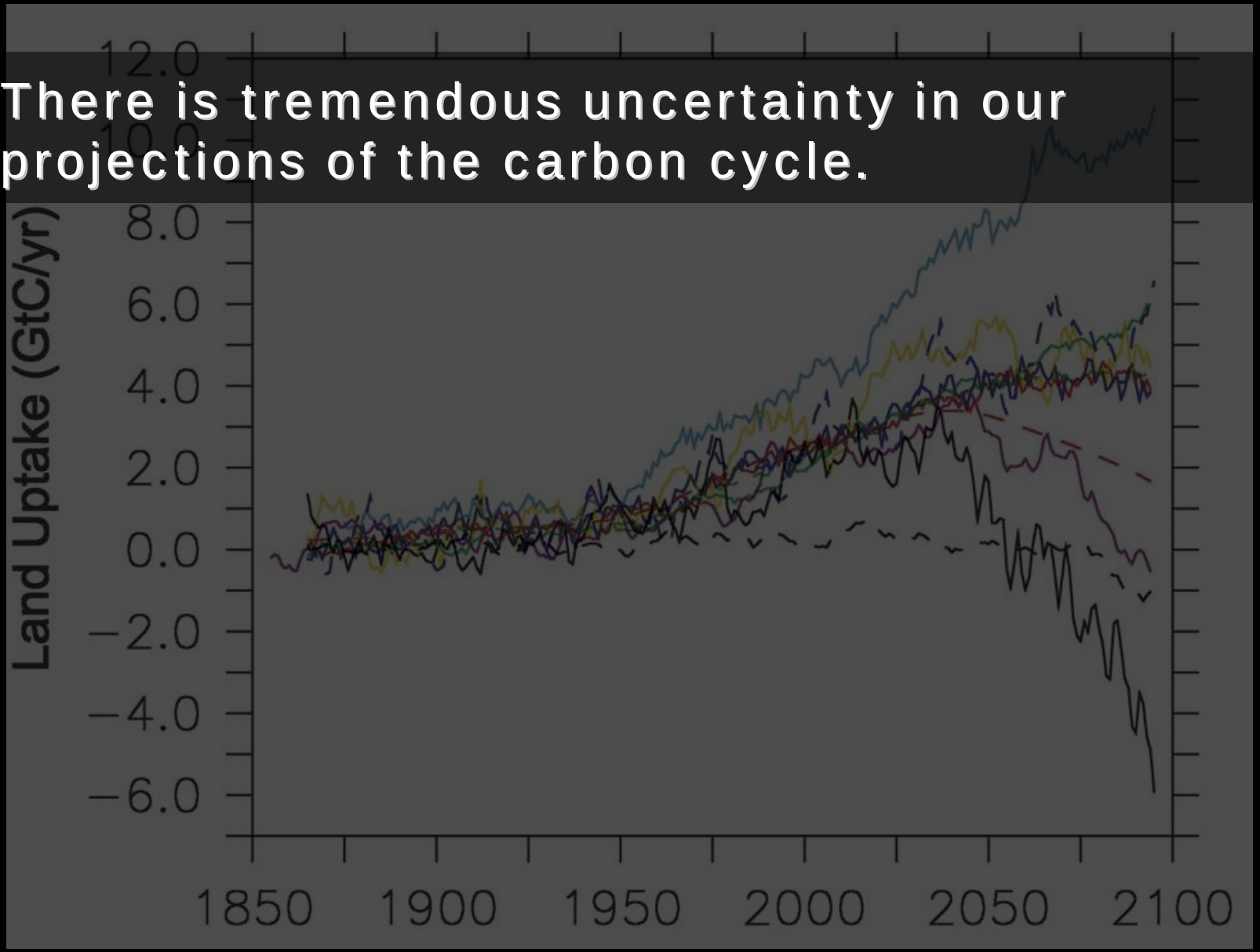


Why an inverse model?

There is tremendous uncertainty in our projections of the carbon cycle.



Sink

Source

Why an inverse model?

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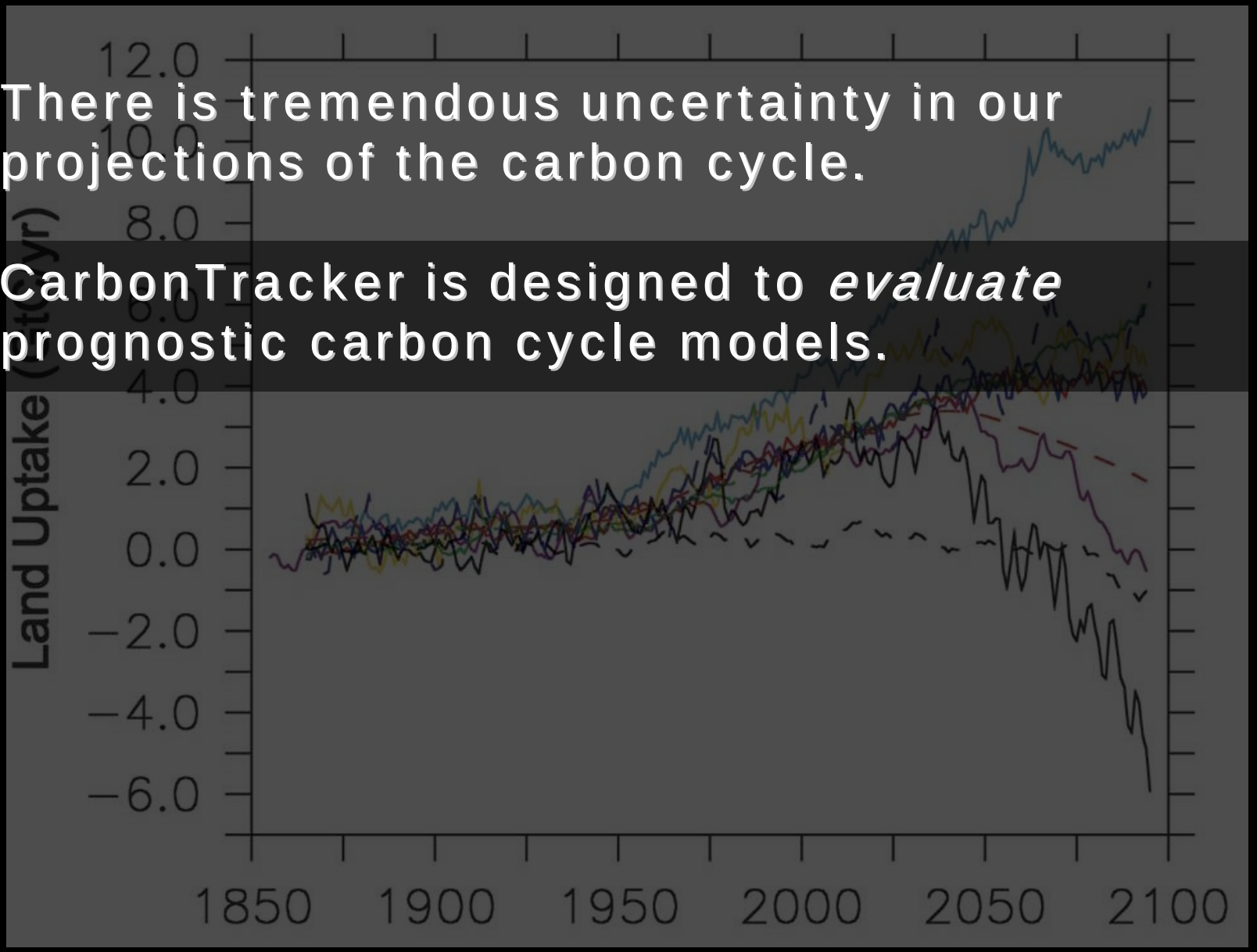
CarbonTracker is designed to *evaluate* prognostic carbon cycle models.



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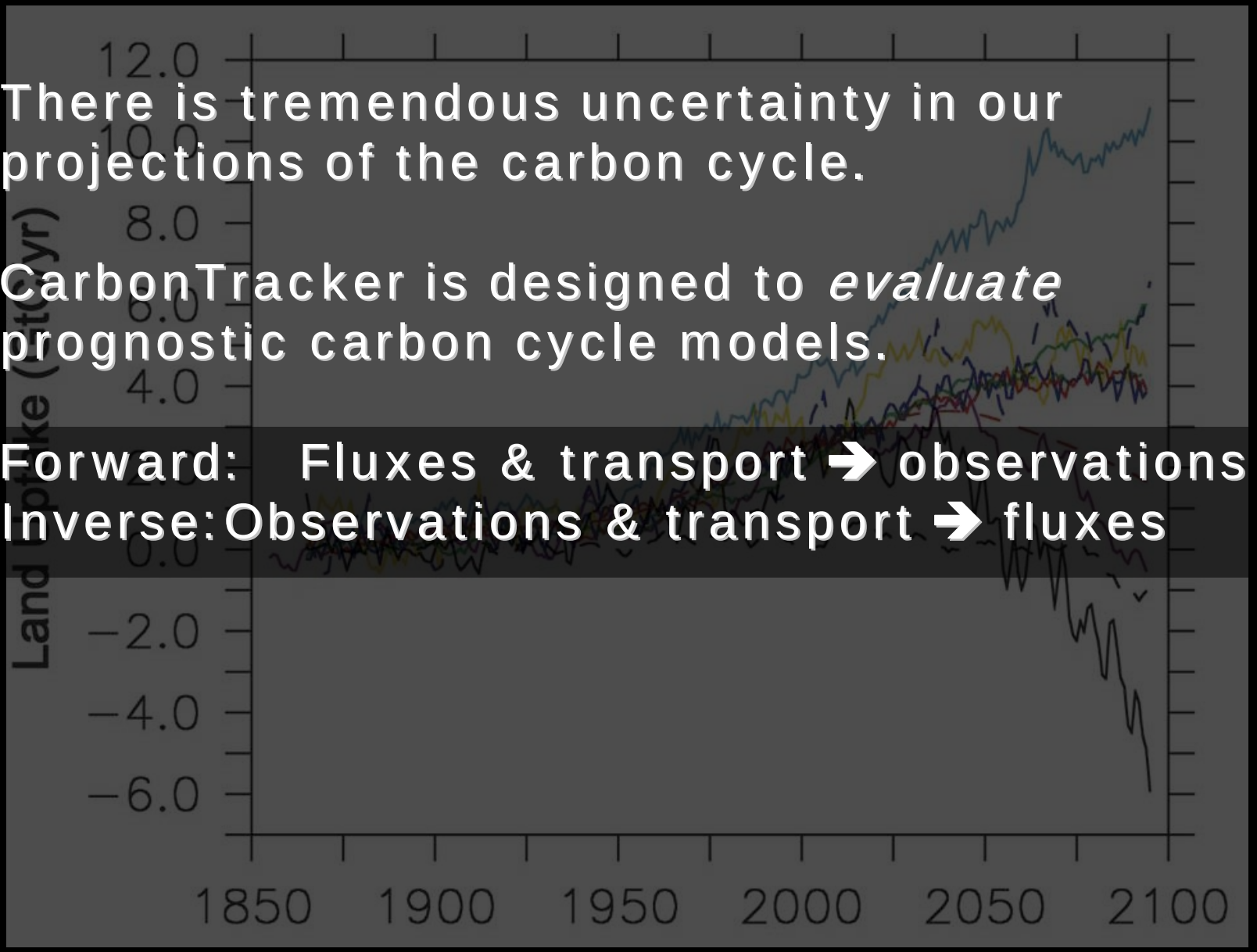
Inverse: Observations & transport ➔ fluxes



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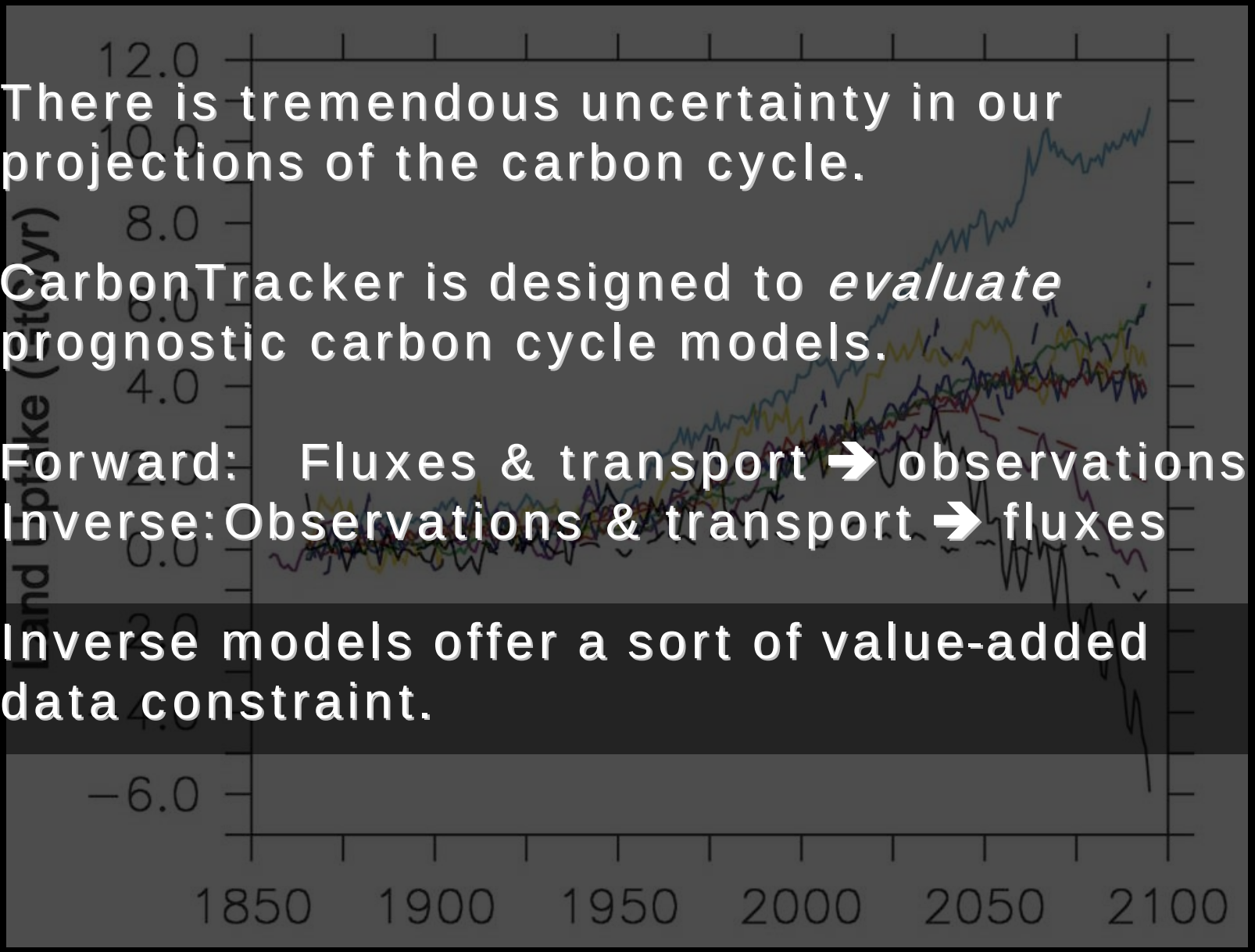
Inverse models offer a sort of value-added data constraint.



Sink

Source

CarbonTracker

structure

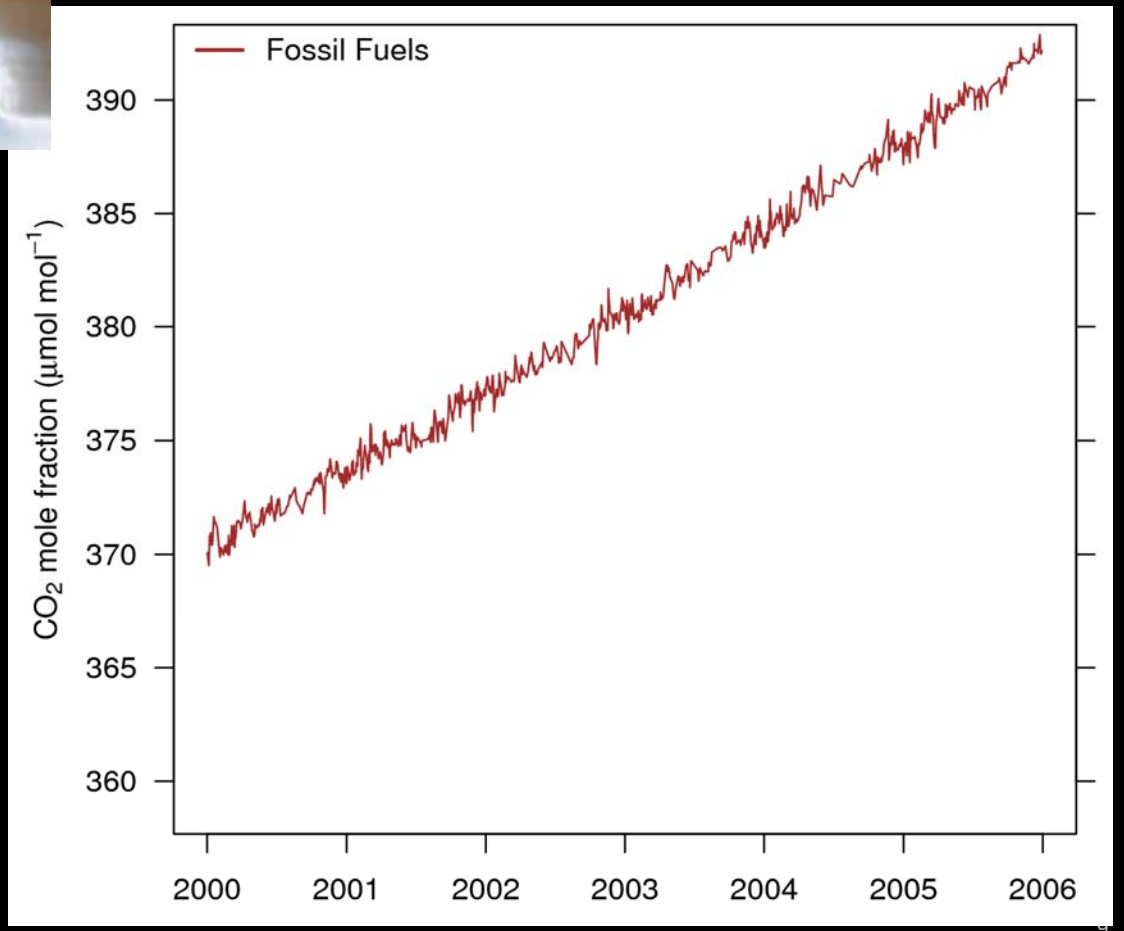
Fossil Fuel emissions: John Miller, from EDGAR, BP, CDIAC

CarbonTracker

structure

Transport: offline model (TM5) driven by ECMWF analyses, postprocessed to conserve mass.

Mauna Loa, Hawaii

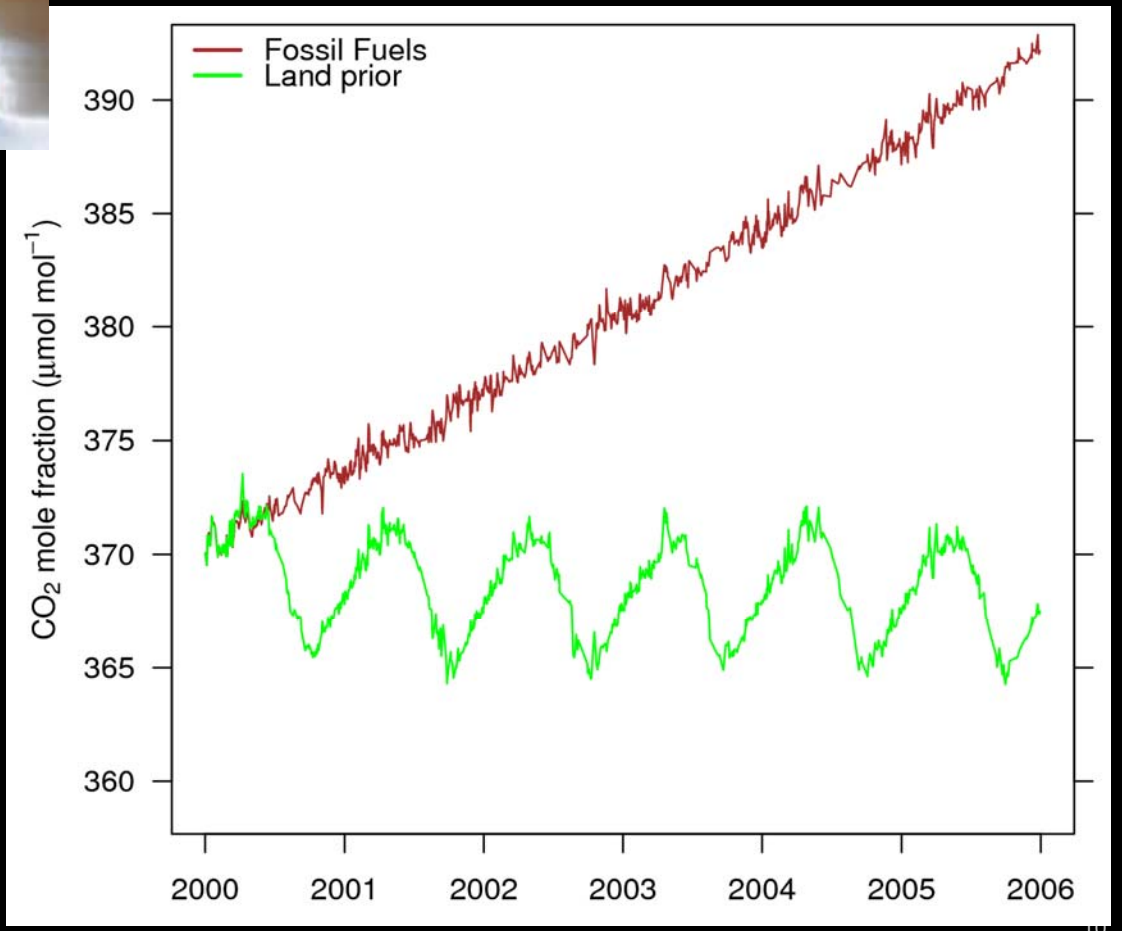


CarbonTracker

structure

Terrestrial biosphere: satellite fire counts acting on NDVI-driven "CASA" model (from GFED2 of van der Werf et al.)

Mauna Loa, Hawaii



CarbonTracker

structure

Air-sea fluxes: ocean interior inversions of Jacobson et al. (2007)

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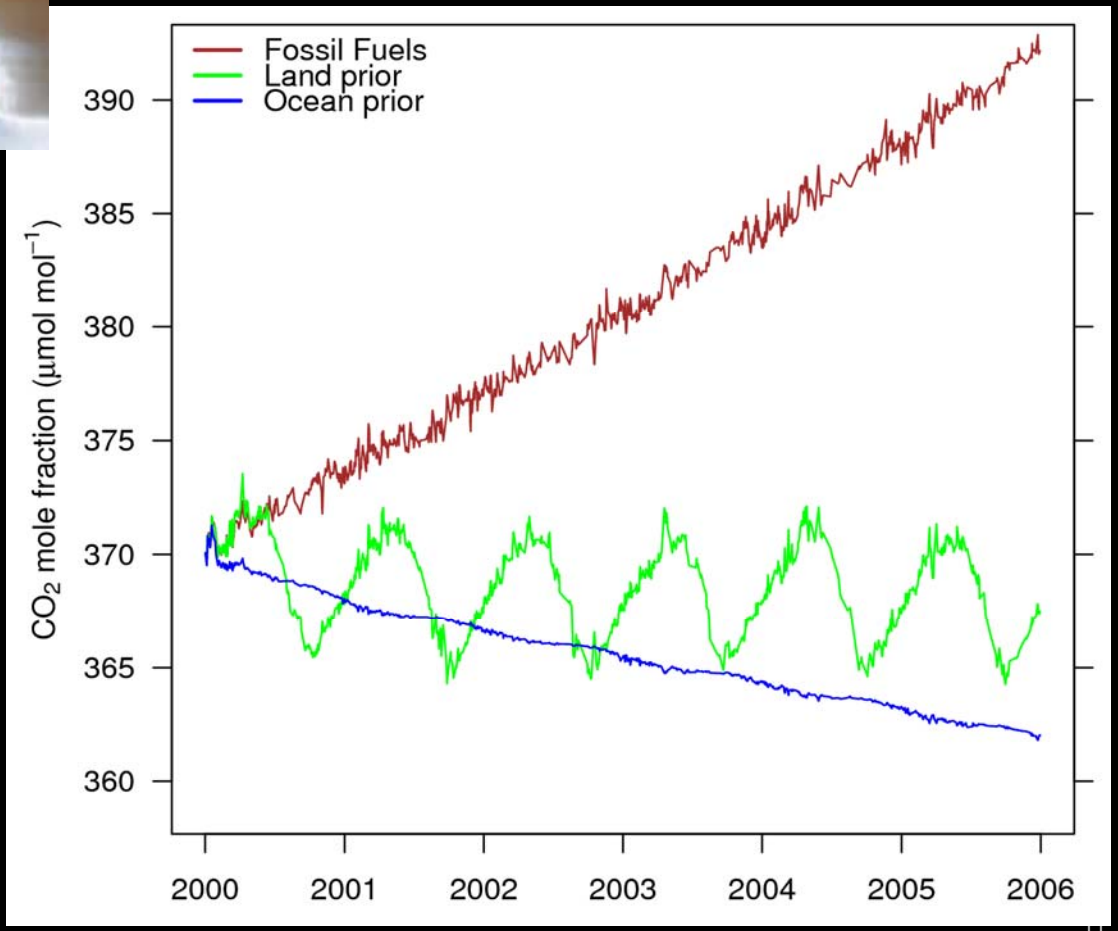

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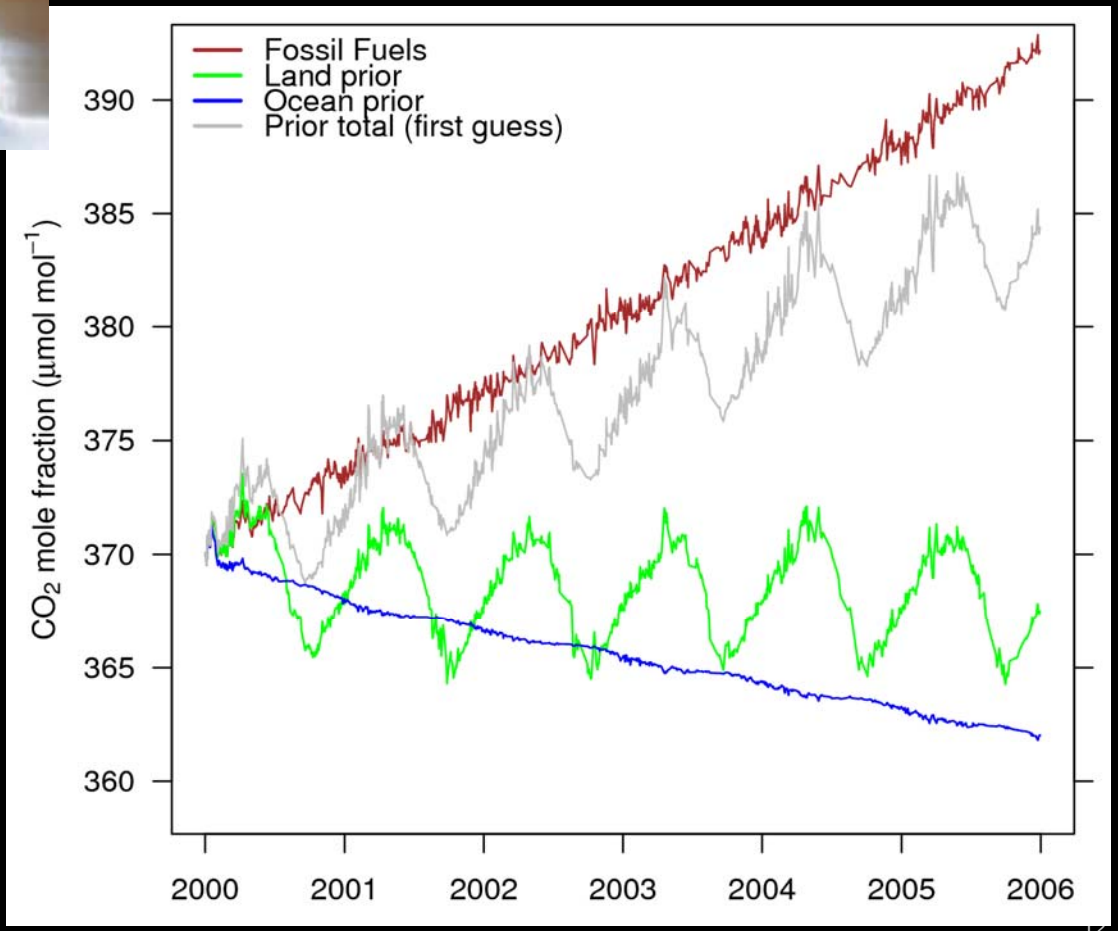

CarbonTracker

structure

Observations: GMD, EC, NCAR, CSIRO, …

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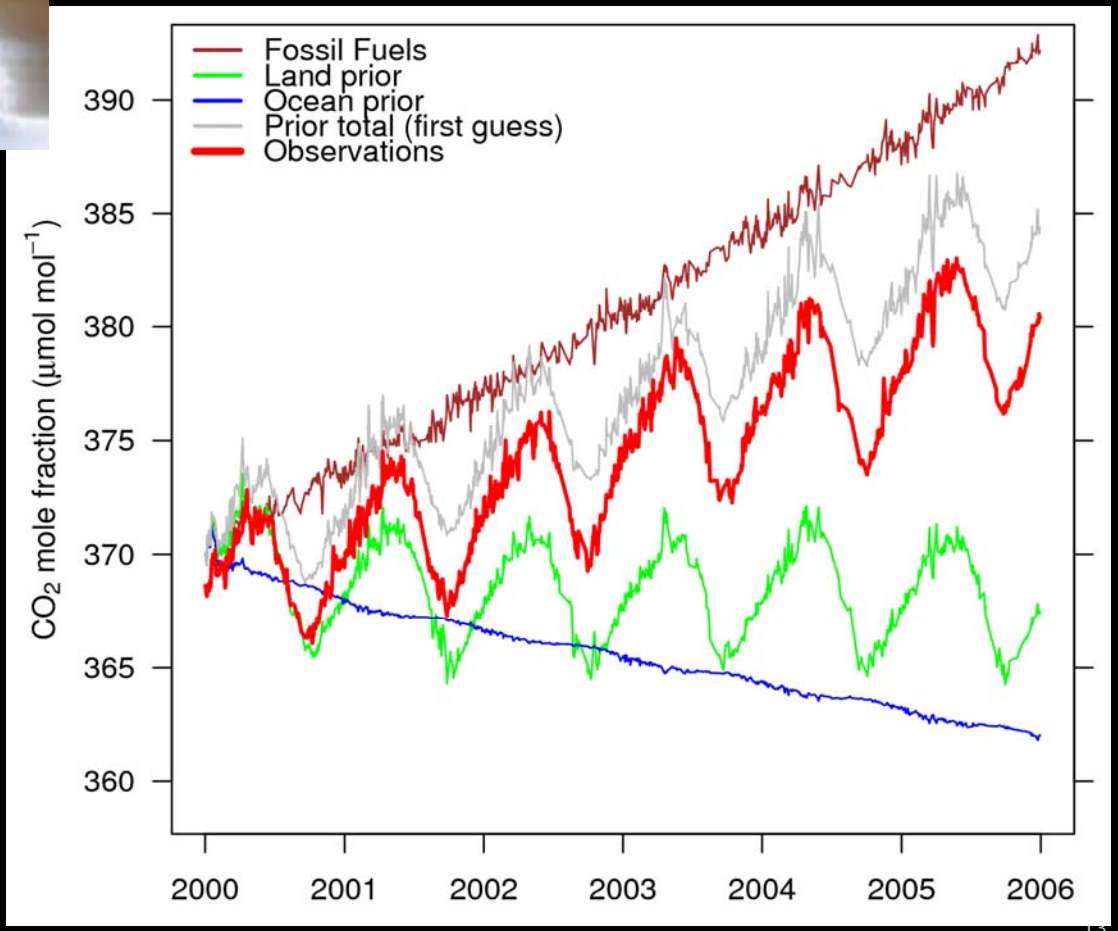
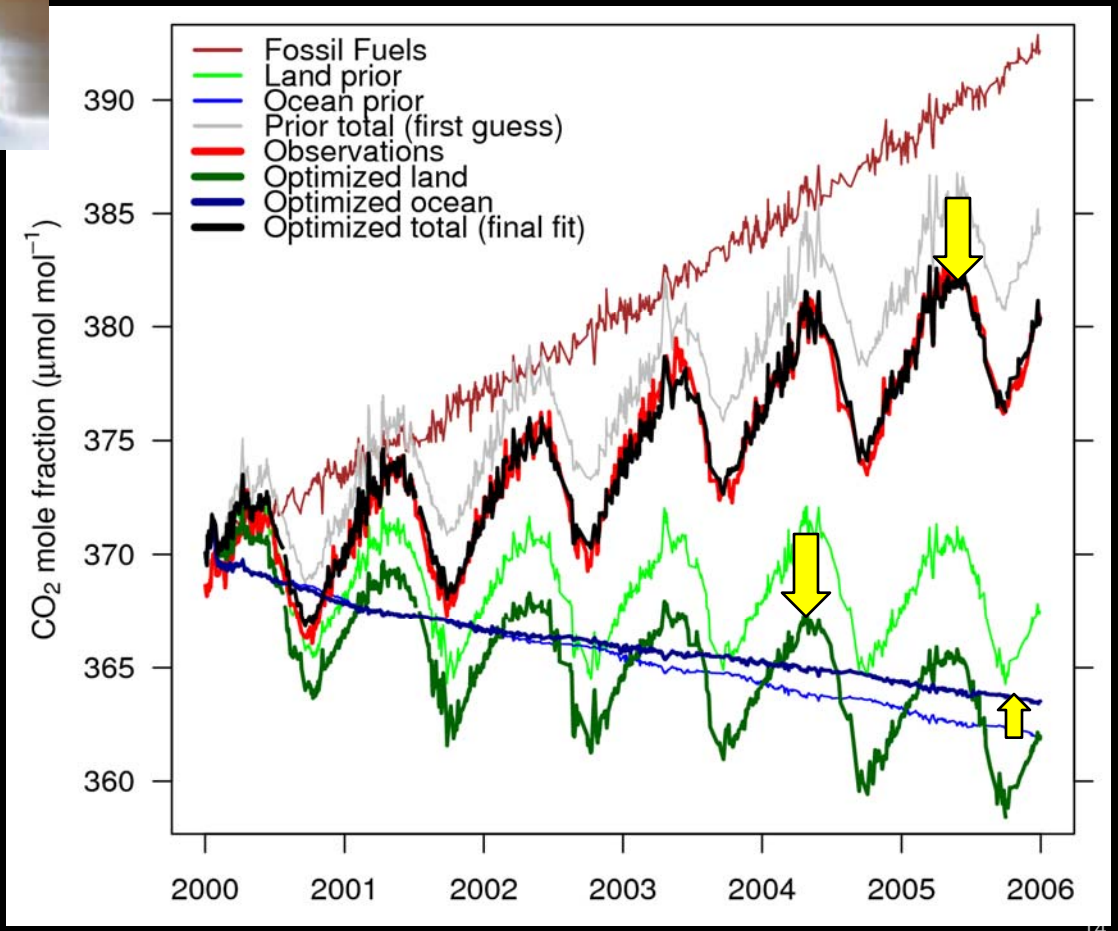


CarbonTracker

structure

Optimization: EnSRF of Whitaker and Hamill (2002)

Mauna Loa, Hawaii



CarbonTracker

Strengths, Weaknesses, and Challenges

- Designed to work in well-observed areas, especially North America.
- Tropical, Southern Hemisphere results less certain.
- Does not predict fluxes.
- Atmospheric transport, fossil fuel emissions assumed.
- Network originally designed to avoid signals we now want (mixed-determined).
- Transport is uncertain.

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CarbonTracker

Outreach

From: Chris Measures <chrism@soest.hawaii.edu>
To: carbontracker.team@noaa.gov
Subject: Re: CarbonTracker updated: new release
Created: 12/21/2007 19:30:04

Dear Pieter et al:

This is really great, thank you for putting this together. I will certainly be using your figures and explanations in the lectures I give to my undergraduates about the CO2 system. They really want to know the facts and the most recent data are always of great interest to young people since it conveys the immediacy of the problem. I had found it increasingly difficult to get hold of some of the most recent basic information over the last few years, this web resource has made it much easier.

I am particularly happy to get the Mauna Loa data through 2006.

Thanks for facilitating teaching as well as research,

Cheers, Chris Measures
Oceanography, University of Hawaii

CarbonTracker

Future

- Multi-model ensemble (both transport and flux models)
- More data, including satellite obs
- Other weakly-reactive carbon species (CO, CH_4)
- OSSEs, hypothesis testing
- Optimize model parameters directly
- Can we provide estimates at the scale of U.S. states?

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