

EM - 1 PROJECT



*Reservoirs' net greenhouse
gas emissions research project*

GHG FLUXES (CO₂, CH₄, N₂O) AND pCO₂ MONITORING BEFORE AND DURING THE FIRST THREE YEARS OF THE EASTMAIN-1 RESERVOIR (QUEBEC, CANADA)

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www.eastmain1.org

Objectives

- Estimate net GHG emissions from a boreal reservoir
 - The difference in carbon and GHG mass balance of natural ecosystems and the new system created over 100 years



Collaboration

- Aquatic aspects
 - Dr. Yves Prairie, UQAM
 - Dr. Paul Del Giorgio, UQAM
 - Environnement Illimité
- Terrestrial aspects
 - Dr. Michelle Garneau, UQAM
 - Dr. Nigel Roulet, McGill
 - Dr. Ian Strachan, McGill
 - Marcelle Grenier, M.Sc., Environnement Canada
- Modelisation
 - Dr. Changhui Peng, UQAM
 - Dr. Nigel Roulet, McGill



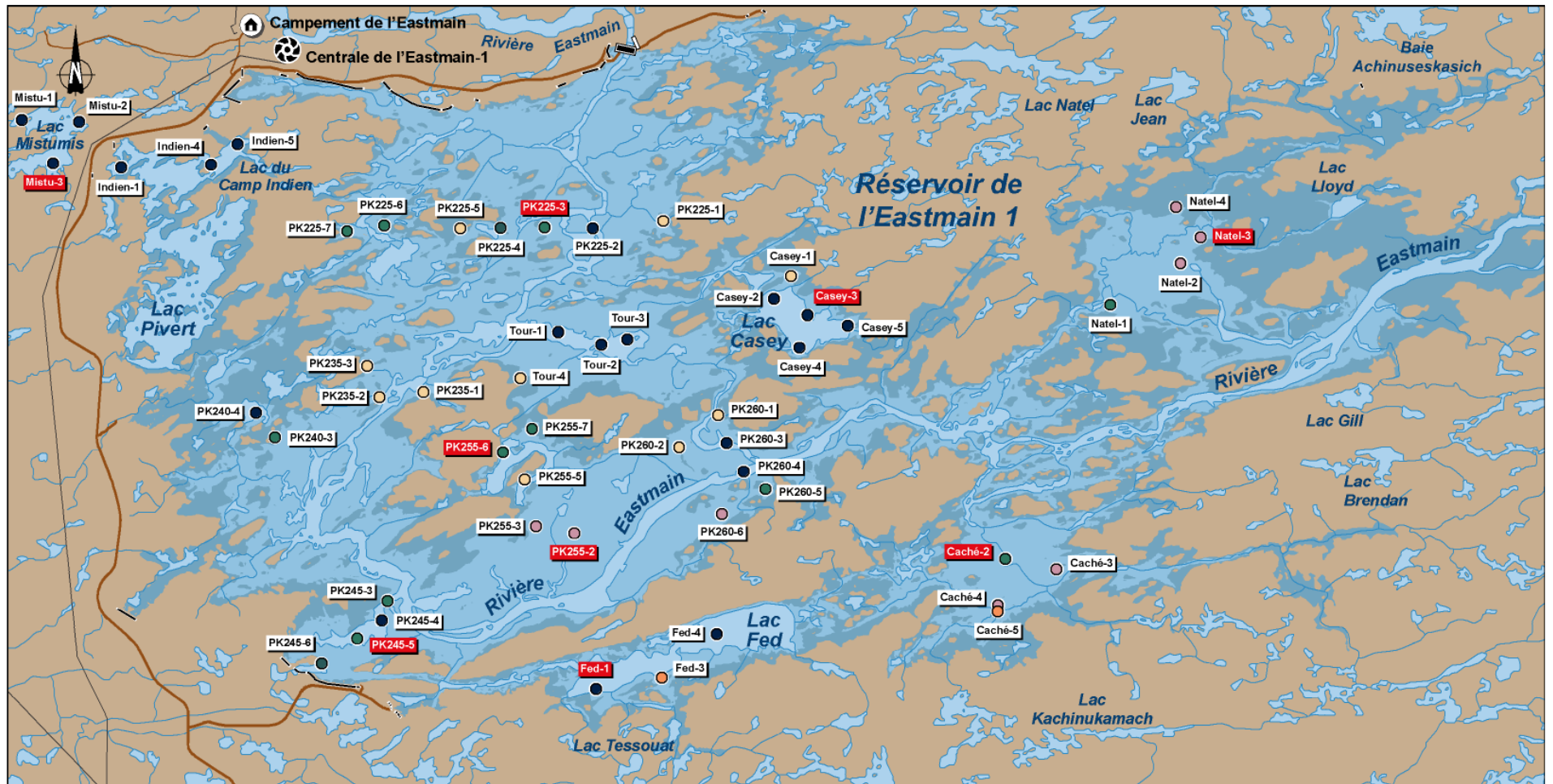
Characteristic of EM-1 reservoir



- Impoundment: Nov. 2005
- May 2006
- 480 MW Power plant
- Reservoir: 603 km²,
2.3 months,
11.5 m (z)
- Lakes and rivers: ~ 21%
- Forest: ~ 65%
- Peat lands: ~ 14%



Stations





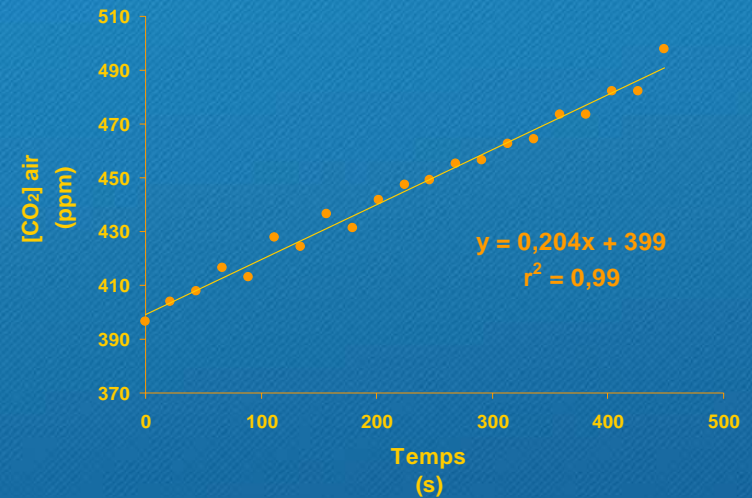
Summer campaigns (2003-2008)

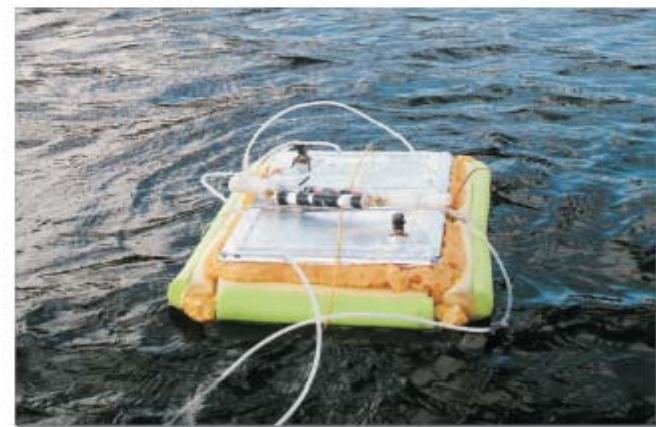
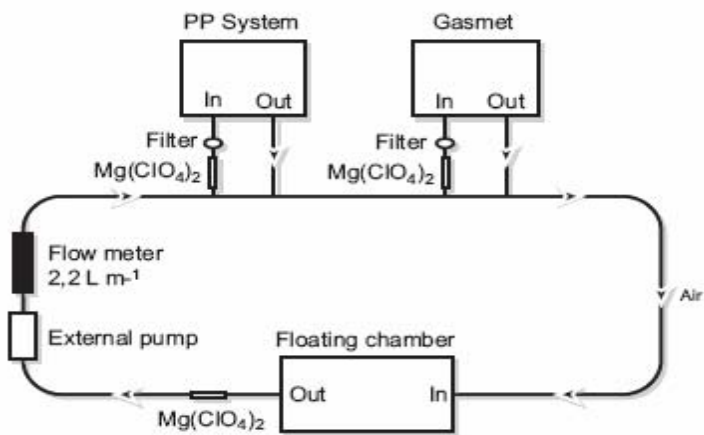


Summer campaign (2003 to 2008)

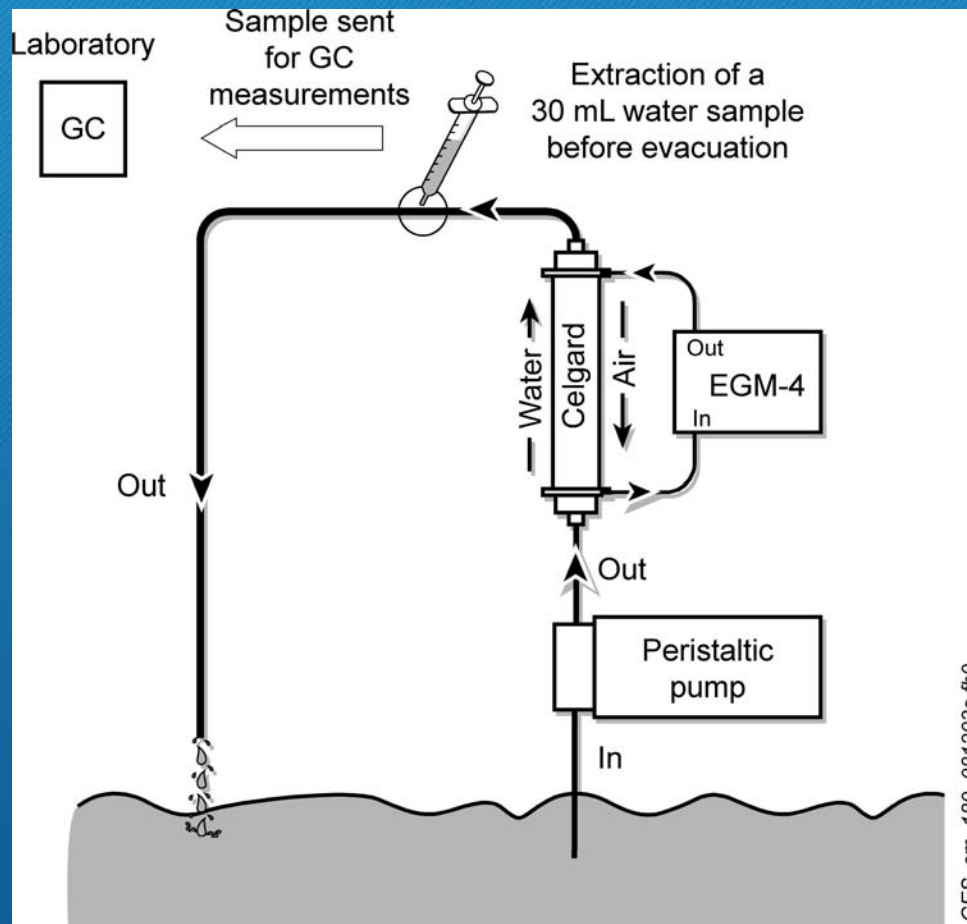
1- Floating chambers

- Direct CO₂, CH₄, N₂O flux measurements





Partial pressure measurements



Winter campaigns (2007-2008)

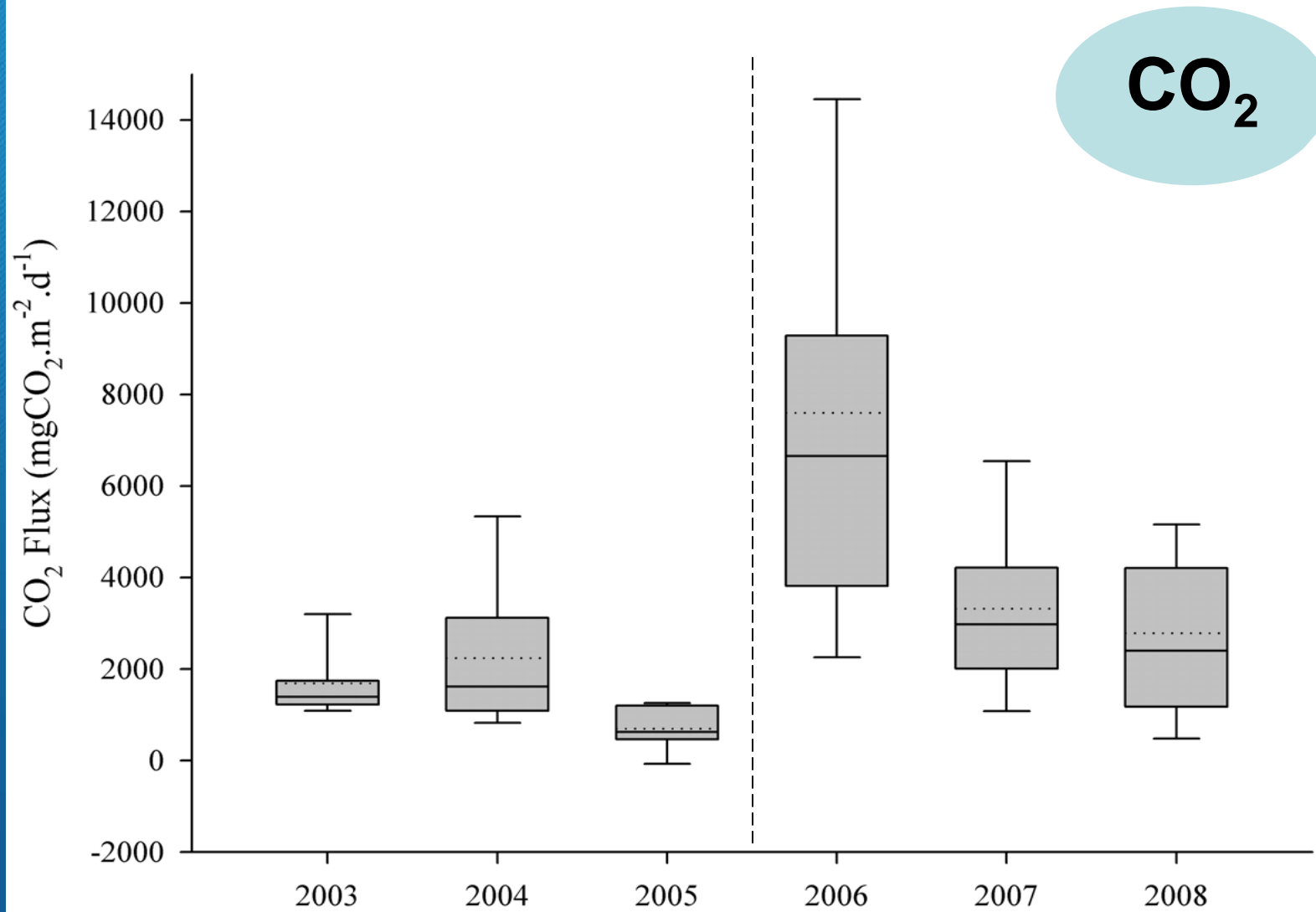


Complementary measurements

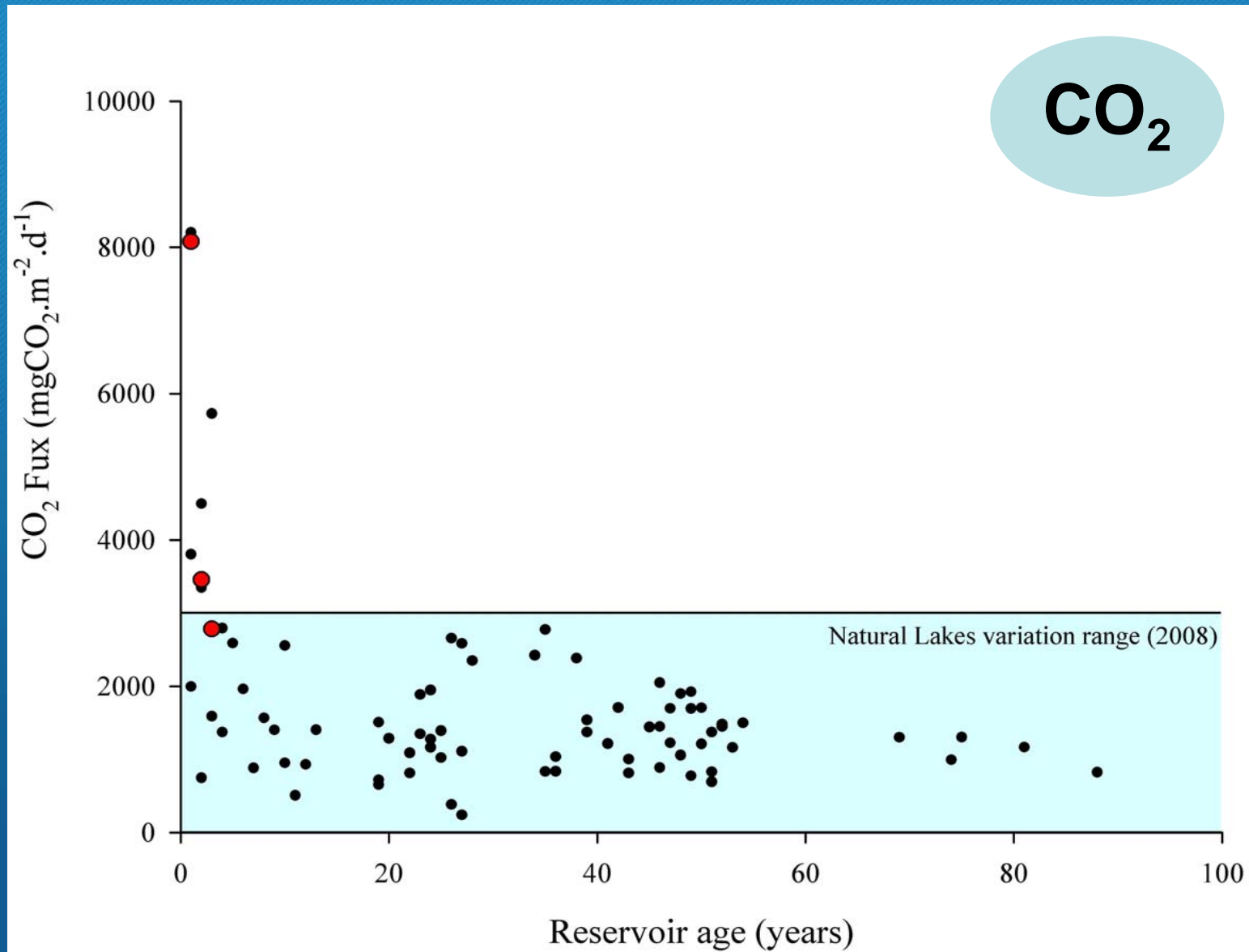
- Physico-chemical conditions (z, pH, Alk., O₂, T_{water}, Secchi)
- Meteorological conditions (wind, wave height, atmospheric pressure, T_{air})

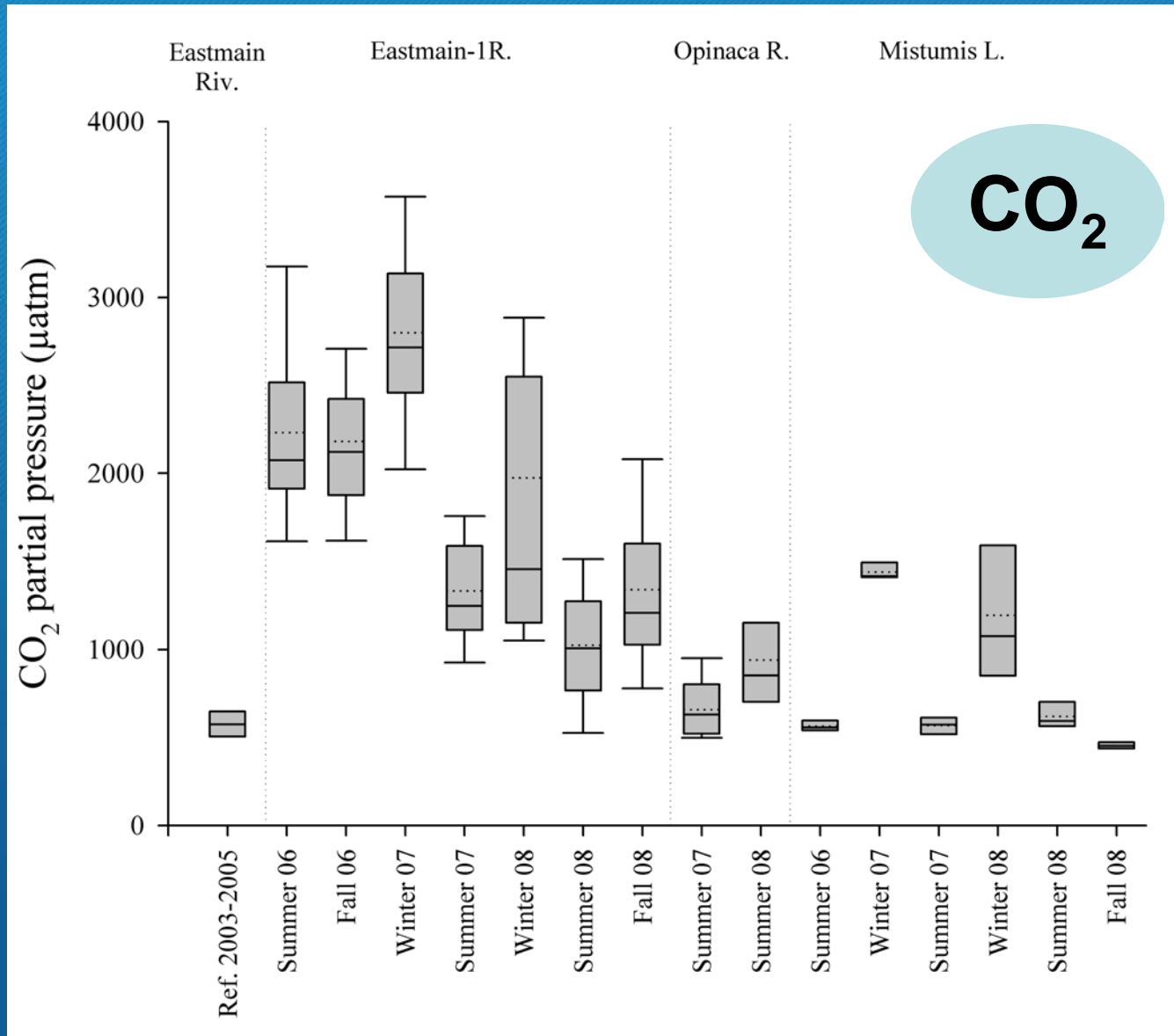


CO₂ fluxes

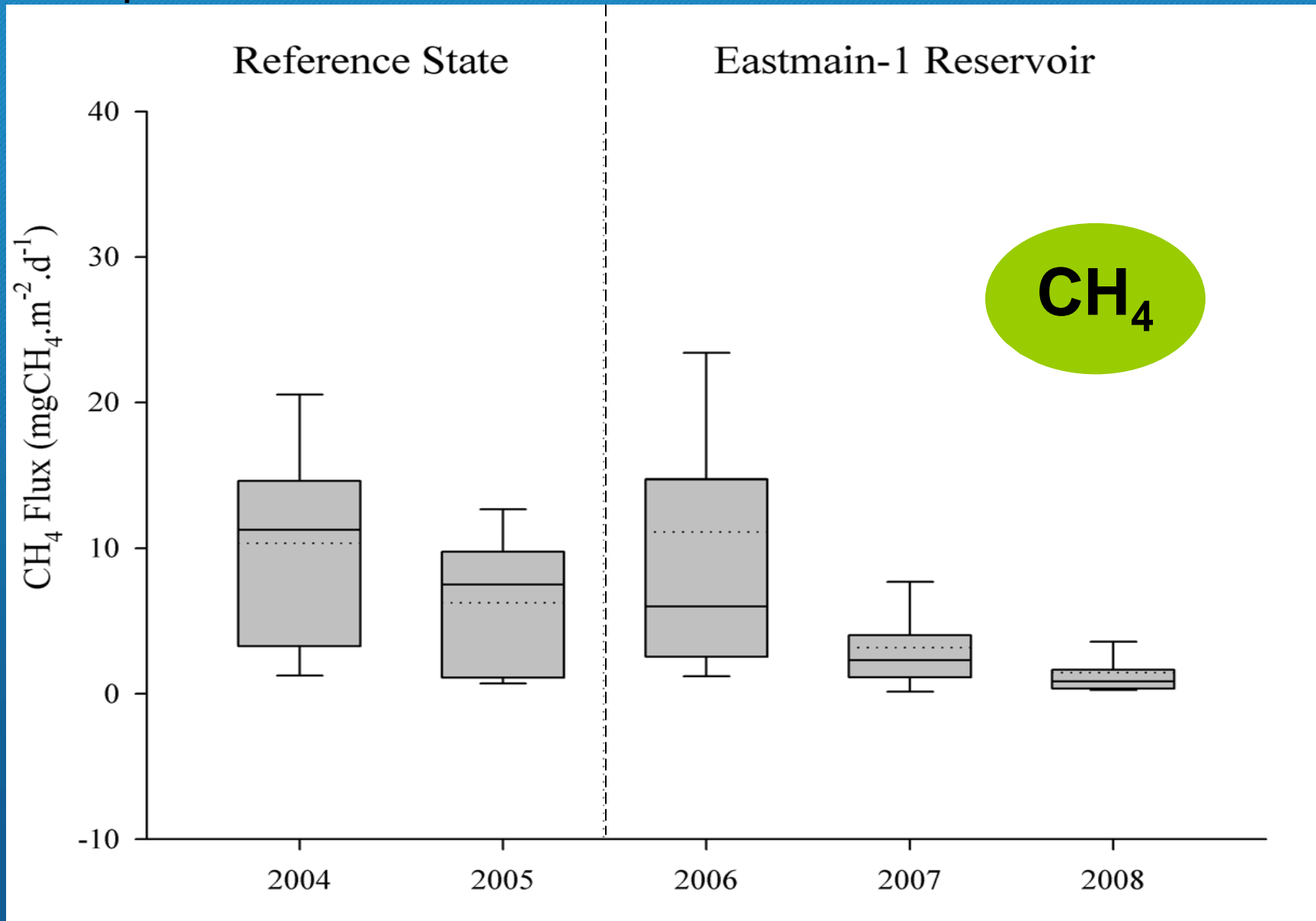


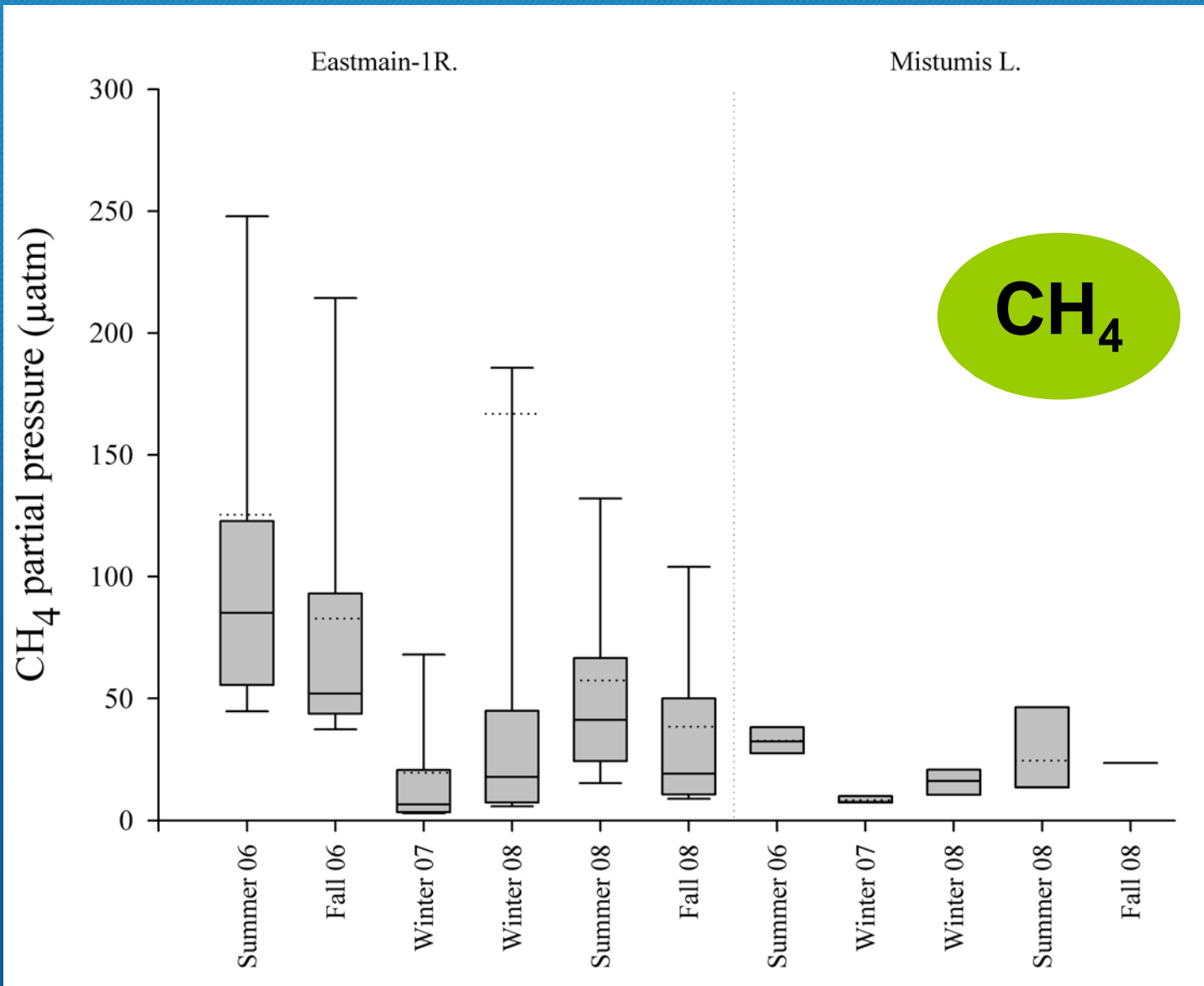
CO₂ fluxes



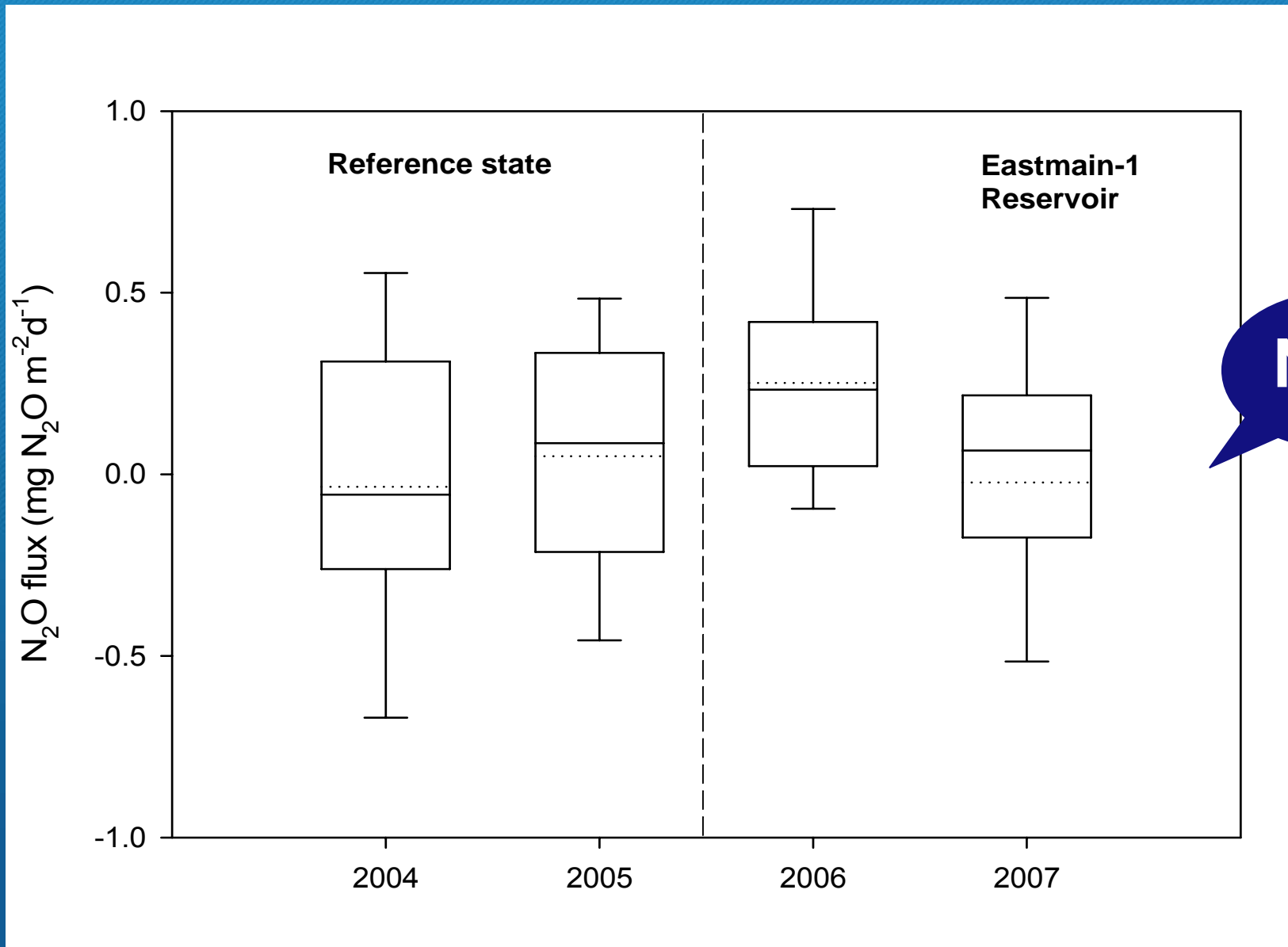
P_{CO_2} 

CH₄ fluxes



P_{CH_4} 

N₂O fluxes



N₂O



Annual budget

- No CH₄ accumulation under ice cover
- 1 Year of emission =
 - + 31 days of springtime flux
 - + 214 days : baseline flux (average of summer-autumn) early winter flux
 - + 120 days : flux = 0 (ice cover)

→ May 1st 2008 to May 1st 2009:

EM-1: 556 gCO₂eq.m⁻²

Mistumis L. : 168 gCO₂eq.m⁻²



Conclusions

- Highest GHG emissions (CO_2 , CH_4) from EM-1 reservoir were observed during the 1st year following impoundment (2006)
- Summertime daily CO_2 fluxes have dropped significantly in 2007 and 2008 and are now comparable to reference lakes and old reservoirs
- $p\text{CO}_2$ in the EM-1 reservoir are still higher than those from reference lakes
- CH_4 fluxes have returned to the reference state level in 2007 and are comparable to old reservoirs
- N_2O fluxes did not vary significantly between 2003 and 2007
- Annual emissions from EM-1 reservoir are higher than from Mistumis L.



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Questions ?

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