

Does the integration of dynamic N cycle in land surface model improve the long-term trend of vegetation index (Leaf Area Index, LAI)?

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# The model: O-CN

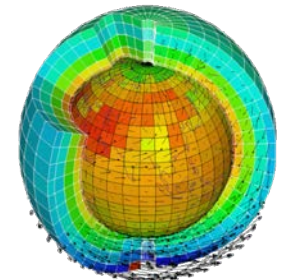
- Developed by Zaehle and Friends (2010).
- Based on the **ORCHIDEE model** (Krinner et al. 2005)
- Representation of key mechanisms of the N cycle:
  - **dynamic representation of the N flows** within plants pool biomass
  - **N limitation** on litter decomposition
  - **N deposition, fertilization & biological fixation.**
  - The O-CN model could also run with a fix representation of the N cycle (O-C).

# The evaluation

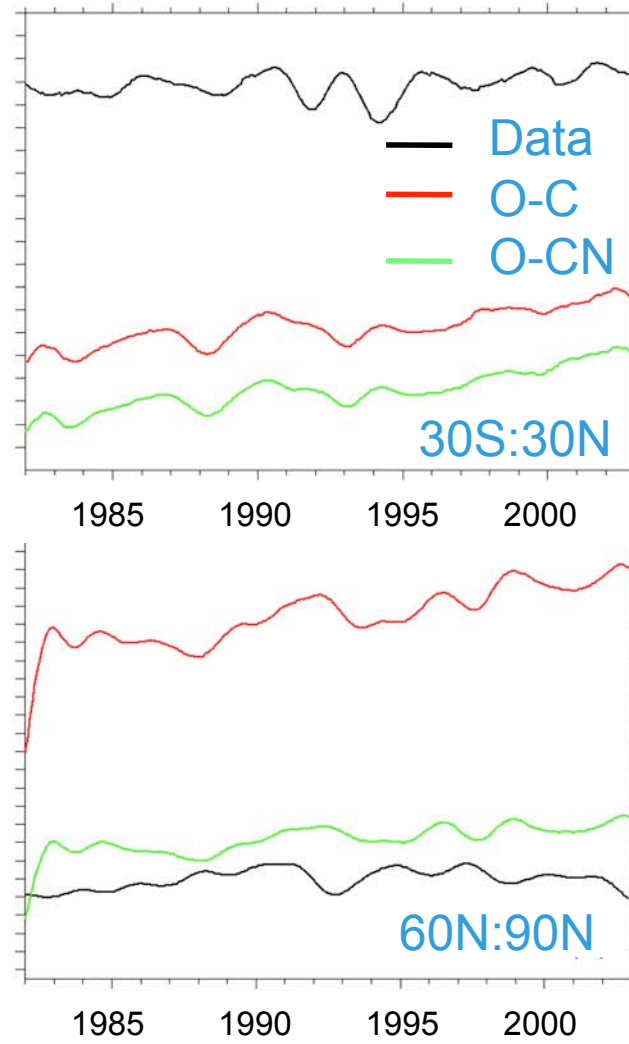
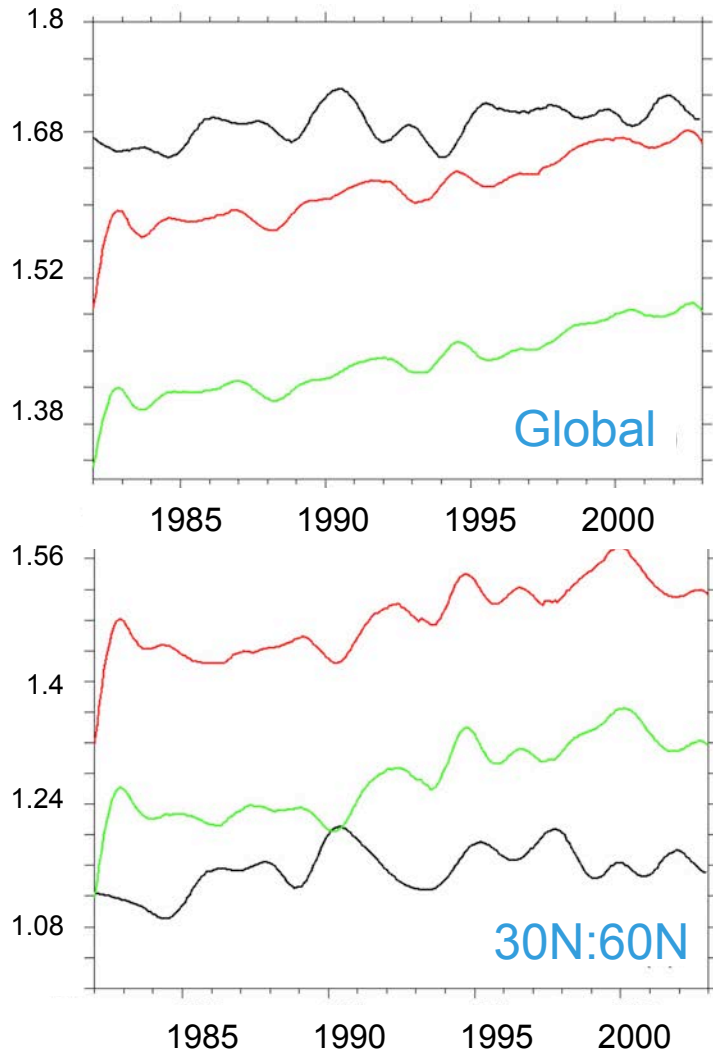
- We used a **satellite-derived LAI dataset** created by Piao et al. (2006) for the period 1982-2002.
- Estimation of the LAI long-term trend with filtering techniques has been used (Thoning et al. 1989).
- Calculation of the increase rate of the LAI long-term trend.
- The metrics used based on Cadule et al., (2009):

$$\text{MOD} = (|x| - |o|) / (|x| + |o|)$$

- Noted from 1 (the best fit) to the 0.1 (the worst fit)



# Results: Long term trend of LAI

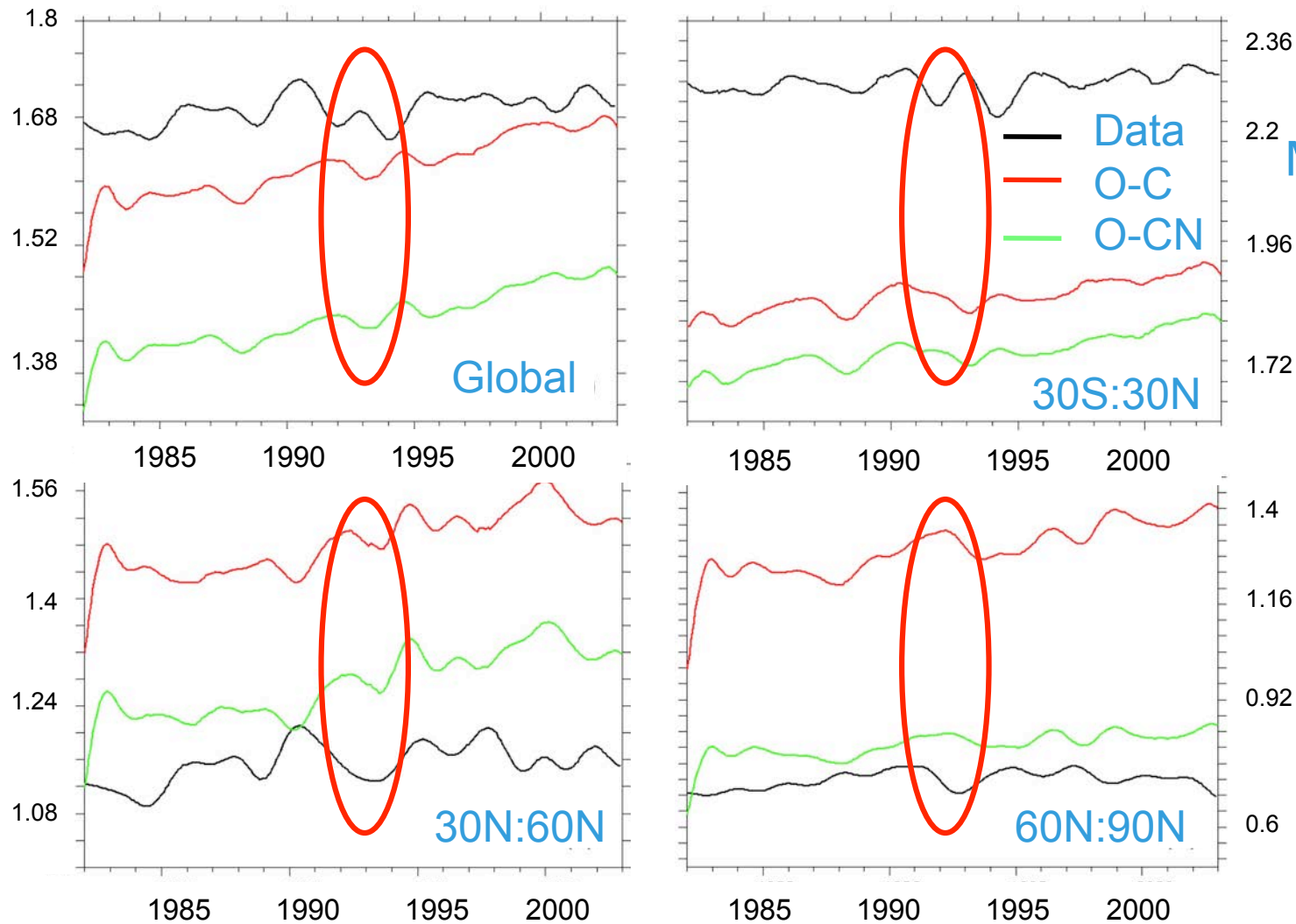


$$MOD = (|x| - |o|) / (|x| + |o|)$$

	O-C	O-CN
Global	0.3	0.3
30S: 30N	0.3	0.3
30N: 60N	0.4	0.4
60N: 90N	0.1	0.4

Long term trend of LAI.

# Results: Long term trend of LAI

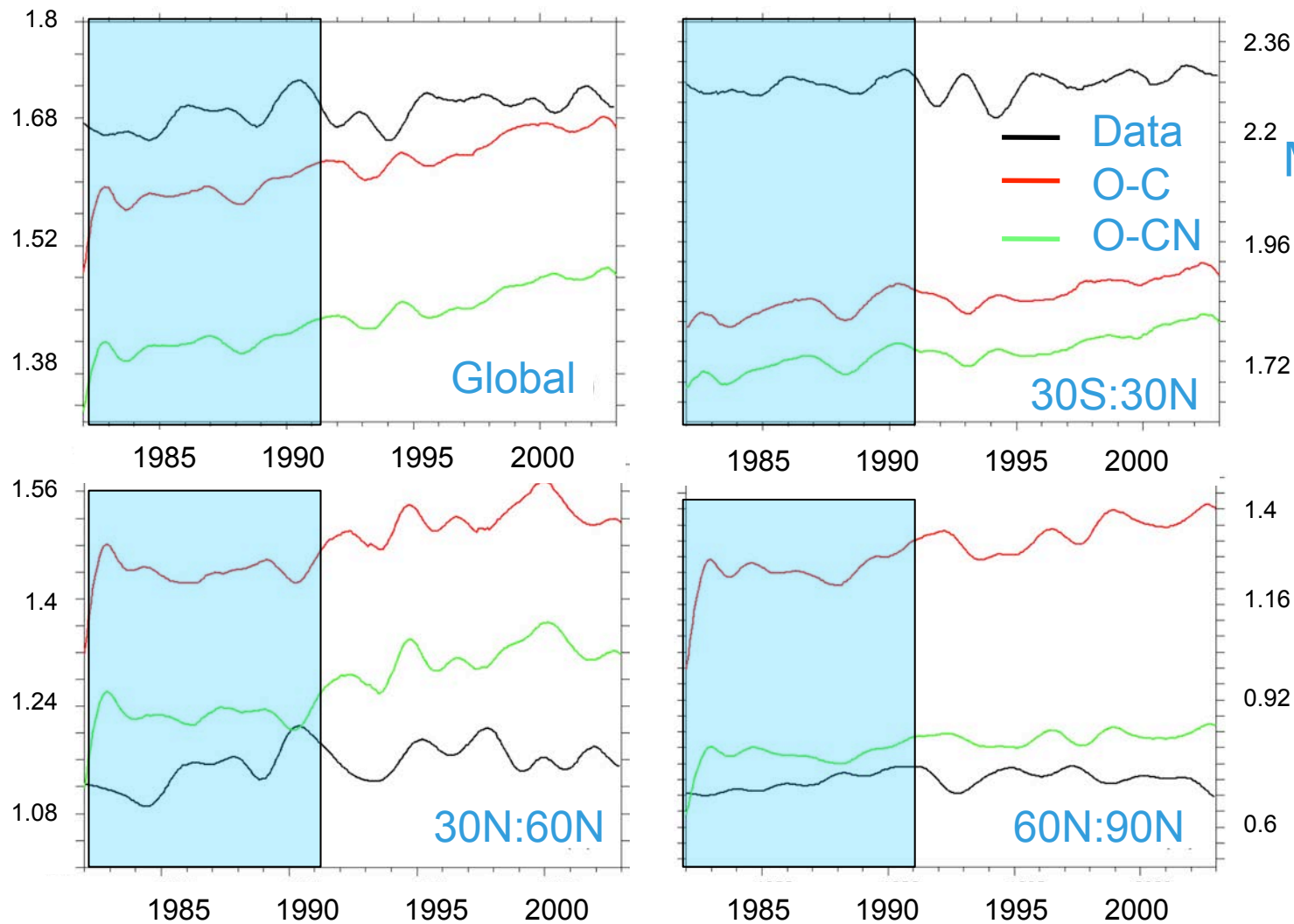


$$MOD = (|x| - |o|) / (|x| + |o|)$$

	O-C	O-CN
Global	0.3	0.3
30S: 30N	0.3	0.3
30N: 60N	0.4	0.4
60N: 90N	0.1	0.4

Long term trend of LAI.

# Results: Long term trend of LAI, pre-Pinatubo

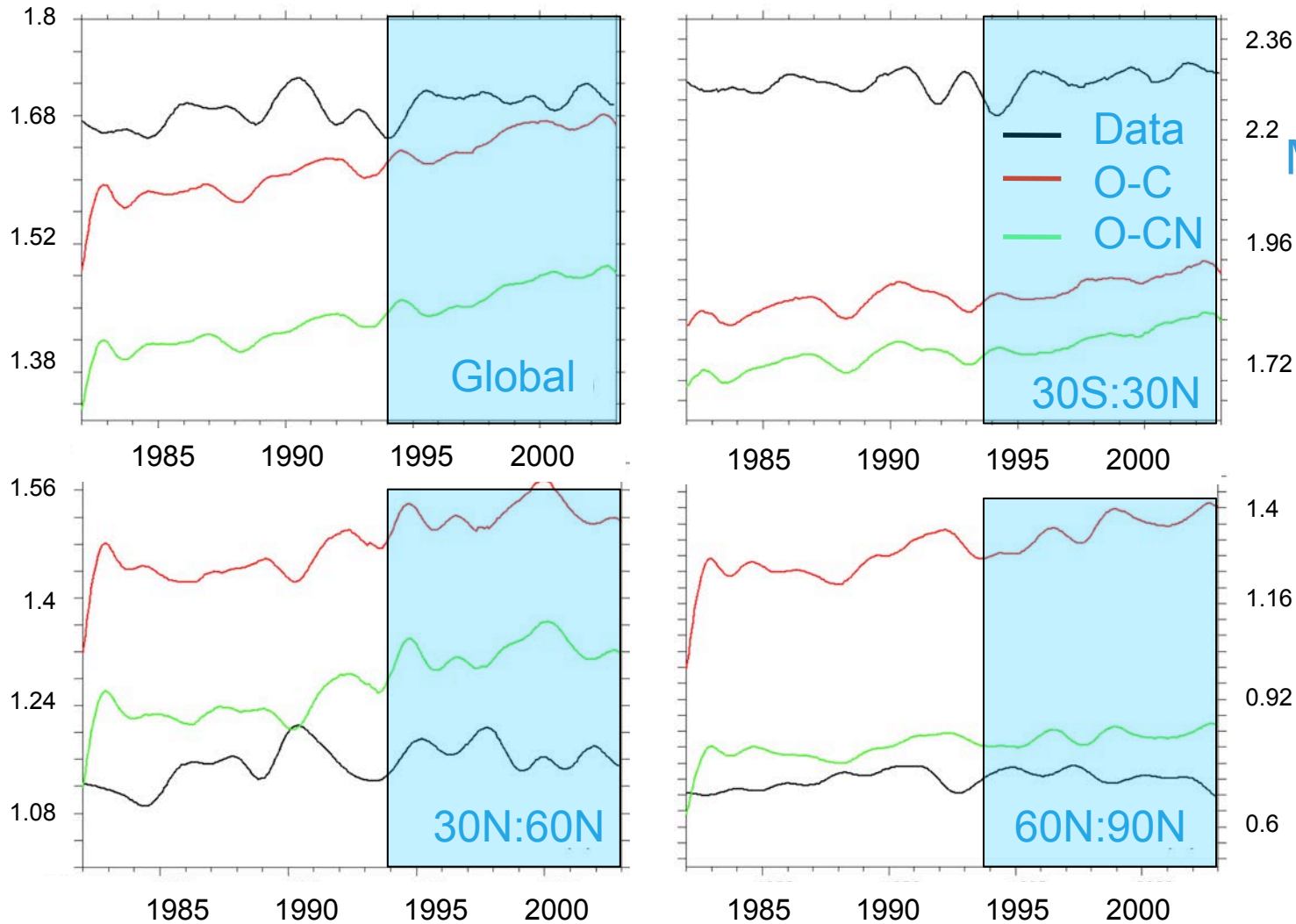


$$MOD = (|x| - |o|) / (|x| + |o|)$$

	O-C	O-CN
Global	0.8	0.9
30S: 30N	0.2	0.2
30N: 60N	0.5	0.4
60N: 90N	0.7	1

Long term trend of LAI.

# Results: Long term trend of LAI, post-Pinatubo



$$MOD = (|x| - |o|) / (|x| + |o|)$$

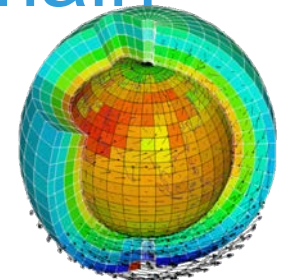
	O-C	O-CN
Global	0.5	0.5
30S: 30N	0.7	0.6
30N: 60N	0.1	0.5
60N: 90N	0.1	0.5

Long term trend of LAI.



# Summary

- Both versions of the model failed to reproduce Pinatubo consequences.
- Representation of **dynamic N cycle** improve the representation of the **long term trend of LAI**.
- Particularly true for **boreal latitudes**.
- Over this period, **climate** might be the main **driving force**.





# The special issue

- The data presented.
- The driving forces of the long term trend (climate, CO<sub>2</sub>, N deposition, etc.) for different regions.
- The land surface CO<sub>2</sub> emission (analysis in progress).
- Thank you...

