Nitrogenous emissions from soils

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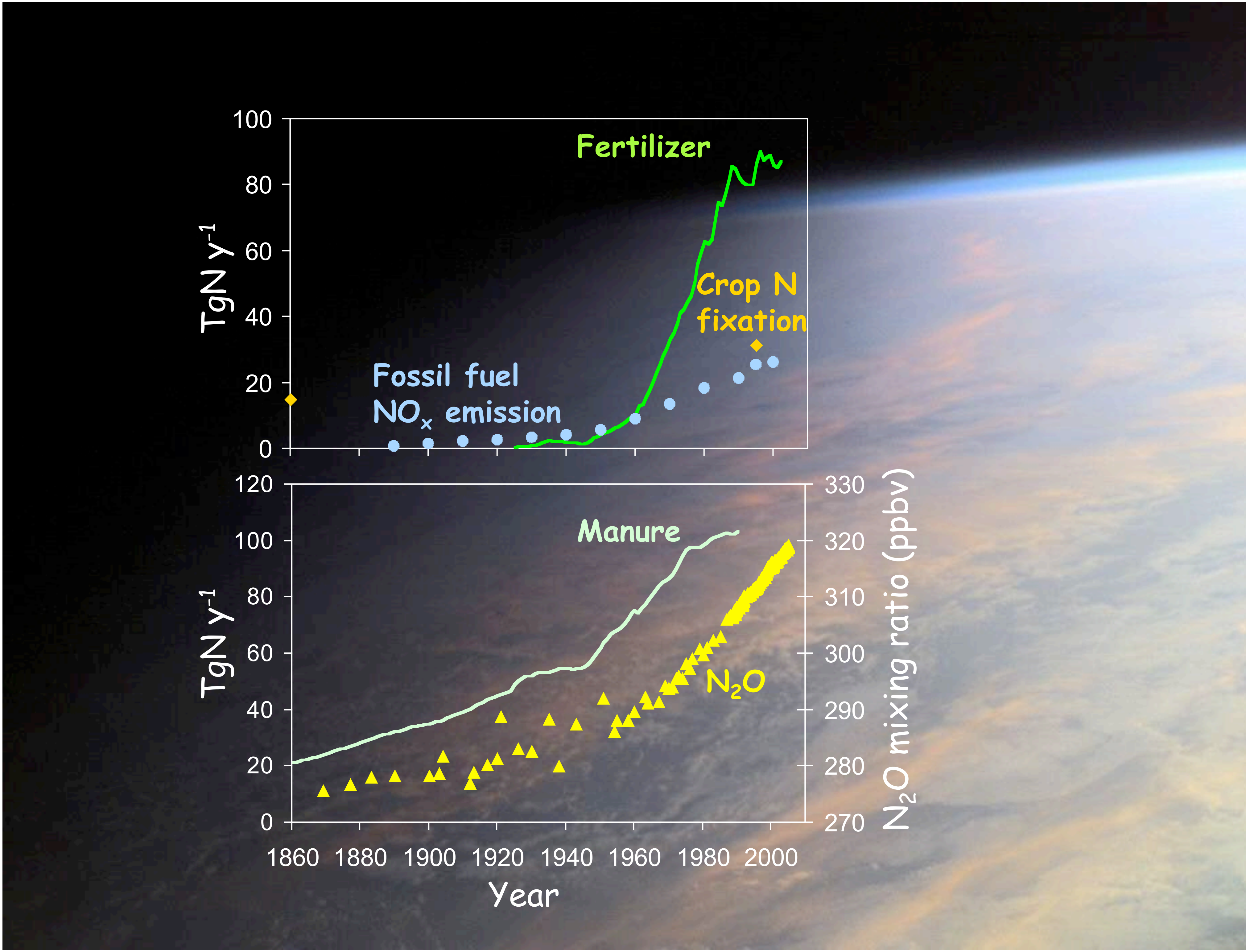
June 16, 2009

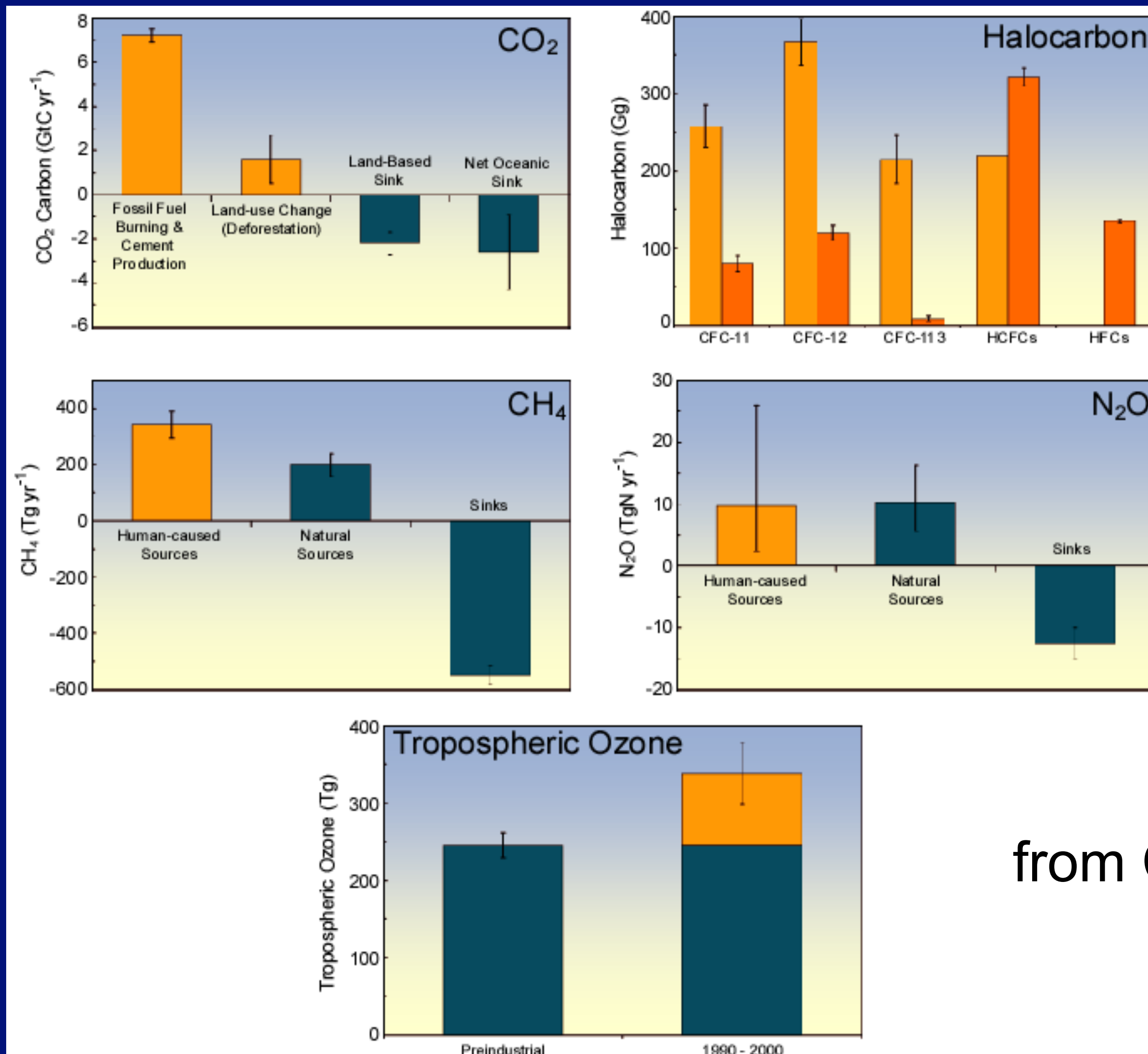
Global sources (in TgN yr^{-1}) for the 1990s. AR4

Source	NO_x	NH_3	N_2O
Anthropogenic sources			
Fossil fuel combustion & industrial processes	25.6	2.5	0.7 (0.2–1.8)
Aircraft	(0.5-0.8)	-	-
Agriculture	1.6	(35)	(1 2.8 3)
Biomass and biofuel burning	5.9 (6-12)	5.4 (3-8)	0.7 (0.2–1.0)
Human excreta	–	2.6 (1.3-3.9)	0.2 (0.1–0.3)
Rivers, estuaries, coastal zones	–	–	1.7 (0.5–2.9)
Atmospheric deposition	0.3	–	0.6 (0.3–0.9)
Anthropogenic total	**33.4**	**45.5**	**6.7**
Natural sources			
Soils under natural vegetation	7.3)	2.4 (1-10)	(6.6
Oceans	–	8.2	3.8 (1.8-5.8)
Lightning	1.1–6.4 (3–7)	–	–
Atmospheric chemistry	–	–	0.6 (0.3–1.2)
Natural total	**8.4 – 13.7**	**10.6**	**11.0**
Total sources	**41.8 – 47.1** (37.4–57.7)	**56.1** (26.8–78.4)	**17.7** (8.5–27.7)

IPCC Fourth Assessment Report 2007, WG1, table 7.8

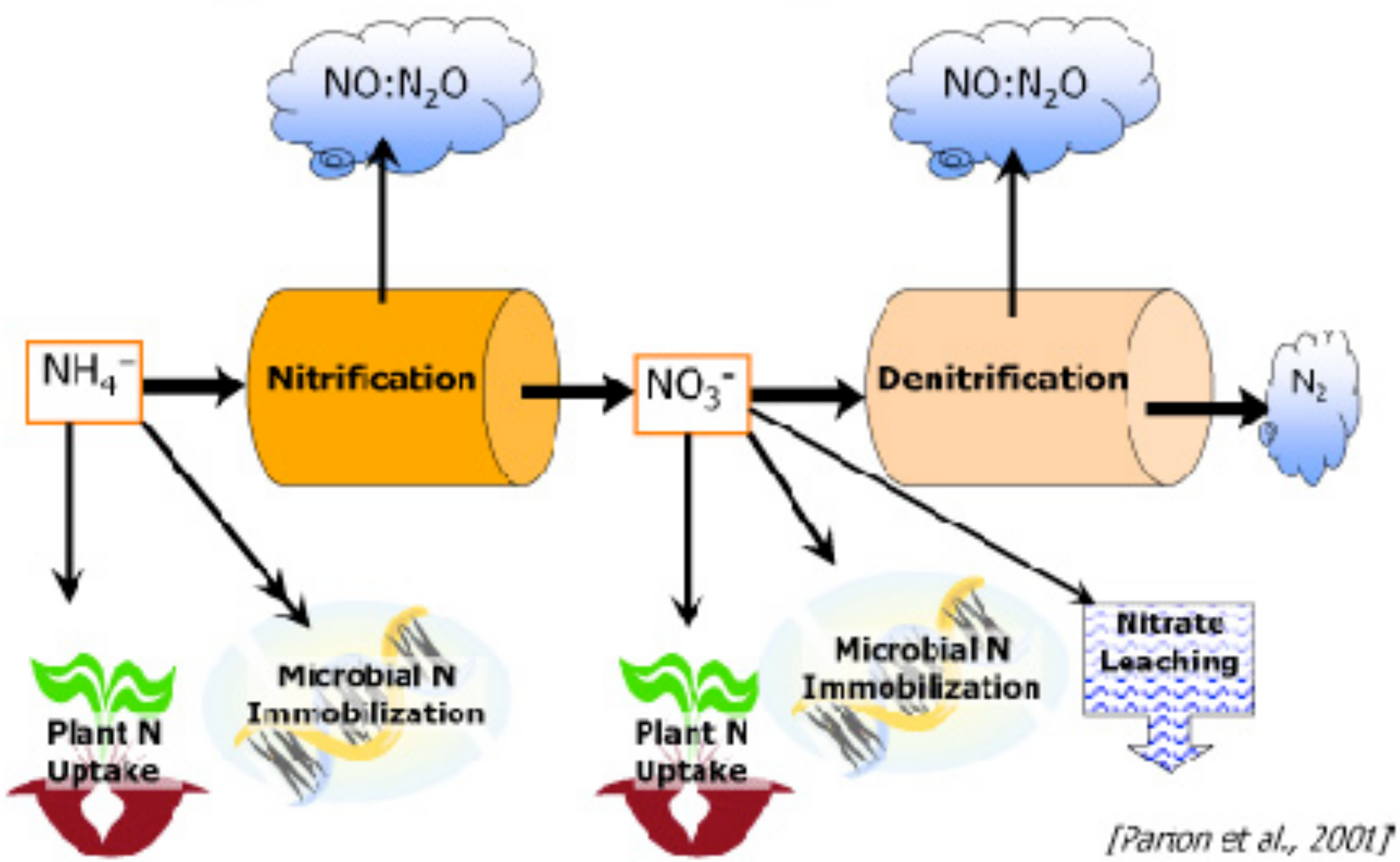

Fertilizer
Crop N fixation
Fossil fuel NOx emission
TgN y-1
100
80
60
40
20
0
Manure
N2O
120
330
320
310
300
290
280
270
N2O mixing ratio (ppbv)
1860
1880
1900
1920
1940
1960
1980
2000
Year

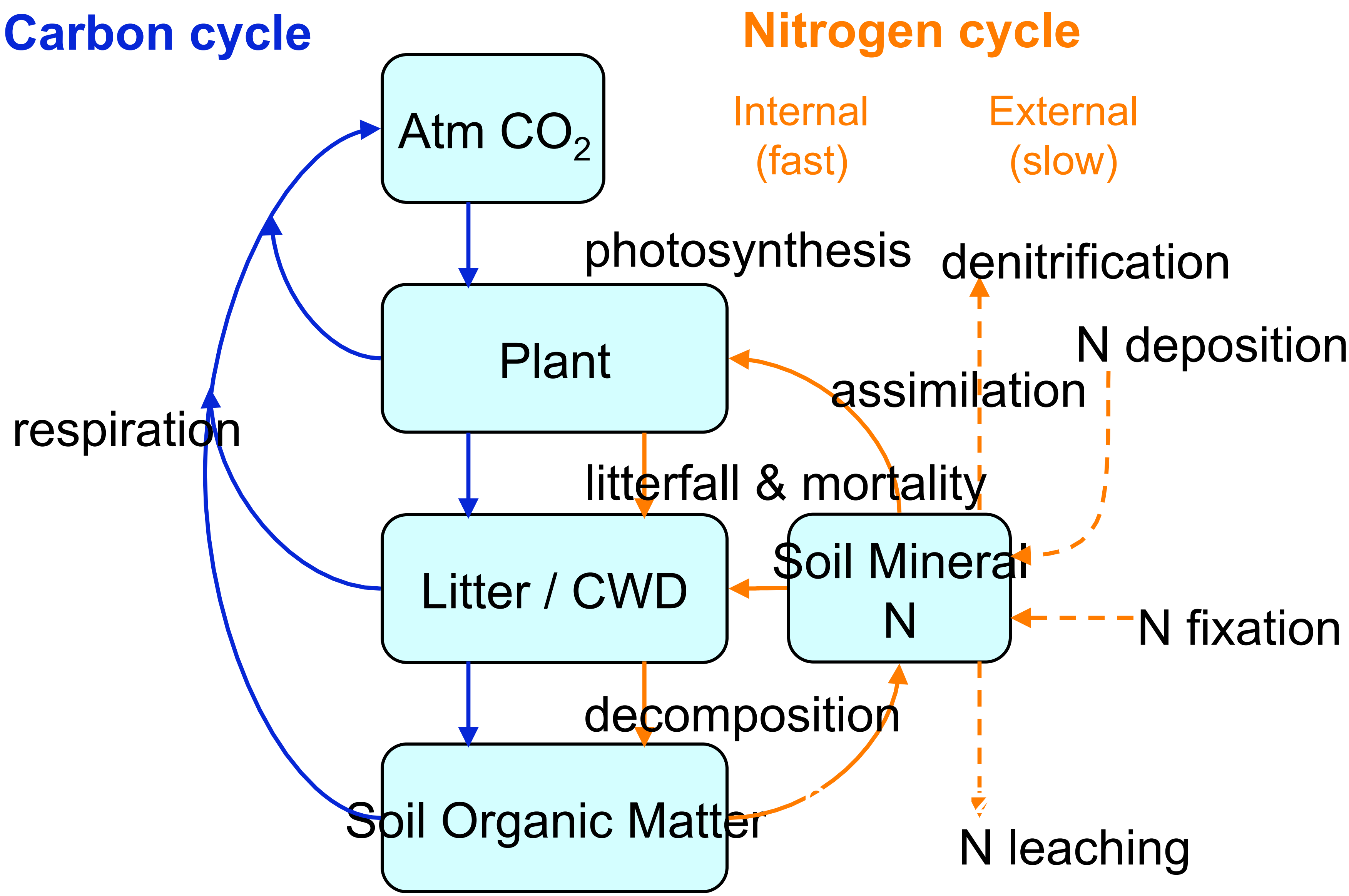
Natural vs Human



from Chapter 7

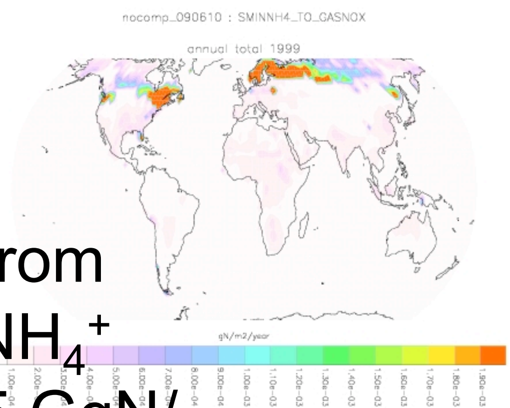
N gas fluxes from soil



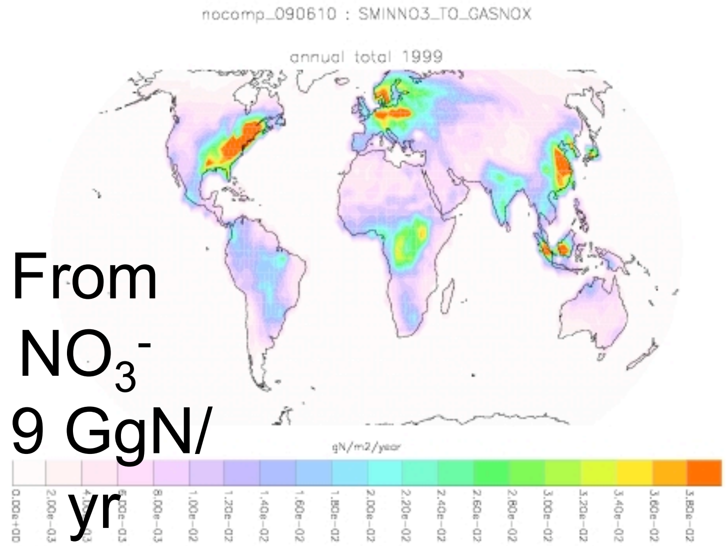


Carbon cycle
Nitrogen cycle
Internal (fast)
External (slow)
Atm CO_2
photosynthesis
denitrification
Plant
N deposition
assimilation
respiration
litterfall & mortality
Litter / CWD
Soil Mineral N
N fixation
decomposition
Soil Organic Matter
N leaching

NO_x gas flux

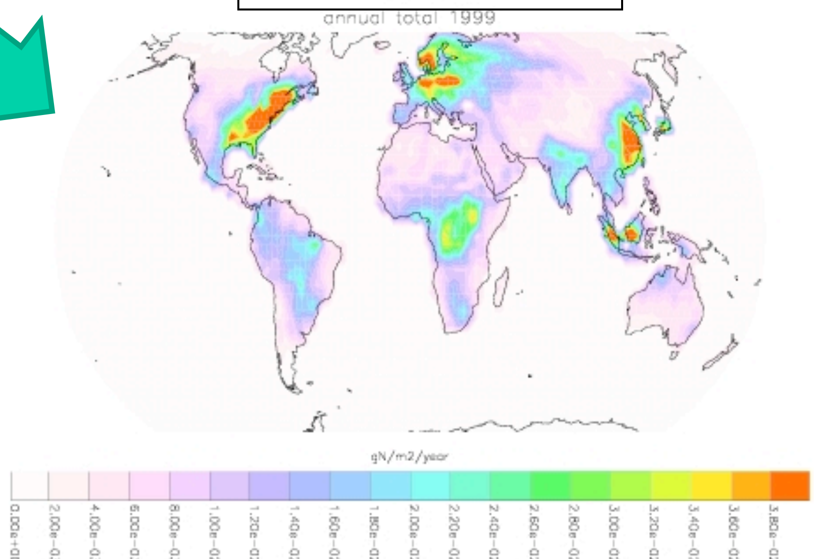


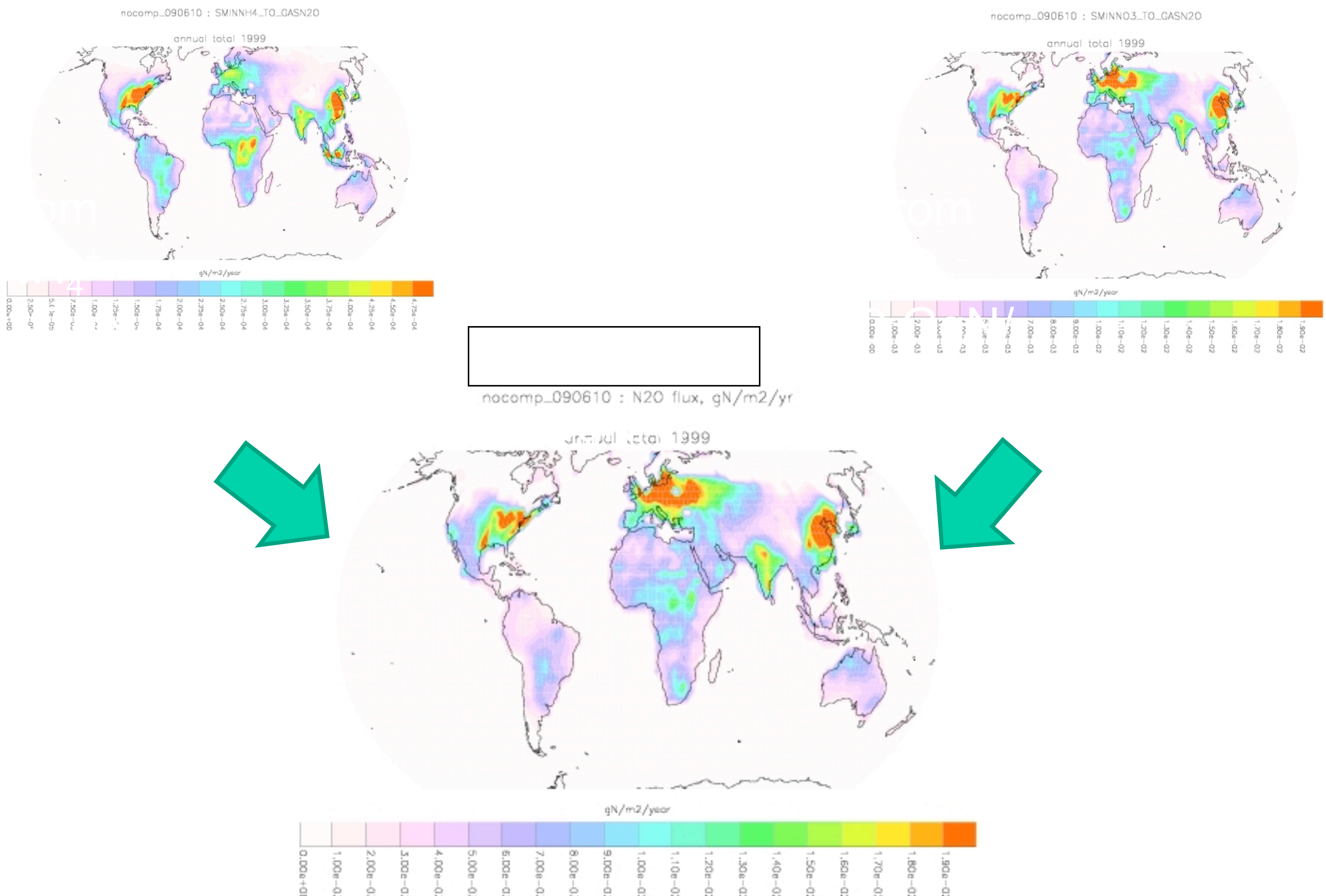
from NH_4^+ 0.5 GgN/yr



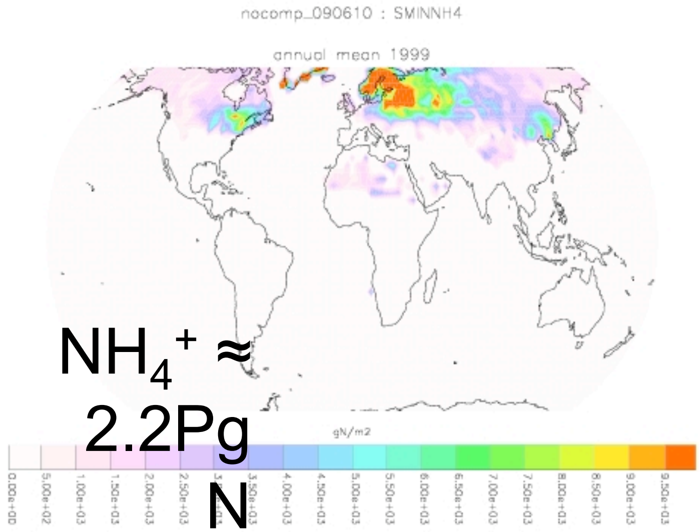
From NO_3^- 19 GgN/yr

Flux ≈ 19 GgN/yr

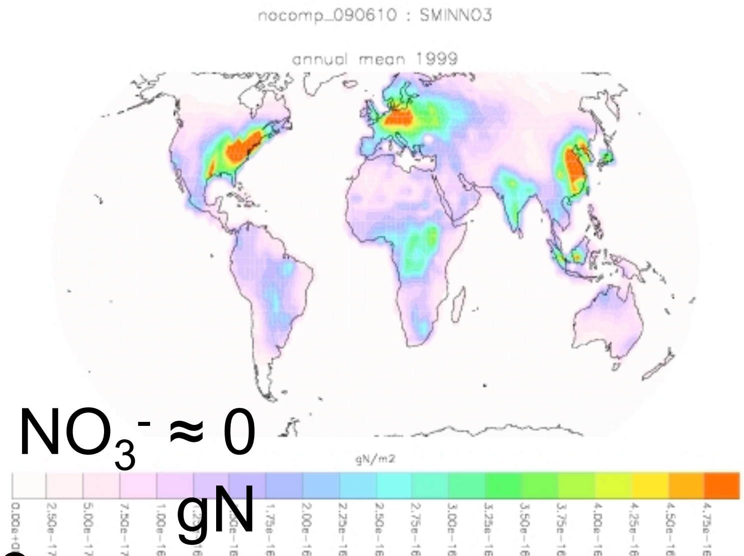



nocomp_090610 : SMINNH4_TO_GASN2O
annual total 1999
gN/m2/year
nocomp_090610 : SMINNO3_TO_GASN2O
annual total 1999
gN/m2/year
nocomp_090610 : N2O flux, gN/m2/yr
gN/m2/year
0.00e+00
1.00e-03
2.00e-03
3.00e-03
4.00e-03
5.00e-03
6.00e-03
7.00e-03
8.00e-03
9.00e-03
1.00e-02
1.10e-02
1.20e-02
1.30e-02
1.40e-02
1.50e-02
1.60e-02
1.70e-02
1.80e-02
1.90e-02

In-soil nitrification flux (NH_4^+ to NO_3^-)

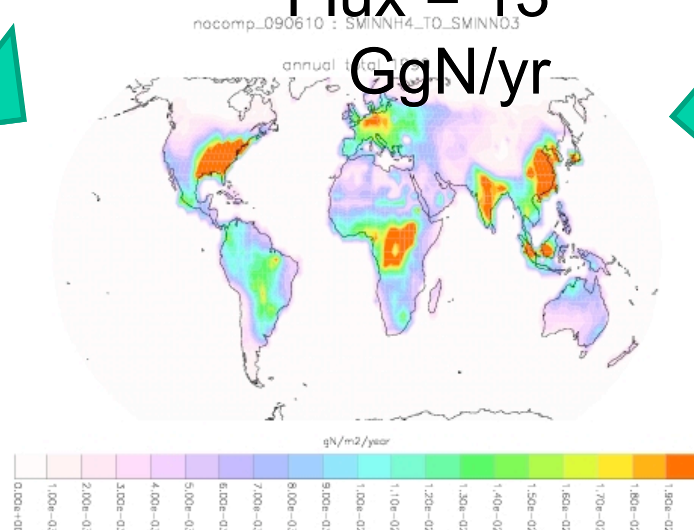


$NH_4^+ \approx$ 2.2Pg N

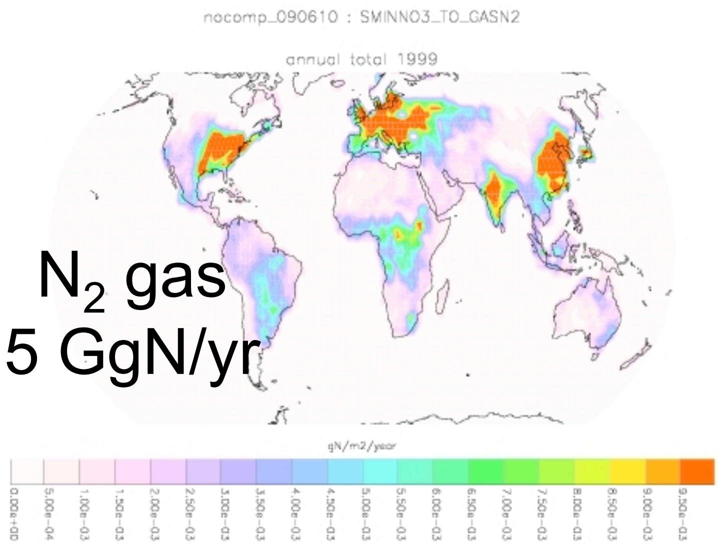


$NO_3^- \approx 0$ gN

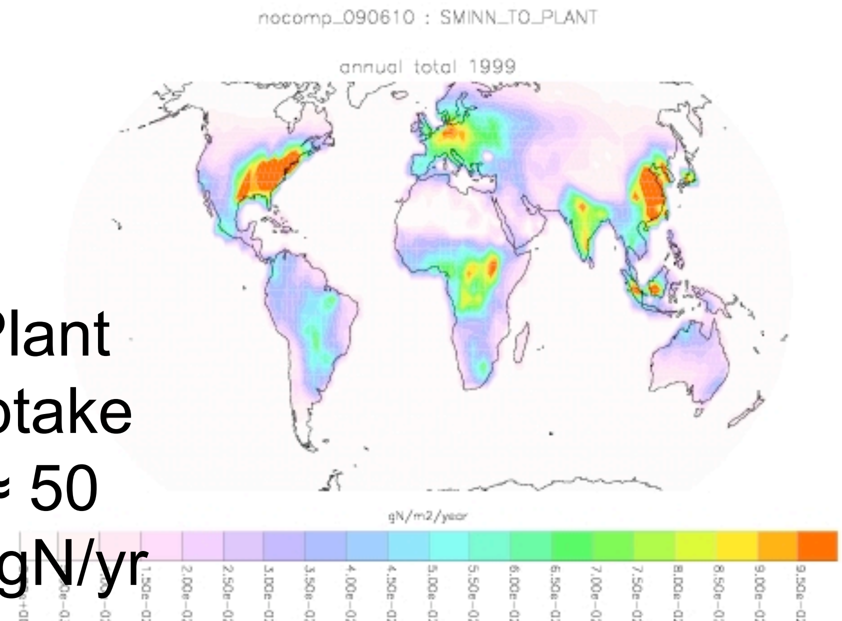
Flux = 13 GgN/yr



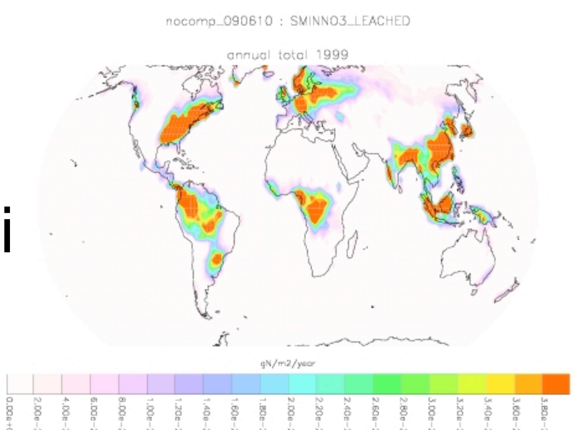
Other N loss fluxes



N_2 gas
5 GgN/yr

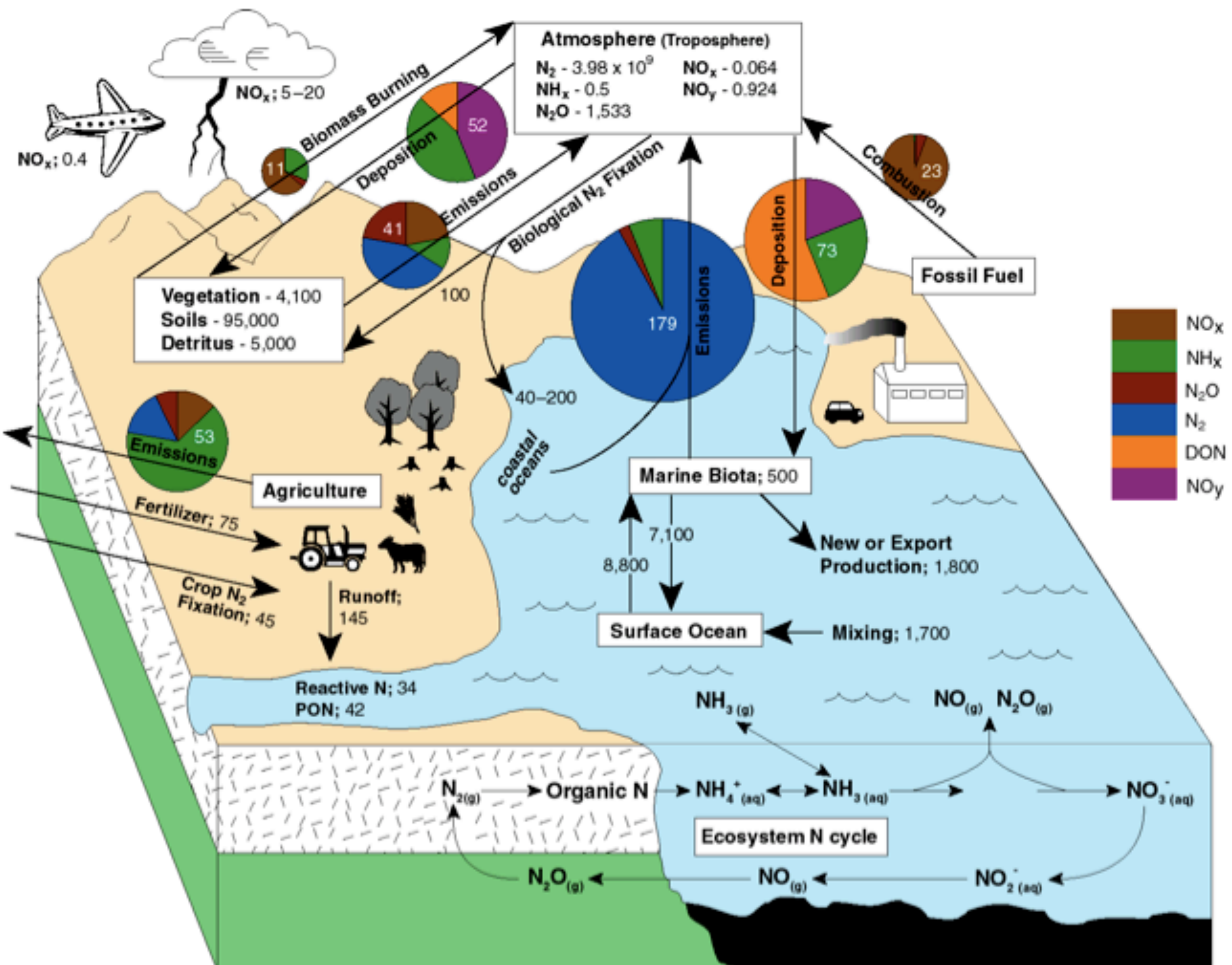


Plant uptake ≈ 50 GgN/yr

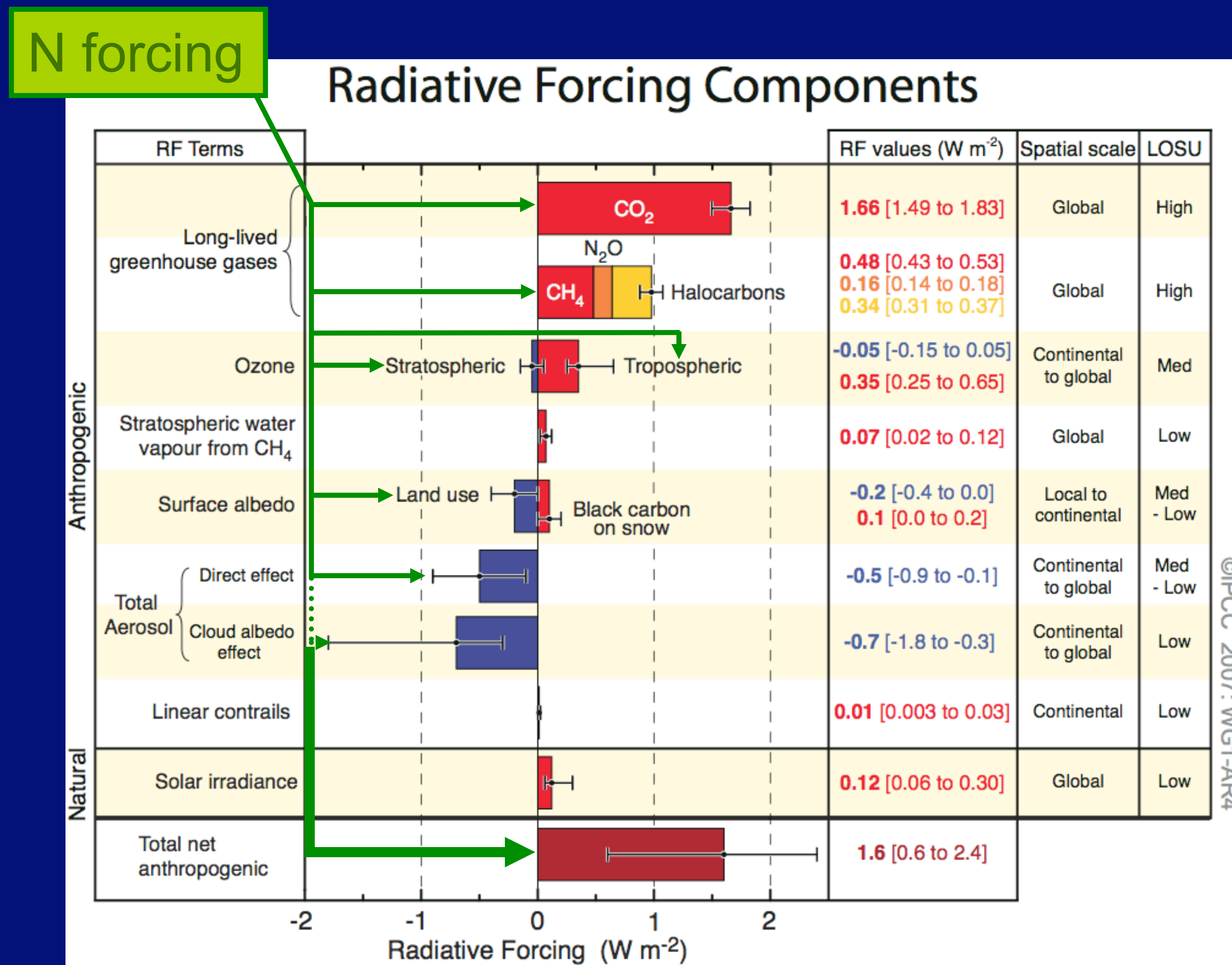


Leaching ≈ 0 gN/yr

The Global N Cycle, Paint by Number

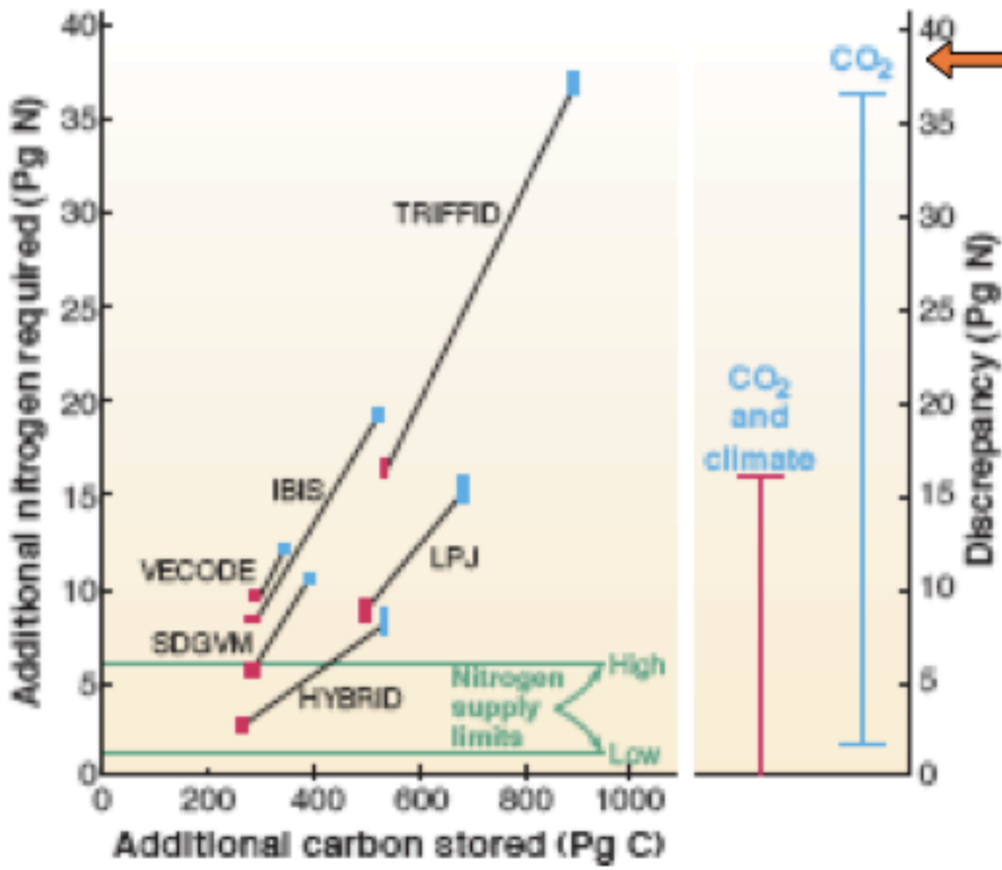


Human and Natural Drivers of Climate Change



Nitrogen and Climate Change

Bruce Hungate, Jeffery S. Dukes, M. Rebecca Shaw, Yiqi Luo, Christopher B. Field



Models of carbon uptake predict the following carbon uptake under rising carbon dioxide and changing climate according to the TAR.

To take up carbon, terrestrial ecosystems need nitrogen

Estimated N storage and efficiency of N deposition uptake is insufficient to sustain the needed carbon uptake.

Science Nov 28, 2003, vol 302: 1512-1513