Ciclos de carbono e nitrogênio

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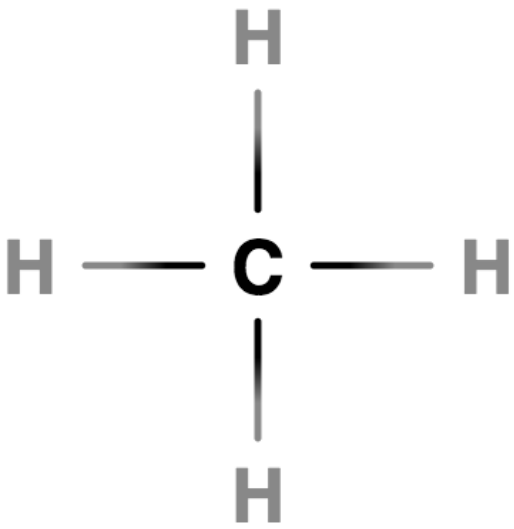
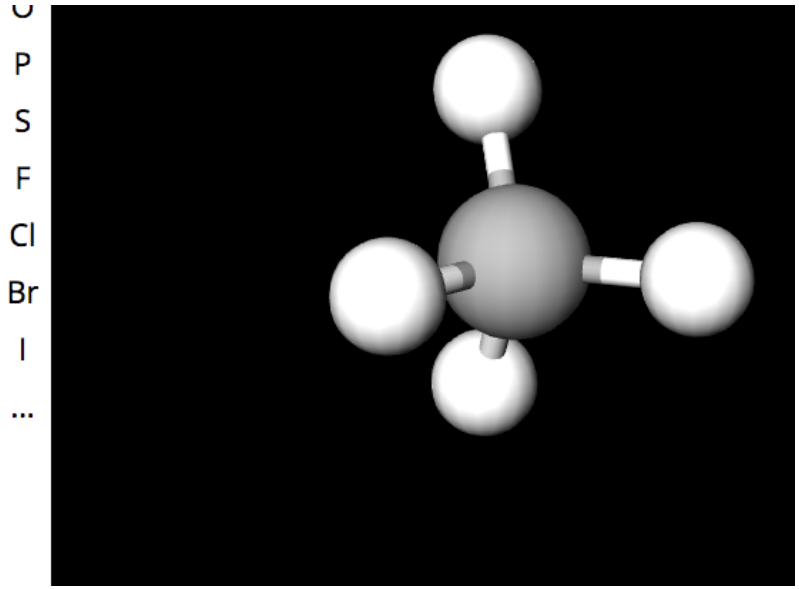
Outline

Carbono

Outline

Metano (CH_4)





- Fontes: micróbios anaeróbicos
- Output: CH4 + OH $\rightarrow$ H2O + CH3

Metano (CH_4) - concentrações históricos

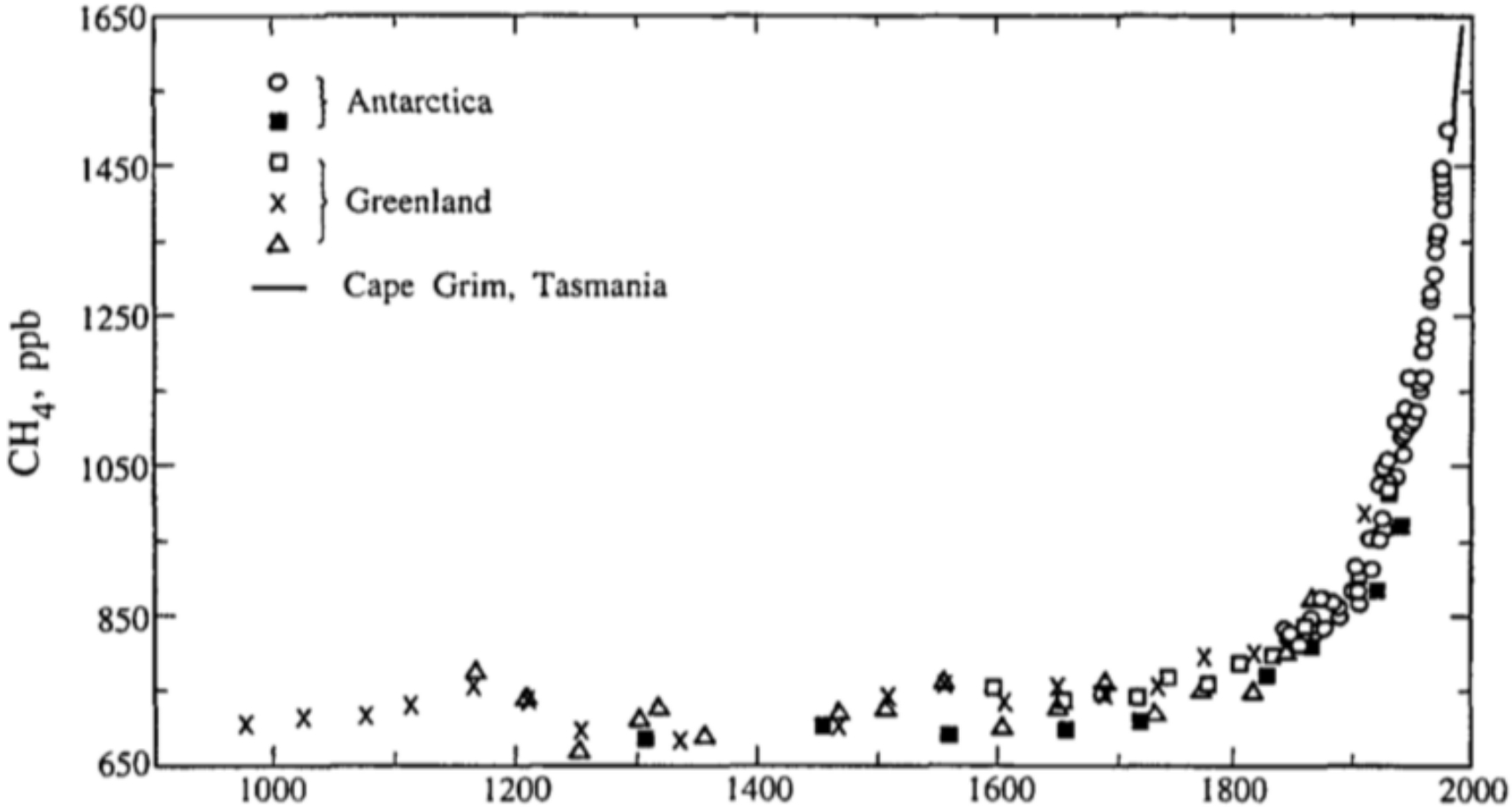


FIGURE 2.4 Methane mixing ratios over the last 1000 years as determined from ice cores from Antarctica and Greenland (IPCC 1995). Different data points indicate different locations. Atmospheric data from Cape Grim, Tasmania, are included to demonstrate the smooth transition from ice core to atmospheric measurements.

Metano (CH_4) - Fluxos

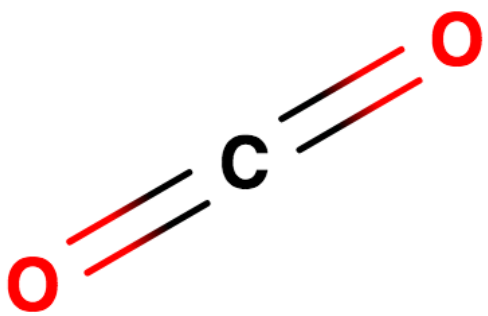
TABLE 2.10 Estimates of the Global CH_4 Budget (in Tg CH_4 yr^{-1}) and Values Adopted by IPCC (2001)

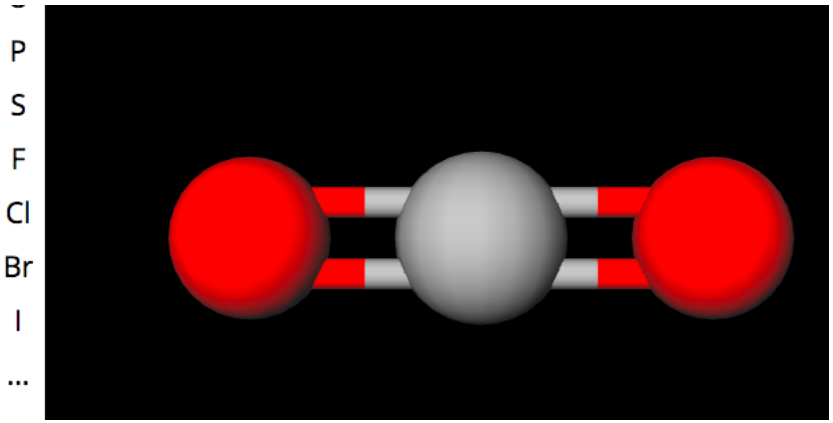
Reference:	Fung et al. (1991)	Hein et al. (1997)	Lelieveld et al. (1998)	Houweling et al. (1999)	Mosier et al. (1998a)	Olivier et al. (1999)	Cao et al. (1998)	IPCC (2001)
Base Year:	1980s	—	1992	—	1994	1990	—	1998
Natural sources								
Wetlands	115	237	225[b]	145			92	
Termites	20	—	20	20				
Ocean	10	—	15	15				
Hydrates	5	—	10	—				
Anthropogenic sources								
Energy	75	97	110	89		109		
Landfills	40	35	40	73		36		
Ruminants	80	90[a]	115	93	80	93[a]		
Waste treatment	—	—[a]	25	—	14	—[a]		
Rice agriculture	100	88	—[b]	—	25–54	60	53	
Biomass burning	55	40	40	40	34	23		
Other	—	—	—	20	15			
Total source	500	587	600					598
			Imbalance (Trend)					+22
Sinks								
Soils	10	—	30	30	44			30
Tropospheric OH	450	489	510					506
Stratospheric loss	—	46	40					40
Total sink	460	535	580					576

[a]Waste treatment included under ruminants.
[b]Rice included under wetlands.

Outline

Dióxino de carbono (CO_2)





- Fotossíntese: $6CO_2 + 6H_2O + \text{energia (luz solar)} \rightarrow C_6H_{12}O_6 + 6O_2$
- Respiração: $C_6H_{12}O_6$ (matéria orgânica) $+ 6O_2 \rightarrow 6CO_2 + 6H_2O +$ energia
- $\tau_0 = 3{,}5$ anos (330 anos no oceáno)
- $\tau_1 = 34$-44 anos

Dióxino de carbono (CO_2) - concentrações históricos

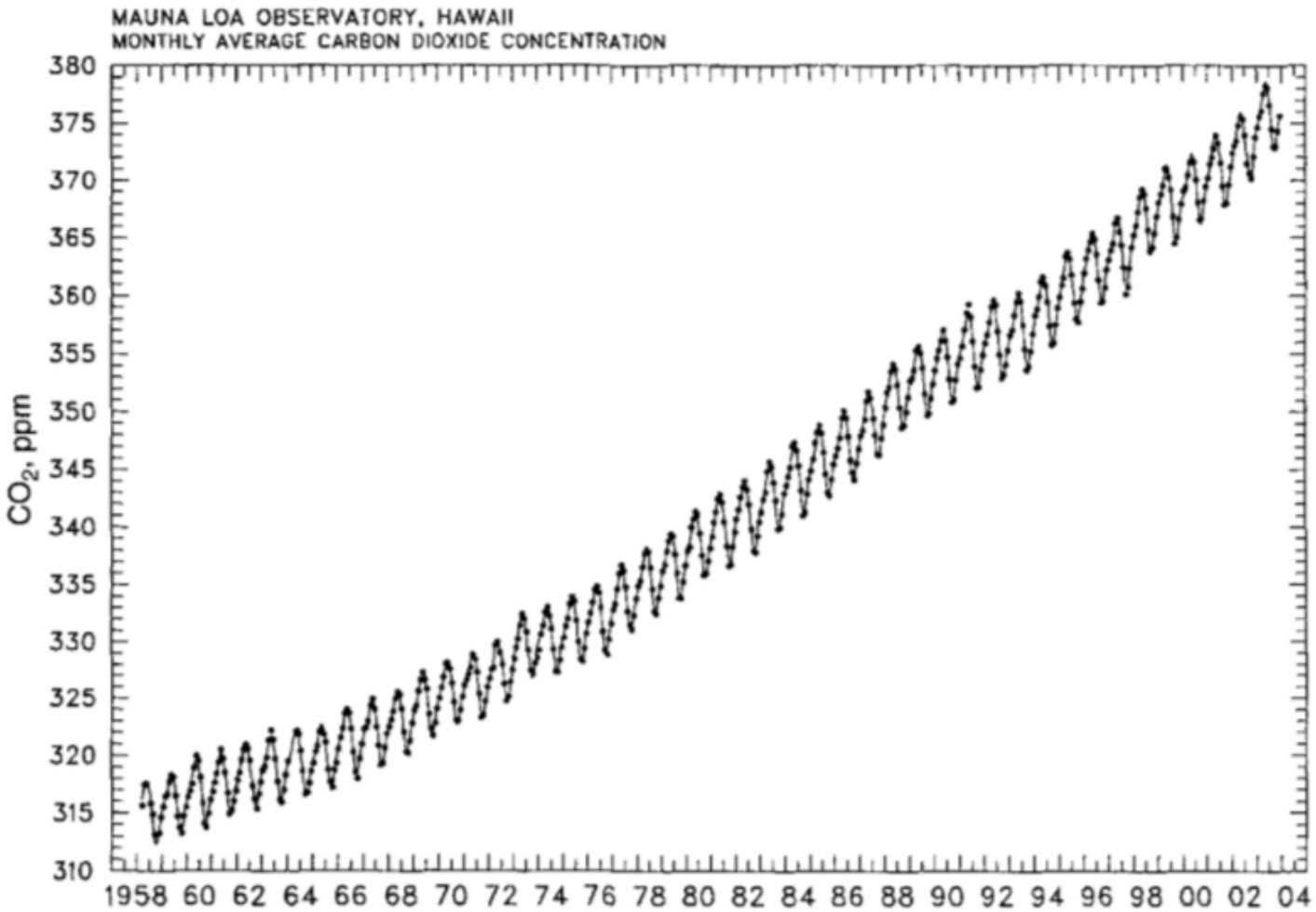
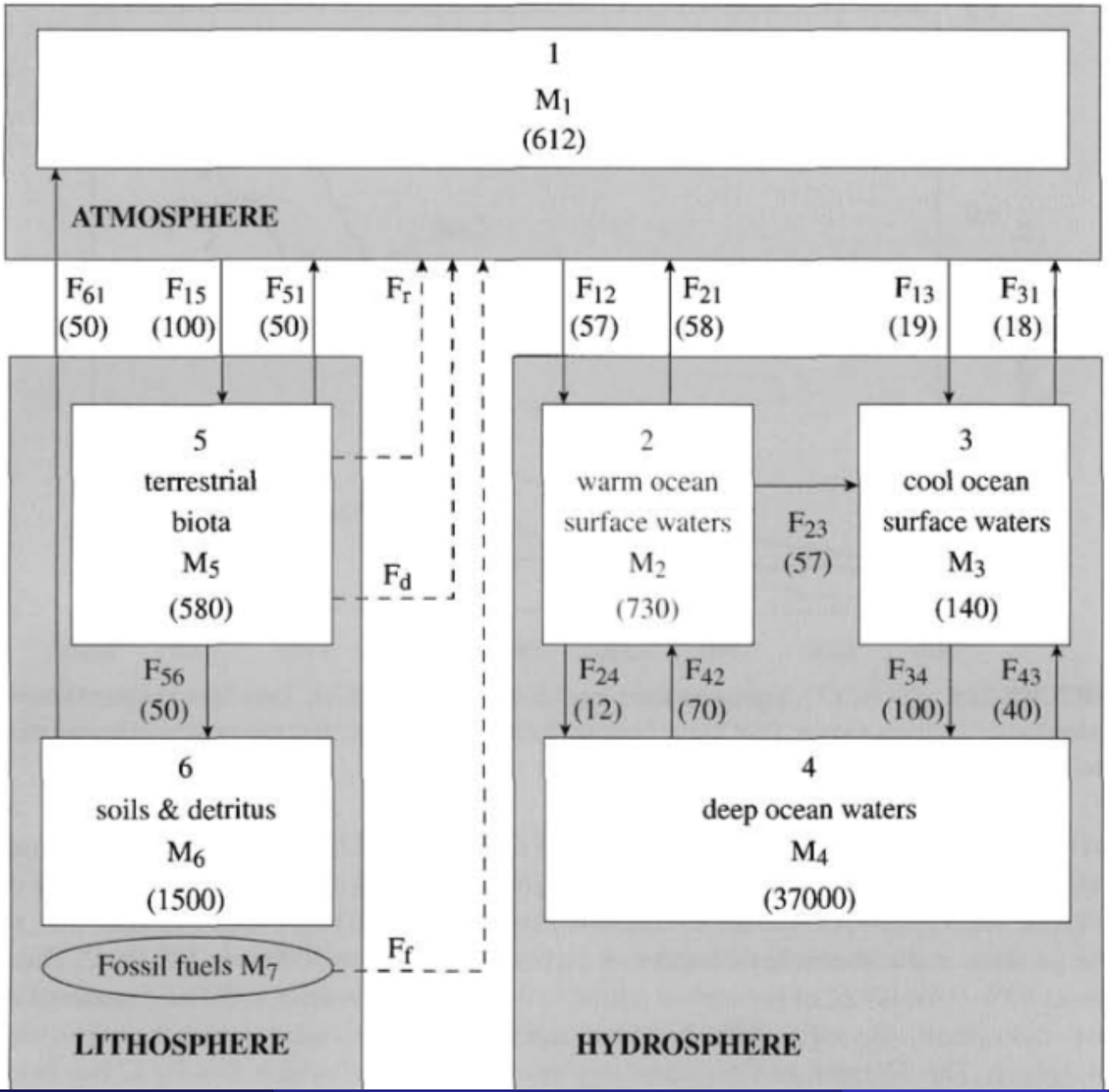


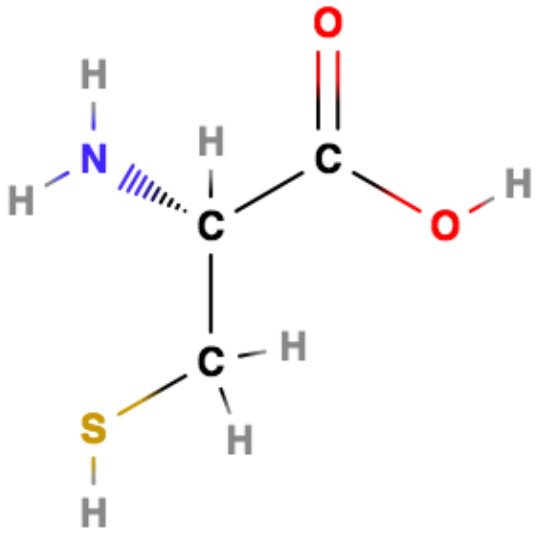
FIGURE 22.3 CO_2 mixing ratio measured at Mauna Loa, Hawaii, since 1958 (Carbon Dioxide Research Group, Scripps Institution of Oceanography).

Dióxino de carbono (CO_2) - Fluxos



Estrutura

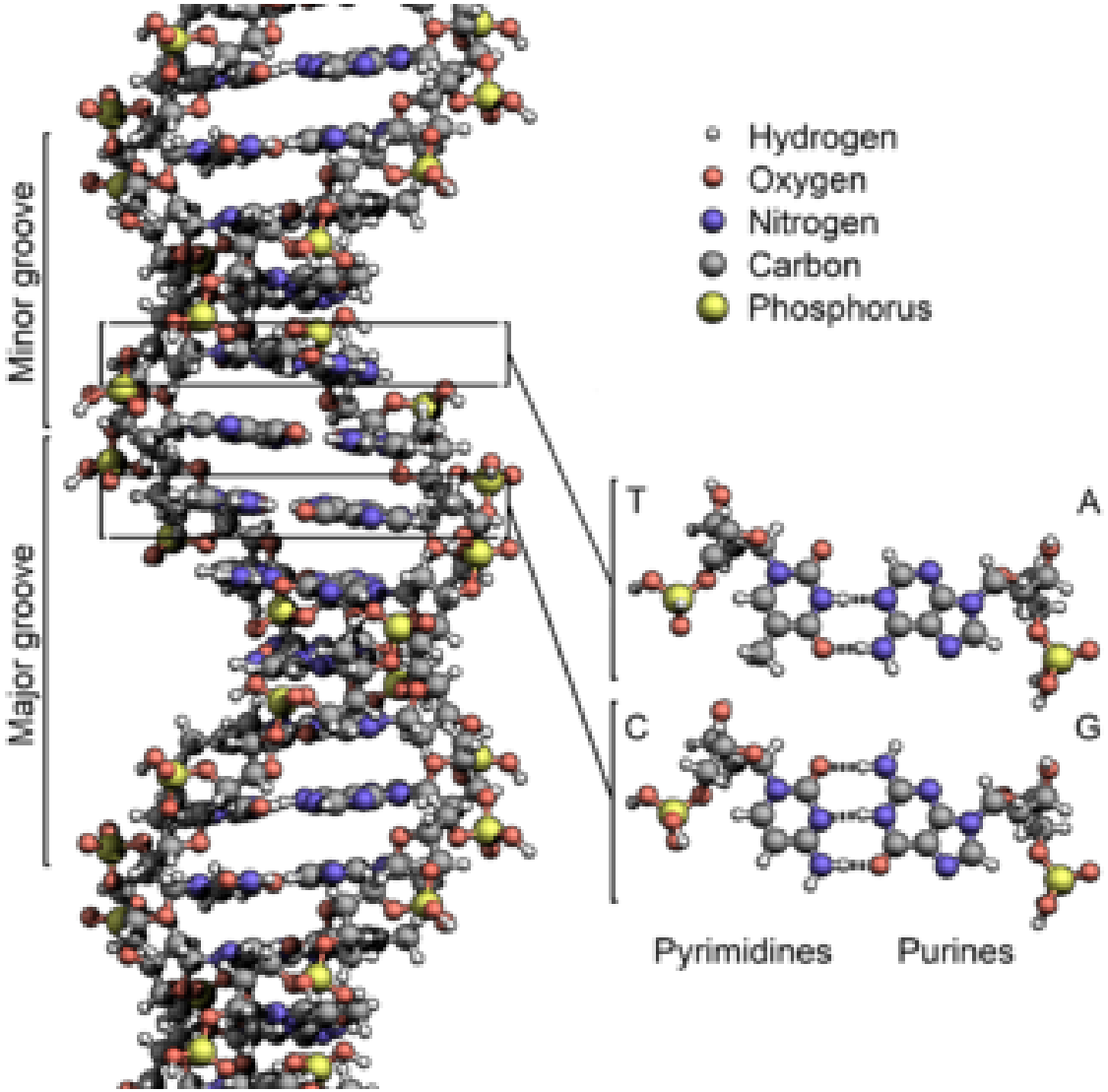
Moléculas



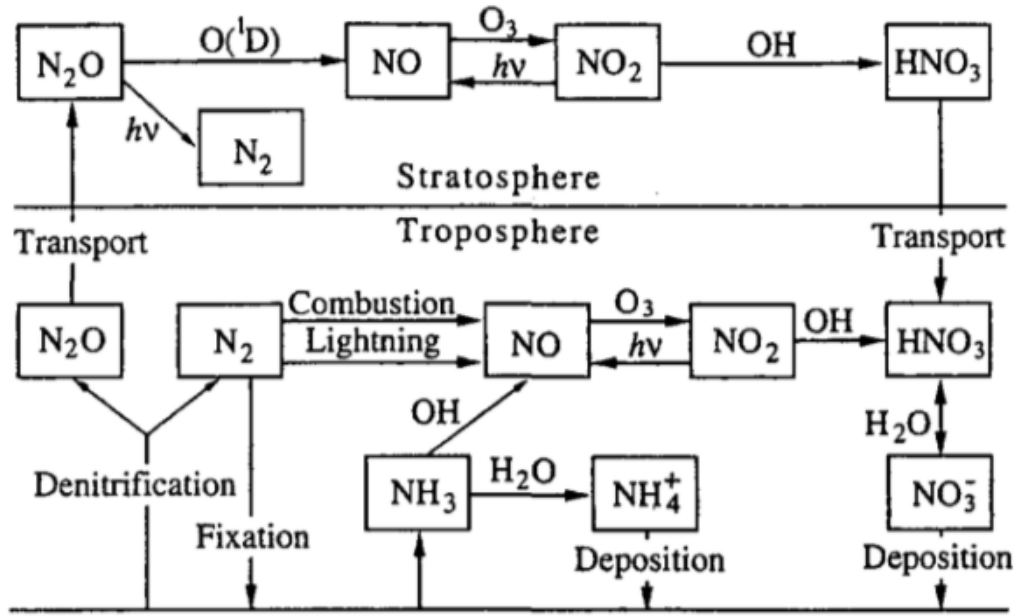
S
F
Cl
Br
I
...

- Atmosfera: N_2, NO, N_2O, HNO_3, NH_3
- NO_3^-, HNO_2, HNO_3
- aminoácidos (por exemplo: cisteina)
- Ácido desoxirribonucleico

DNA


Minor groove
Major groove
Hydrogen
Oxygen
Nitrogen
Carbon
Phosphorus
T
A
C
G
Pyrimidines
Purines

Atmosfera



Assimilation: NO_3^-, NH_4^+ $\rightarrow$ RN

Ammonification: RN $\rightarrow$ NH_3 $\rightarrow$ NH_4^+

Nitrification: $NH_4^+ \rightarrow NO_3^- \rightarrow NO_2^-$

Denitrification: $NO_3^- \rightarrow NO_2^- \rightarrow NO \rightarrow N_2O \rightarrow N_2$

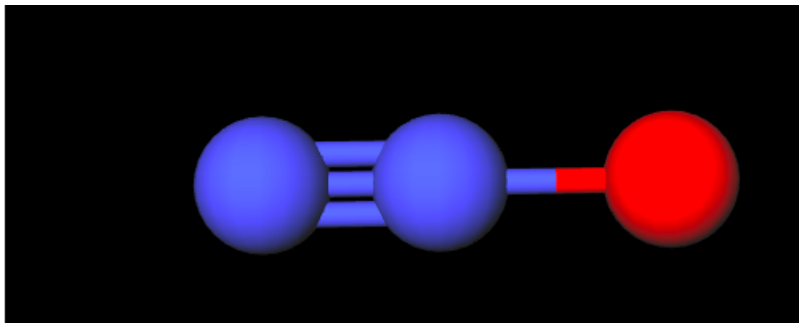
Fixation: $N_2 \rightarrow$ NO, NH_3

FIGURE 2.2 Processes in the atmospheric cycle of nitrogen compounds. A species written over an arrow signifies reaction with the species from which the arrow originates.

Outline

Óxido nitroso (N_2O)

F
Cl
Br
I
...



- Fontes biológicos
- $\tau = 120$ anos
- $\text{GWP}_{N_2O} = 300 * \text{GWP}_{CO_2}$
- 90% fotodissociação (90%), oxidação $O(^1D)$ (10%)

Óxido nitroso (N_2O) - concentrações históricos

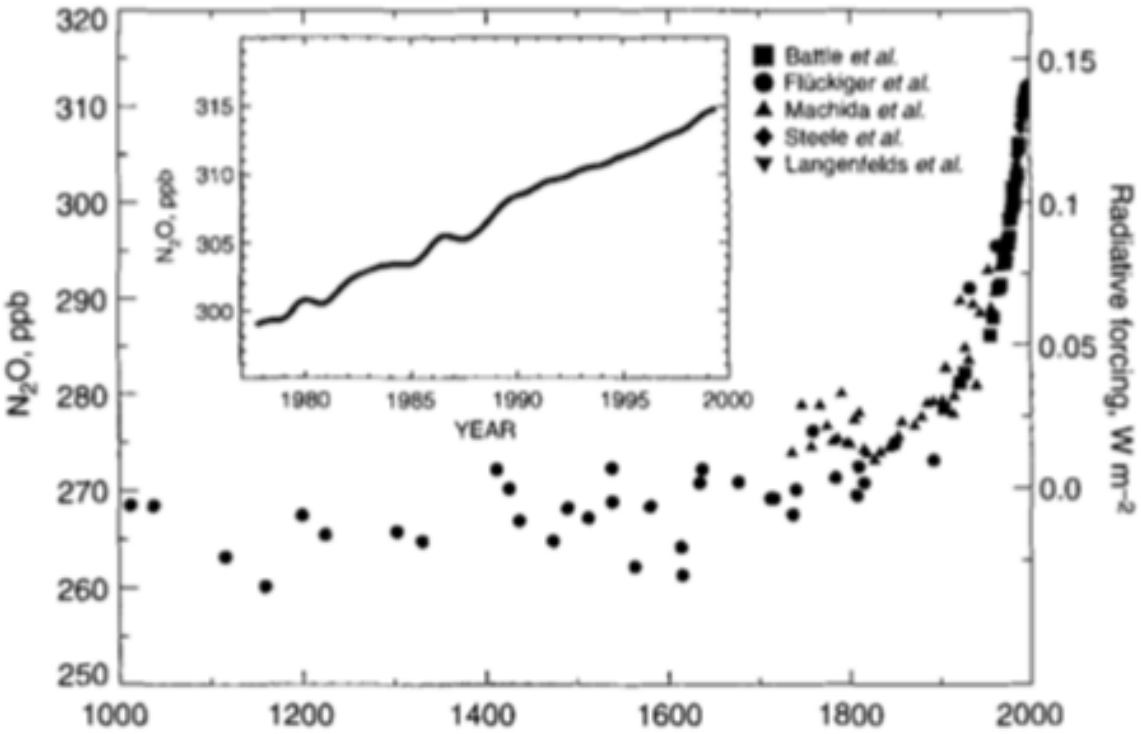


FIGURE 2.3 Atmospheric abundance of N_2O over the last millennium, as determined from ice cores, firn, and whole-air samples (IPCC 2001). Sources of data are indicated, references for which are given in IPCC. The inset contains deseasonalized global averages.

Óxido nitroso (N_2O) - Fluxos atmosféricos

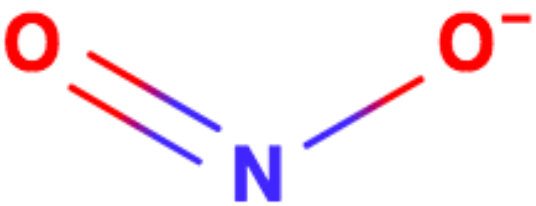
TABLE 2.5 Estimates of the Global N_2O Budget (in TgN/yr) and Values Adopted by IPCC (2001)

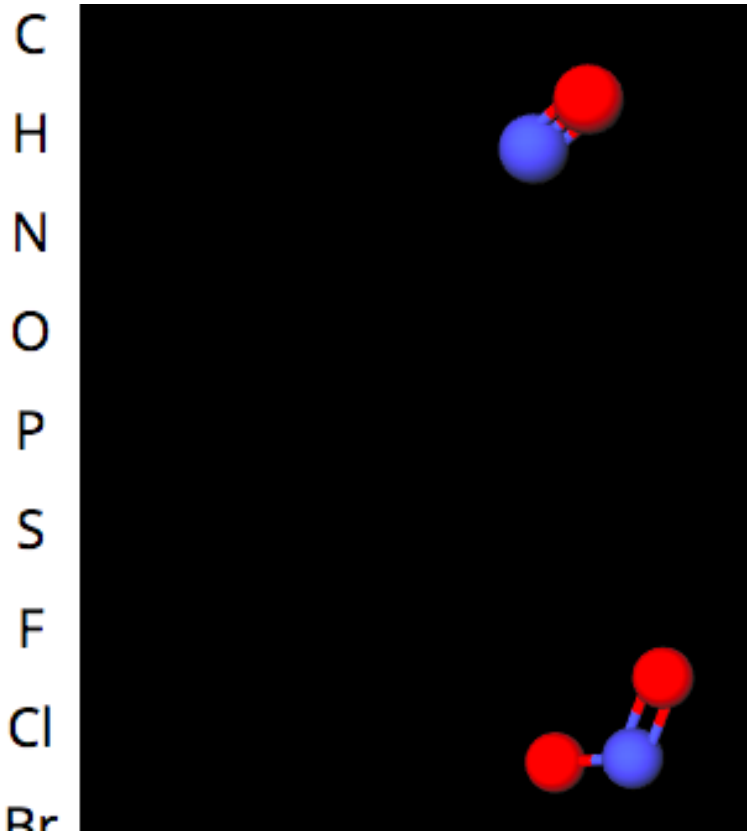
Reference:	Mosier et al. (1998b) Kroeze et al. (1999)		Olivier et al. (1998)		IPCC (2001)
Base Year:	1994	Range	1990	Range	1990s
Sources					
Ocean	3.0	1–5	3.6	2.8–5.7	
Atmosphere (NH_3 oxidation)	0.6	0.3–1.2	0.6	0.3–1.2	
Tropical soils					
Wet forest	3.0	2.2–3.7			
Dry savannas	1.0	0.5–2.0			
Temperate soils					
Forests	1.0	0.1–2.0			
Grasslands	1.0	0.5–2.0			
All soils			6.6	3.3–9.9	
Natural subtotal	9.6	4.6–15.9	10.8	6.4–16.8	
Agricultural soils	4.2	0.6–14.8	1.9	0.7–4.3	
Biomass burning	0.5	0.2–1.0	0.5	0.2–0.8	
Industrial sources	1.3	0.7–1.8	0.7	0.2–1.1	
Cattle and feedlots	2.1	0.6–3.1	1.0	0.2–2.0	
Anthropogenic subtotal	8.1	2.1–20.7	4.1	1.3–7.7	6.9
Total sources	17.7	6.7–36.6	14.9	7.7–24.5	
Imbalance (trend)	3.9	3.1–4.7			3.8
Total sinks (stratospheric)	12.3	9–16			12.6
Implied total source	16.2				16.4

Source: IPCC (2001).

Outline

Óxidos de nitrogênio (NO_x)





- (De)nitrificação

Óxidos de nitrogênio (NO_x) - Emissões

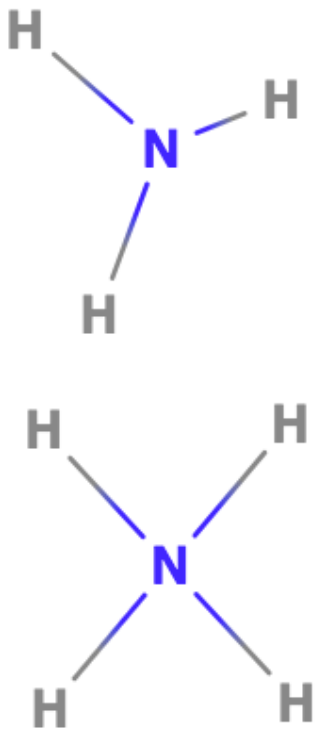
TABLE 2.6 Estimate of Global Tropospheric NO_x Emissions in Tg N yr^{-1} for Year 2000

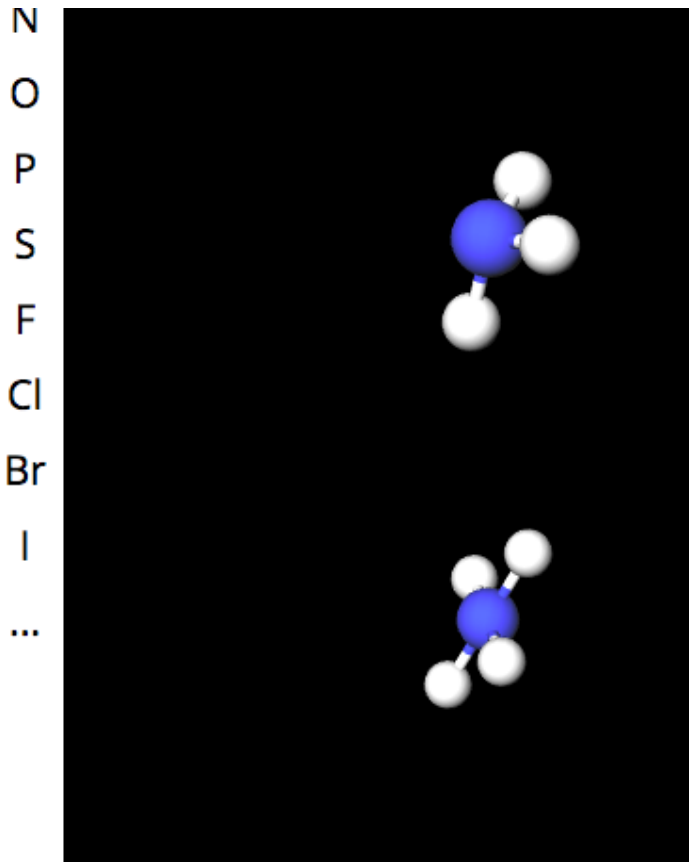
Sources	Emissions, Tg N yr^{-1}
Fossil fuel combustion	33.0
Aircraft	0.7
Biomass burning	7.1
Soils	5.6
NH_3 oxidation	—
Lightning	5.0
Stratosphere	<0.5
Total	51.9

Source: IPCC (2001).

Outline

Amônia (NH_3)





- Ion: NH_4^+
- Fontes: bacterial, agricultural e industrial
- Deposição seca e humida
- Razões: 0.1-10 ppb

Obrigado!