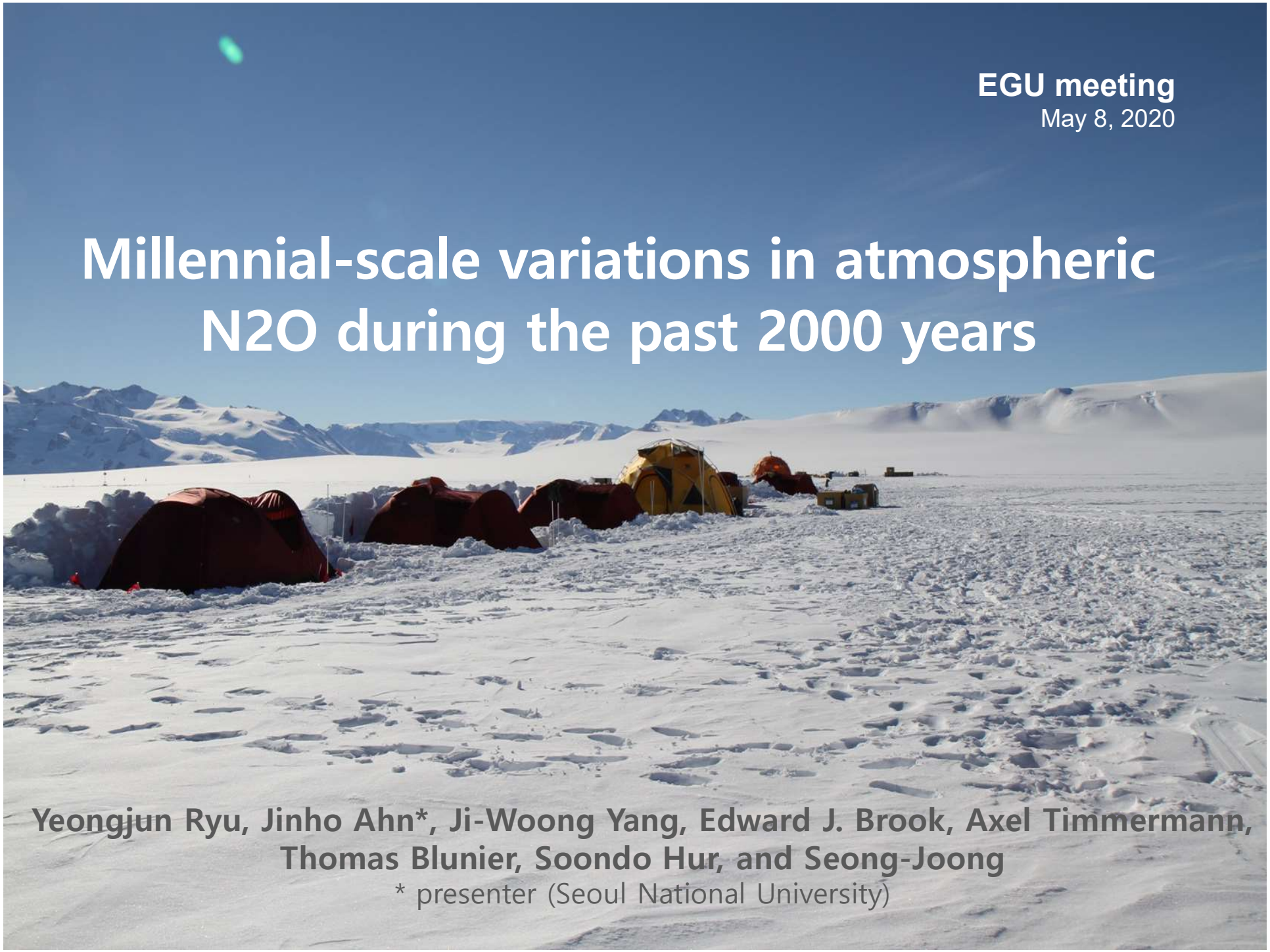

EGU meeting
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Millennial-scale variations in atmospheric N2O during the past 2000 years

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* presenter (Seoul National University)

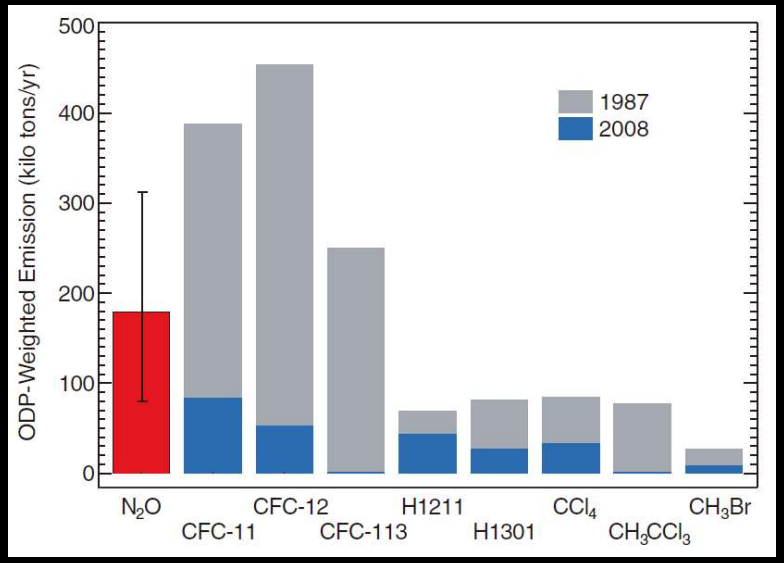
Nitrous oxide (N_2O)

Global Warming Potential (GWP)

		GWP	
	Lifetime (yr)	Cumulative forcing over 20 years	Cumulative forcing over 100 years
CO_2	[b]	1	1
CH_4	12.4	84	28
N_2O	121.0	264	265

(IPCC 5th report, 2013)

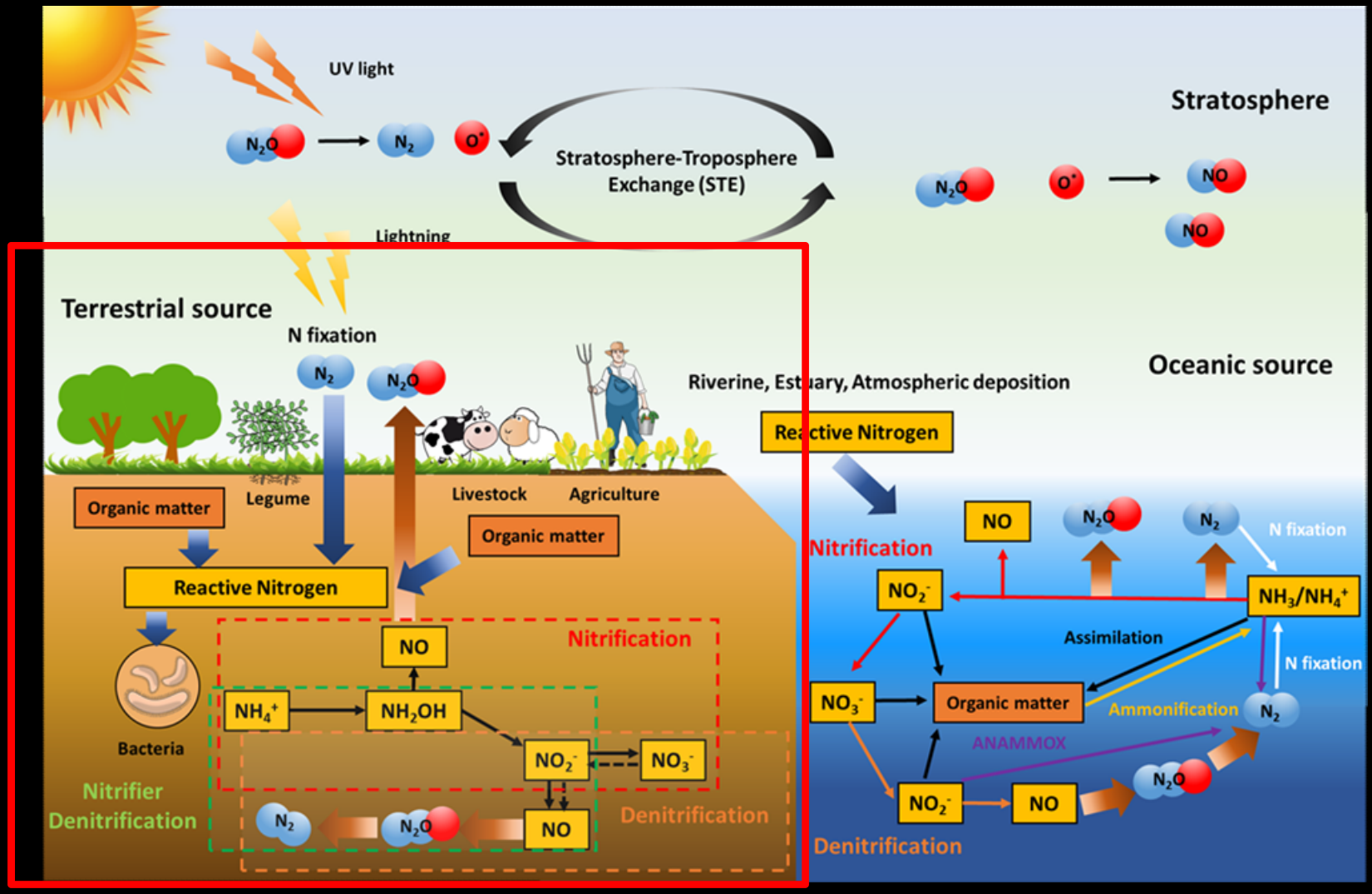
Ozone-Depleting Substance



Ravishankara et al. (2009)

- N_2O is third major long-lived greenhouse gas, having ~260 times higher GWP than CO_2
- N_2O is known as the dominant ozone-depleting substance emitted in the 21st Century (Ravishankara et al., 2009)

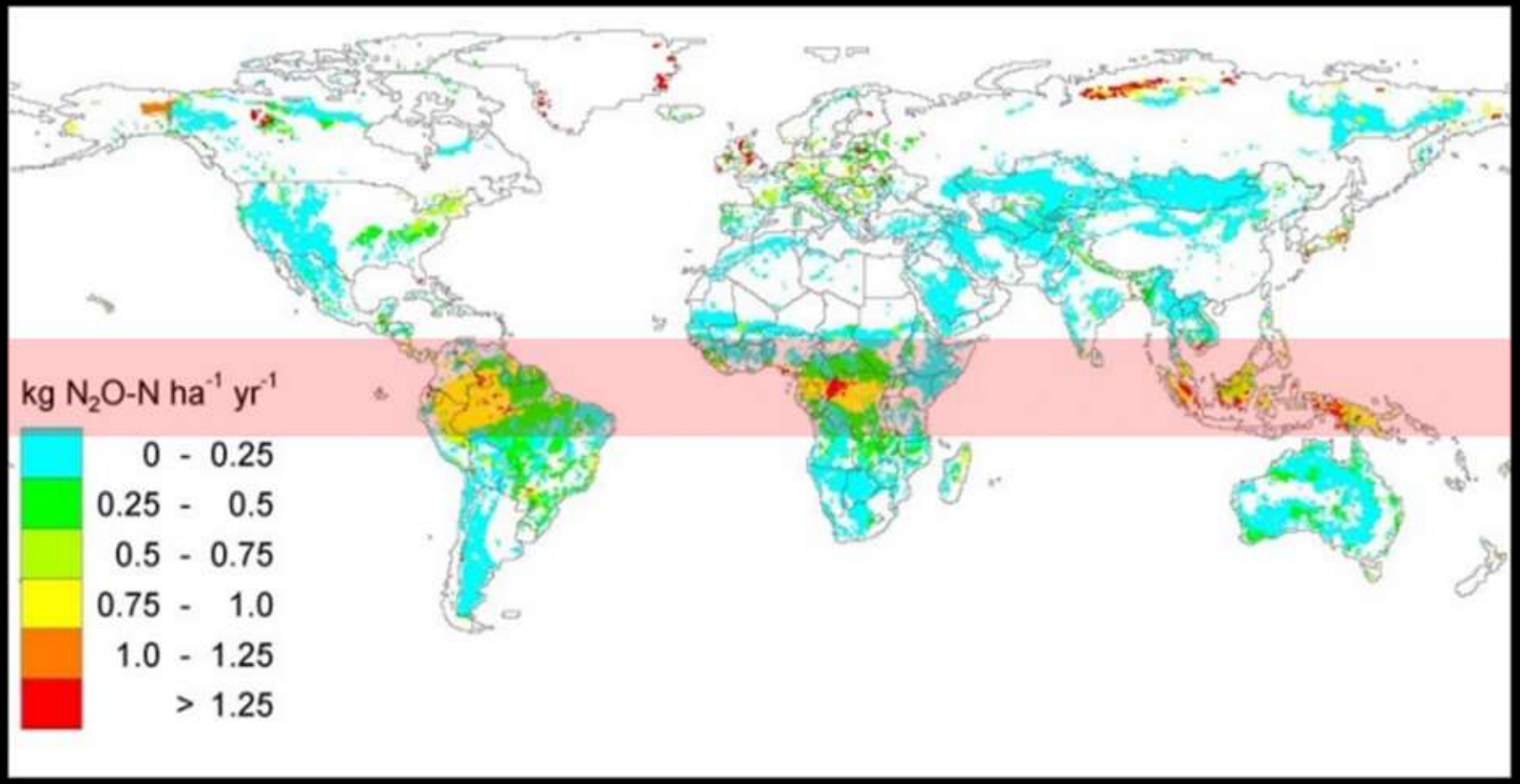
N_2O Sources and Sinks



Source: 1/3 from ocean, 2/3 from soils

Courtesy Yeongjun Ryu

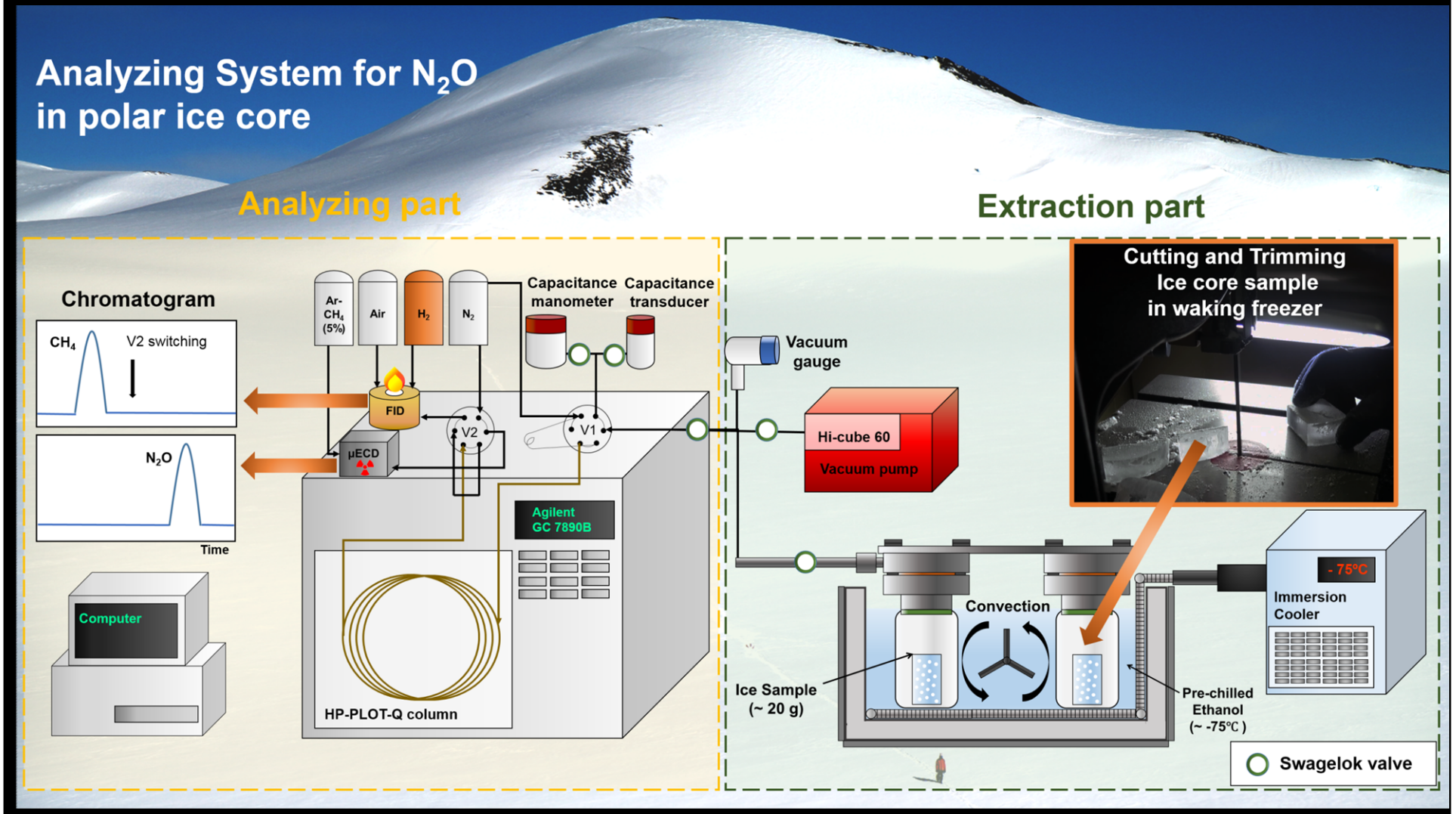
Terrestrial N_2O sources



- Terrestrial soil N_2O emission accounts for ~60% of total natural N_2O fluxes and tropical forest is the major source.

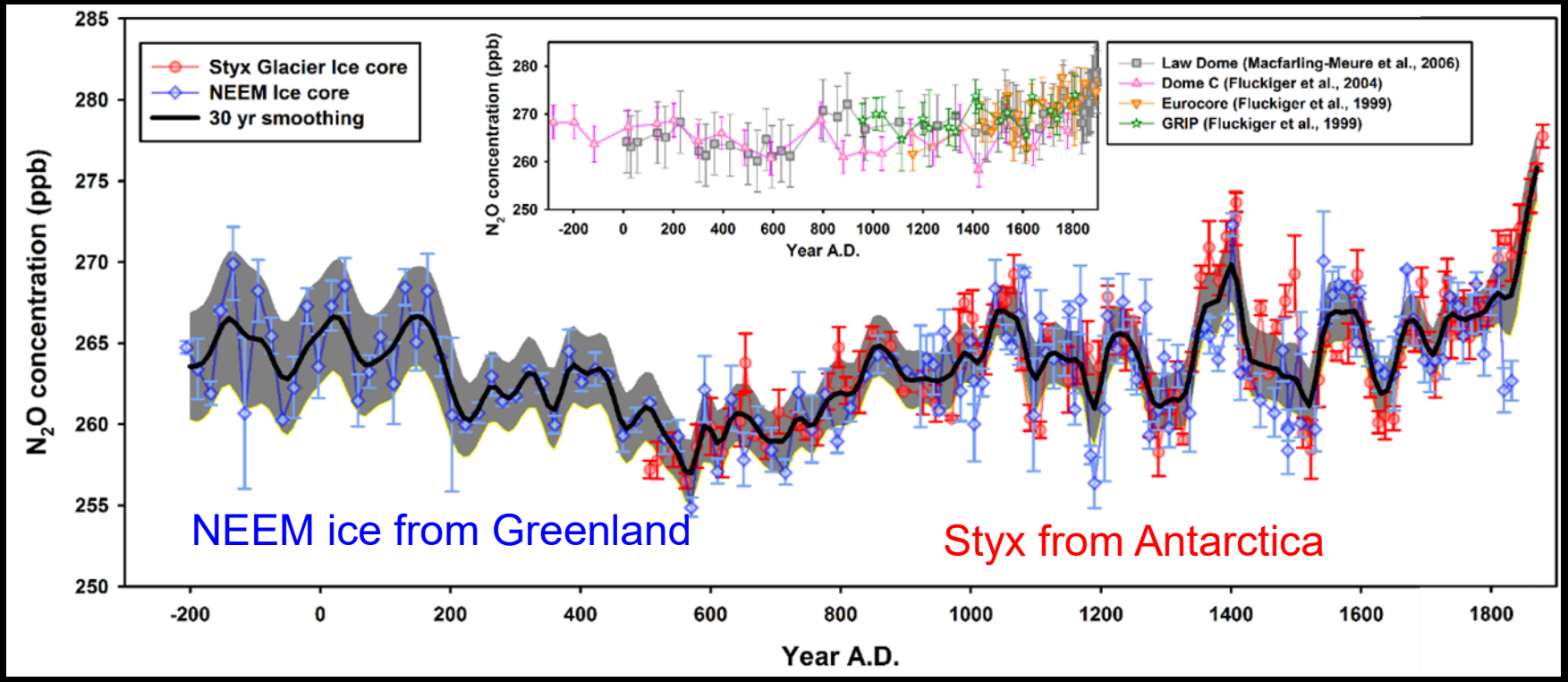
- The strong anthropogenic N_2O fluxes occur the major crop fields (e.g., Asia, South America).

Measurements (Wet Extraction)



Ryu et al. (2018, ES&T)

Centennial N_2O Changes



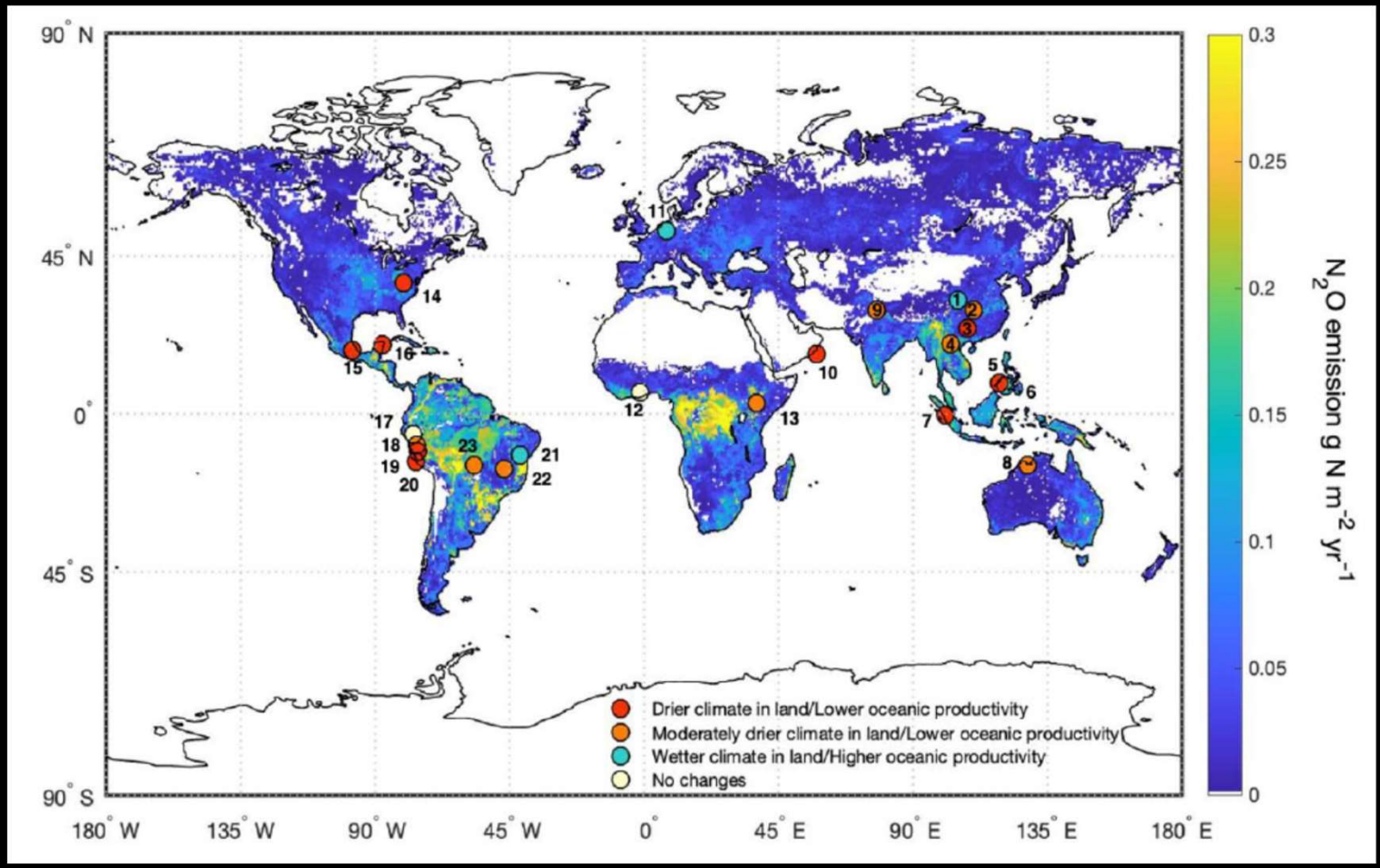
Ryu et al. (in prep.)

Two ice core records from Greenland and Antarctica generally agree during the last 1500 years

We observe local minimum at ~600 C.E.

Centennial N_2O change of 5-10 ppb

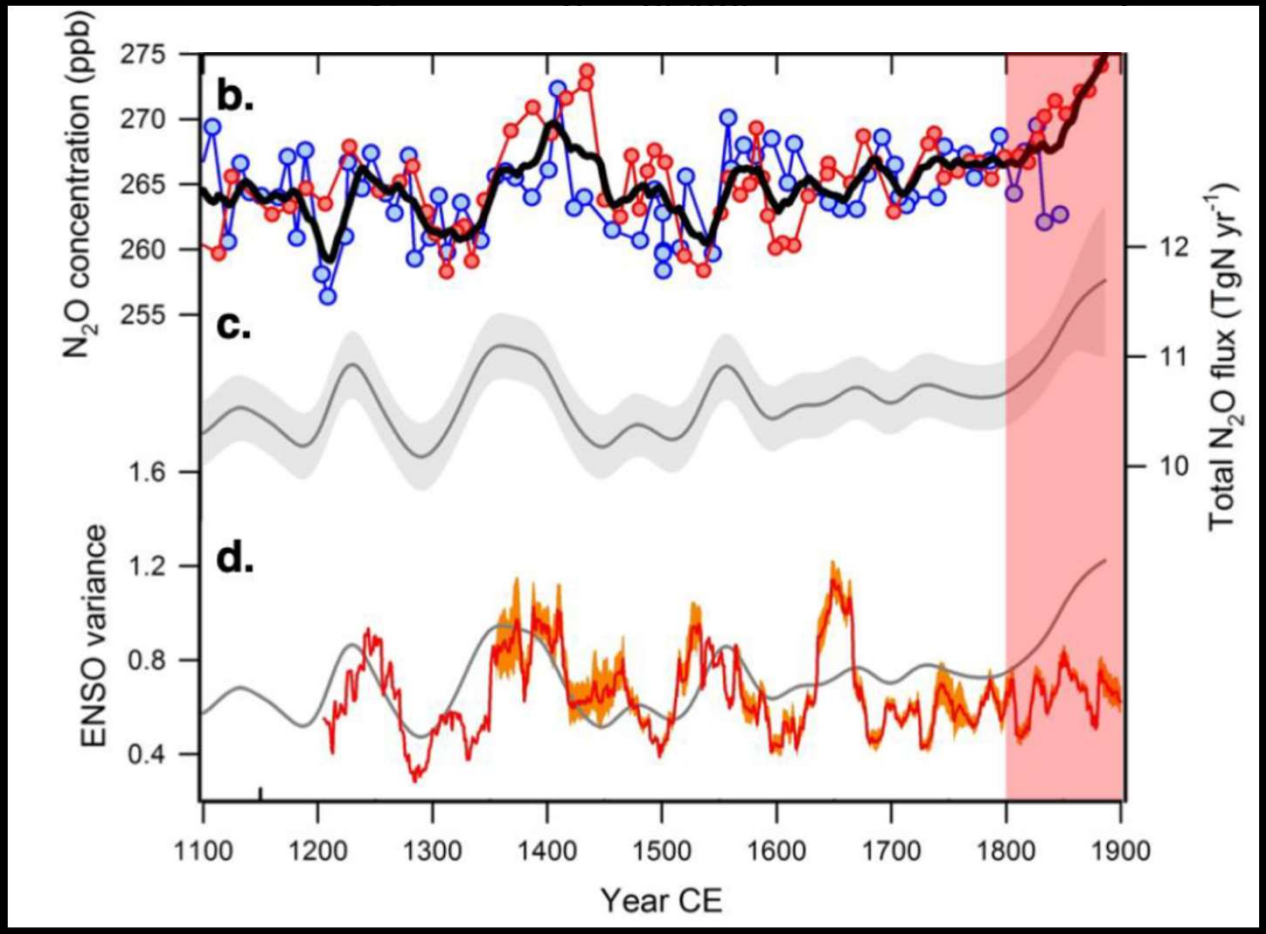
Local minimum of N_2O in 1600 CE



Hydroclimate and oceanic productivity changes between 400-800 CE

Reduced strength of monsoon in low latitudes => low precipitation => low N_2O production in soils
=> Atmospheric N_2O concentration decrease

Total N_2O Flux and ENSO Variance



Centennial N_2O source flux variations of ~ 1 TgN yr^{-1}

ENSO variance => ENSO strength =>Precipitation in tropical soils

$\Rightarrow$ N_2O production change

Summary

- N_2O has not been deeply investigated due to lack of sufficient precision of analytical method.
- Our new high-resolution N_2O records covering the last two millennia using the Greenland and Antarctic ice cores, generally agree well, enabling an analysis of centennial-scale N_2O variations.
- The composite N_2O record documents N_2O variations of ~10 ppb with a local minimum at ~600 AD when tropical monsoon strength was weakened and oceanic Oxygen Minimum Zones (OMZs) were less developed.
- N_2O is driven, to a large extent, by changes in tropical and subtropical land and hydrology and ocean productivity


Thank you for
paying attention!