Radiocarbon (^{14}C) as a Powerful Tool for Studying on Soil Organic Carbon Decomposition under Global Warming

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Inter-methodological comparisons

Remote Sensing

Micrometeorology

Model Calculation

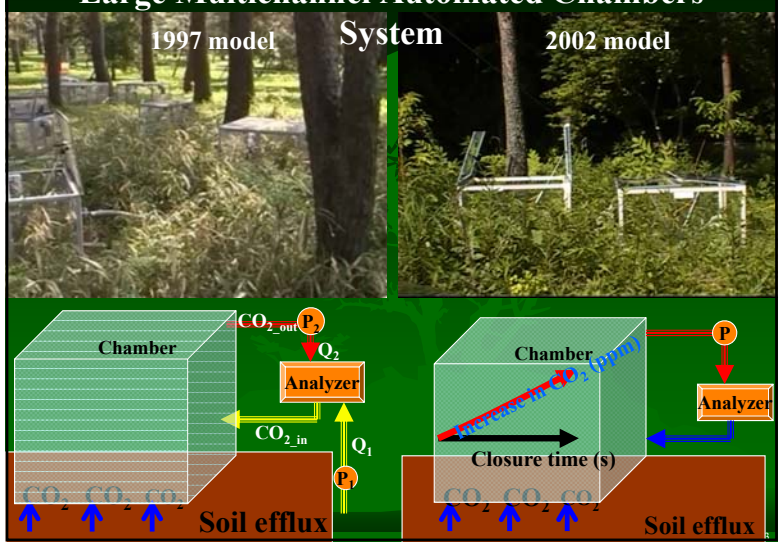
Ecophysiology

Biometrics

Large Multichannel Automated Chambers System

1997 model

2002 model



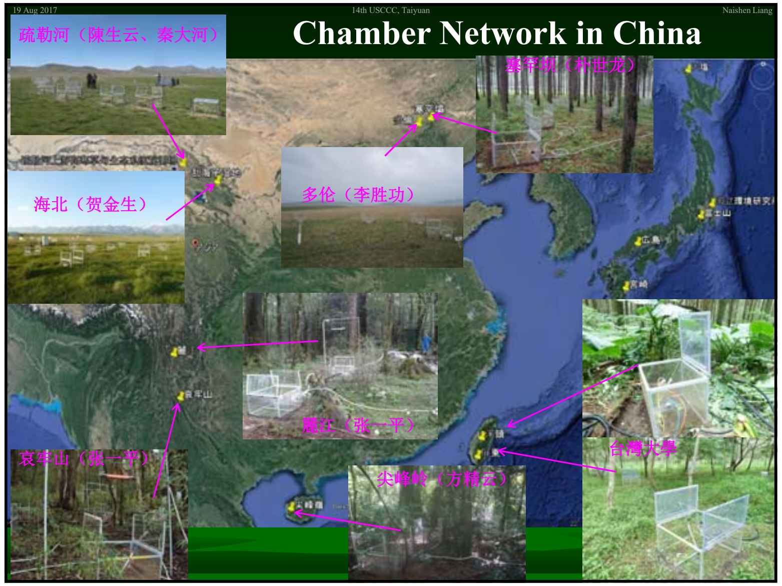
Chamber Network

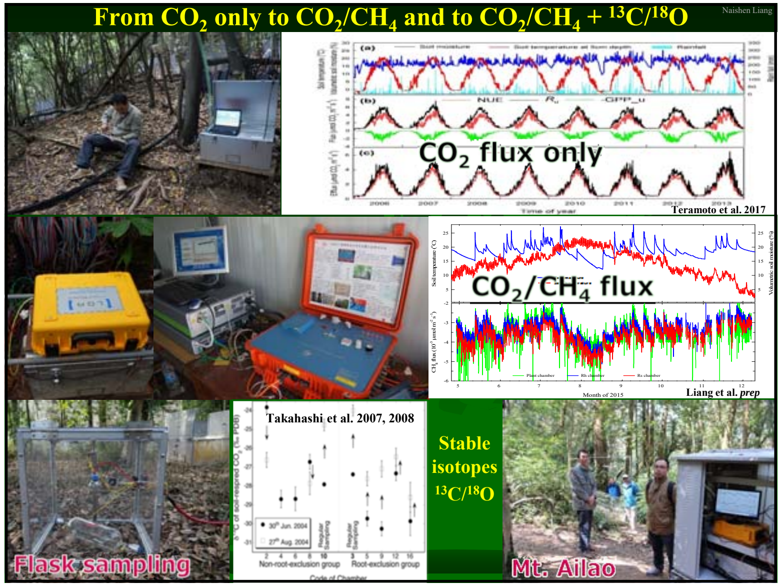
Siberia (boreal)

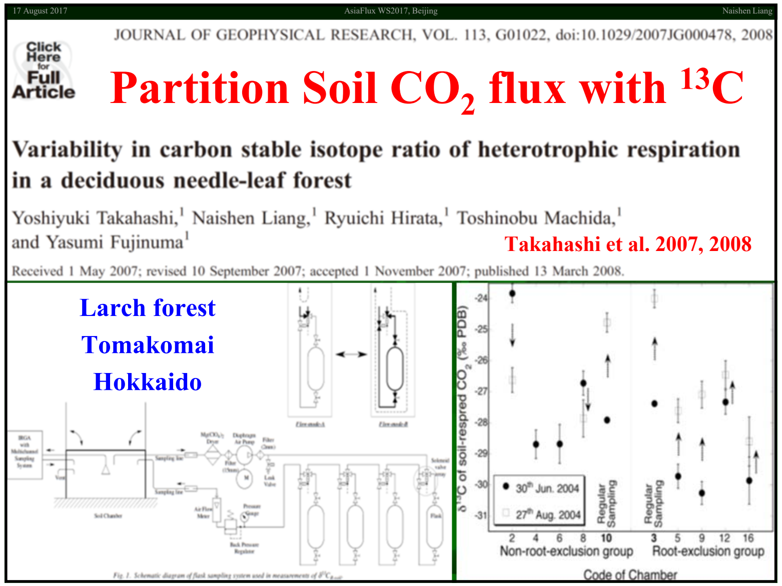
Malaysia (tropical)

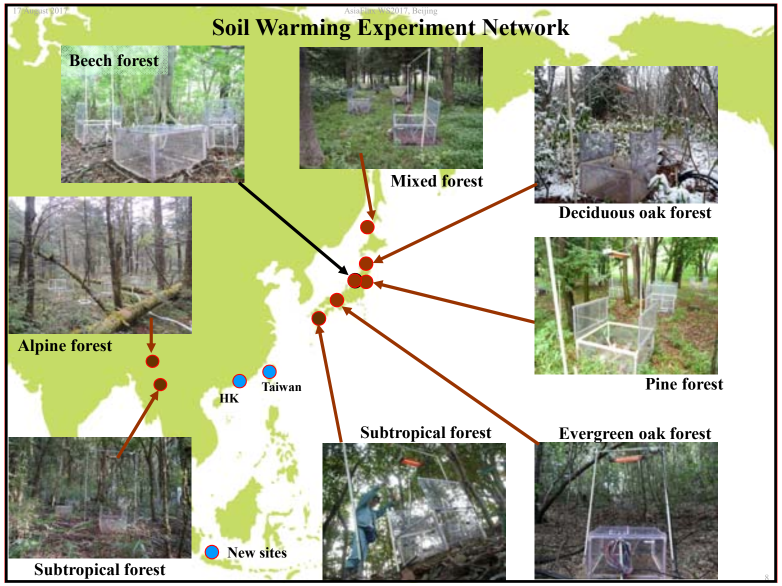
23m (lowland)

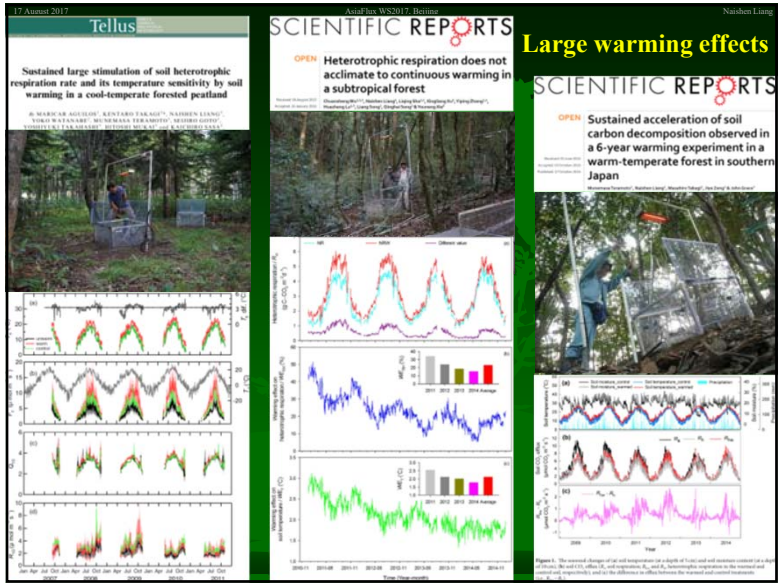
4200m (permafrost)


19 Aug 2017
14th USCCC, Taiyuan
Naishen Liang
Chamber Network in China
疏勒河（陳生云、秦大河）
塞罕坝（朴世龙）
海北（贺金生）
多伦（李胜功）
麗江（张一平）
台灣大學
哀牢山（张一平）
尖峰岭（方精云）


From CO_2 only to CO_2/CH_4 and to CO_2/CH_4 + $^{13}C/^{18}O$
Naishen Liang
CO_2 flux only
Teramoto et al. 2017
CO_2/CH_4 flux
Liang et al. prep
Takahashi et al. 2007, 2008
Stable isotopes $^{13}C/^{18}O$
Flask sampling
Mt. Ailao


17 August 2017
AsiaFlux WS2017, Beijing
Naishen Liang
JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 113, G01022, doi:10.1029/2007JG000478, 2008
Click Here for Full Article
Partition Soil CO_2 flux with ^{13}C
Variability in carbon stable isotope ratio of heterotrophic respiration in a deciduous needle-leaf forest
Yoshiyuki Takahashi,[1] Naishen Liang,[1] Ryuichi Hirata,[1] Toshinobu Machida,[1] and Yasumi Fujinuma[1]
Takahashi et al. 2007, 2008
Received 1 May 2007; revised 10 September 2007; accepted 1 November 2007; published 13 March 2008.
Larch forest
Tomakomai
Hokkaido
$\delta^{13}C$ of soil-respired CO_2 (‰ PDB)
30th Jun. 2004
27th Aug. 2004
Regular Sampling
Non-root-exclusion group
Root-exclusion group
Code of Chamber


Soil Warming Experiment Network
Beech forest
Mixed forest
Deciduous oak forest
Alpine forest
Pine forest
HK
Taiwan
Subtropical forest
Evergreen oak forest
New sites
Subtropical forest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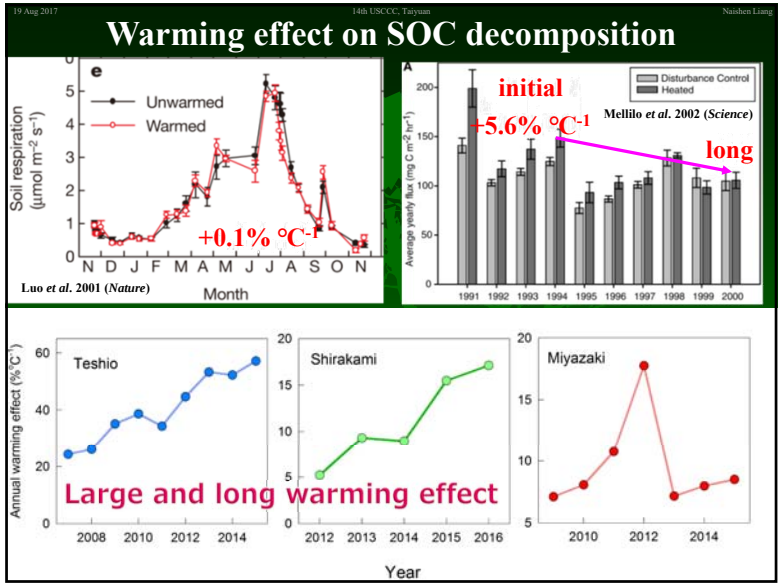
Tellus
Sustained large stimulation of soil heterotrophic respiration rate and its temperature sensitivity by soil warming in a cool-temperate forested peatland
SCIENTIFIC REPORTS
Heterotrophic respiration does not acclimate to continuous warming in a subtropical forest
Large warming effects
SCIENTIFIC REPORTS
Sustained acceleration of soil carbon decomposition observed in a 6-year warming experiment in a warm-temperate forest in southern Japan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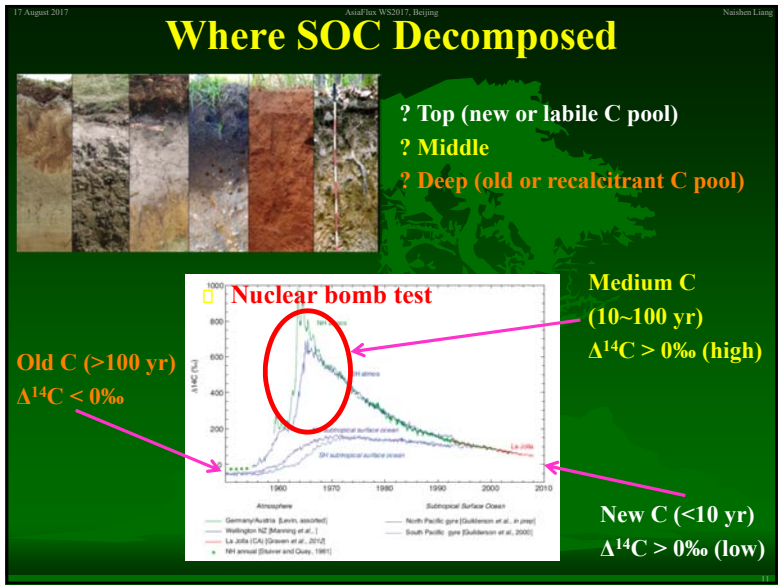
14th USCCC, Taiyuan
Naishen Liang
Warming effect on SOC decomposition
Unwarmed
Warmed
Soil respiration (μmol m⁻² s⁻¹)
Month
+0.1% °C⁻¹
Luo et al. 2001 (Nature)
initial
+5.6% °C⁻¹
long
Disturbance Control
Heated
Mellilo et al. 2002 (Science)
Annual warming effect (%°C⁻¹)
Teshio
Shirakami
Miyazaki
Large and long warming effect
Year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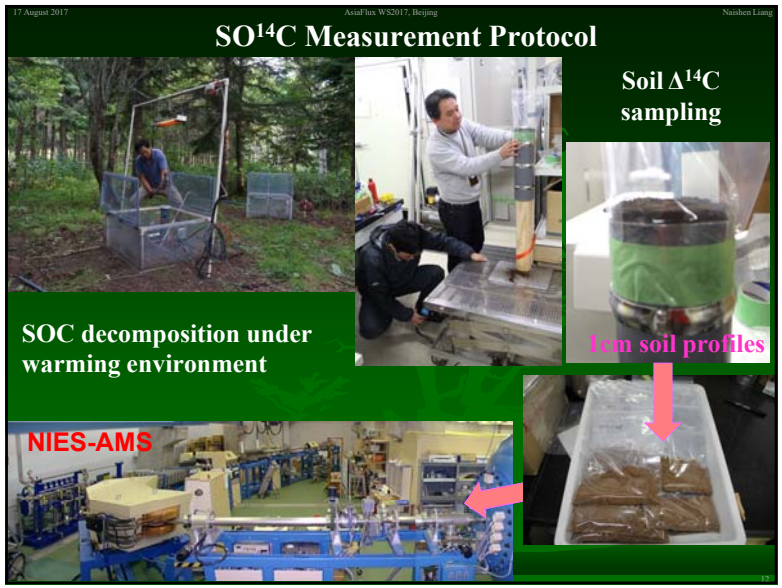
Where SOC Decomposed
? Top (new or labile C pool)
? Middle
? Deep (old or recalcitrant C pool)
Nuclear bomb test
Medium C
(10~100 yr)
Δ14C > 0‰ (high)
Old C (>100 yr)
Δ14C < 0‰
New C (<10 yr)
Δ14C > 0‰ (low)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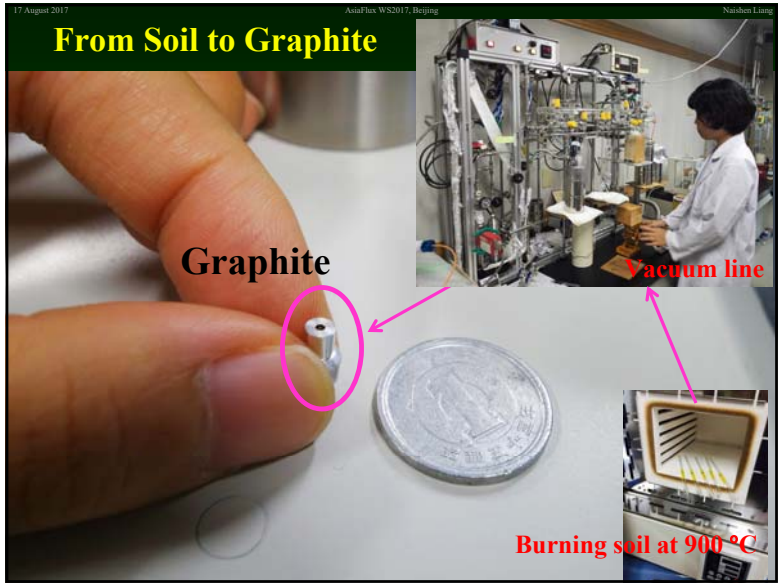
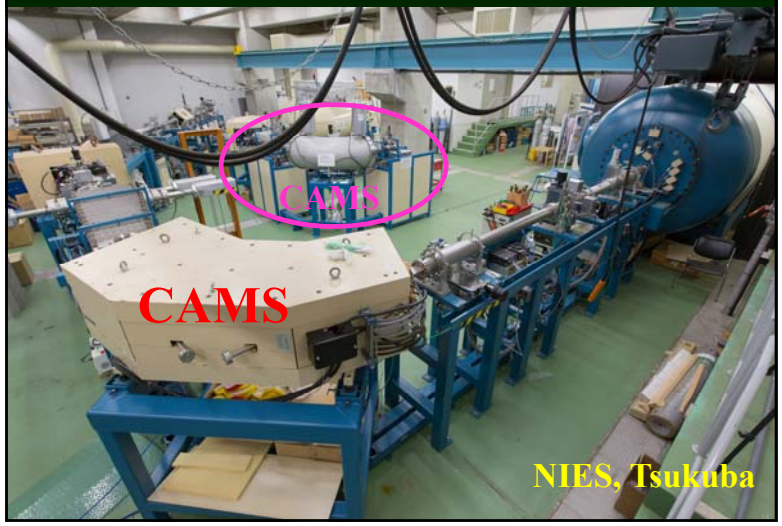
SO14C Measurement Protocol
Soil Δ14C sampling
SOC decomposition under warming environment
1cm soil profiles
NIES-AMS

From Soil to Graphite



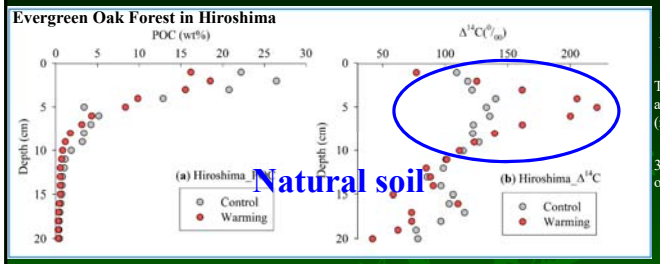
Two Accelerator Mass Spectrometers (AMS) in NIES



Compact Accelerator Mass Spectrometer (CAMS)

Compact Accelerator Mass Spectrometer (CAMS)

POC & ^{14}C Profiles in Top 20cm Soil

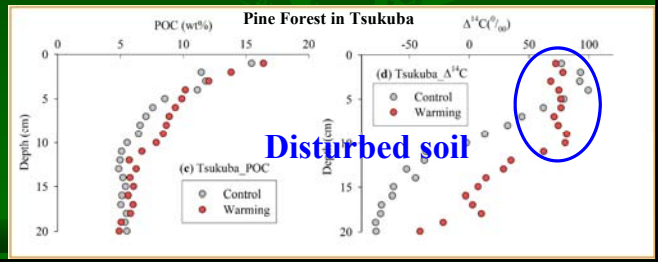


Decomposition

Top 3cm: leaf and fine root litter (new C).

3~8cm: decades old C.

Disturbance in the top soil



Conclusions