Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

ACC29-P01 会場:コンベンションホール 時間:5 月 26 日 18:15-19:30

レーザー氷床掘削のための氷の融解に関する研究
Studies of melting ice using laser for ice drilling

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分析されたアイスコアから過去の気候変動の詳細が明らかにされているが、アイスコアを掘削するためには多大なる努力と時間が必要である。我々は短時間でアイスコアと同等のデータを得るための技術開発を進めている。氷は赤外域の光をよく吸収する。赤外域の代表的なレーザーとして、波長 10.6 μ m の CO_2 レーザーがある。10.6 μ m の波長の光を氷に照射すると、氷は深さ 1mm 程度ですべて光を吸収することが計算から導き出された。このような特徴に着目して、CO_2 レーザーを氷に照射して融解速度を計測する実験を行った。結果、レーザー強度 50W/cm^2 程度で氷は 0.8mm/sec、密度 0.15g/cm^3 の雪では 4mm/sec. の融解速度であった。水平面から傾けてレーザーを氷に照射すると、融解水の影響で融解速度が減少することが解った。ファイバーカップル赤外レーザーを利用すれば、氷床を掘削することは可能であると我々は考えている。

キーワード: 氷, レーザー, 吸収, 融解, 掘削, 氷床
Keywords: ice, laser, absorption, melt, drilling, ice sheet

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アイスコアからみる過去８回の氷期サイクルにおける気候安定性
State dependence of climatic instability from ice-core records over the past eight glacial cycles

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Climatic variability on millennial timescales with bipolar seesaw pattern during glacial period has been documented in palaeo-climatic records, but their frequencies and relationships with mean climatic state are still unclear. Here we investigate the long-term characteristics of such variability using a new 700,000-year ice core record from Dome Fuji, East Antarctica, combined with another long Antarctic record. The 10^3- to 10^4-year warming events over the past eight glacial-interglacial cycles are most frequent when Antarctic temperature is slightly below average, equivalent to an intermediate climate during glacial periods. With the ice core data and climate modeling, we suggest that the prerequisite for the most frequent climate instability with bipolar seesaw pattern during the late Pleistocene is not only the extent of continental ice sheets but also low CO2. North Atlantic cooling sets high sensitivity of AMOC and climate to small perturbations such as moderate freshwater anomaly.

キーワード: ドームふじ氷床コア, 急激な気候変動, 数千年スケール変動
Keywords: Dome Fuji ice core, Abrupt climate change, Millennial-scale variability

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急激な気候変化のモデリング：南北両極シーソーの応答の気候状態依存性
Modelling the state dependency of abrupt climate change and bipolar seesaw

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Millennial climate change such as D-O cycles, AIM recorded in ice cores in both Hemispheres is known to show a relatively higher amplitude in the middle-level of a glacial cycle than in the interglacial state or severe glacial state. Although massive discharge or melt water of Ice sheet to ocean is one of the cause thought to be responsible for the millennial climate change, the thermal response to fresh water release in North Atlantic in global models and/or the paleoclimatic data in the region far from North Atlantic do not agree and even do not explain the dependence of the amplitude upon the level of climate state. Here we ran several sensitivity experiments using a coupled atmosphere and ocean GCM (MIROC3.2.2) and show that the response to fresh water release to the ocean and bipolar response is highly dependent on the background climate. The experiments were conducted with 500 years water hosing of 0.05 to 0.1 Sv (where 1 Sv is equivalent to the water flux of 10m sea level rise in 100 years) in the North Atlantic 50-70N in the same manner and position as CMIP/PMIP protocol under different basic states; Modern Hosing under modern climate with the pre-industrial condition, and Glacial hosing under LGM condition (21ka as PMIP, with ice sheets and lowered Greenhouse Gases). The results show largest cooling response in North Atlantic and a reasonable bipolar warming signal as in the ice cores of Antarctica, and the dependence upon background climate is not relatively the same for the both hemisphere. The mechanism of different responses are discussed in detail through the analysis of model experiment of atmosphere, ocean and sea ice coupling.

キーワード: 気候モデル, 急激な気候変化
Keywords: climate model, abrupt climate change