Investigation of retrieved snow depth by microwave remote sensing with in-situ field data

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ABSTRACT

AMSR-E/AMSR2 is provided the brightness temperature data with more channels, higher spatial resolution and frequent coverage. New snow algorism techniques of remote sensing for snow depth and snow-melting area can be carried out using these in-situ data. We have conducted snow survey from 2006 to now, which is mainly on March and occasionally on January and April/May when seasonal snow melts. The sites are located at an interval of ca. 32-km along the Dalton Highway (Fig. 1). Snow density, snow depth and temperature were measured in snow-pit wall observation at each site. Snow water equivalent (SWE) was calculated by multiplying snow-column snow density by snow depth. As the results, the response of SWE to snow depth showed a positively linear relationship ($R^2 > 0.90$).

1. Site Description & Methods

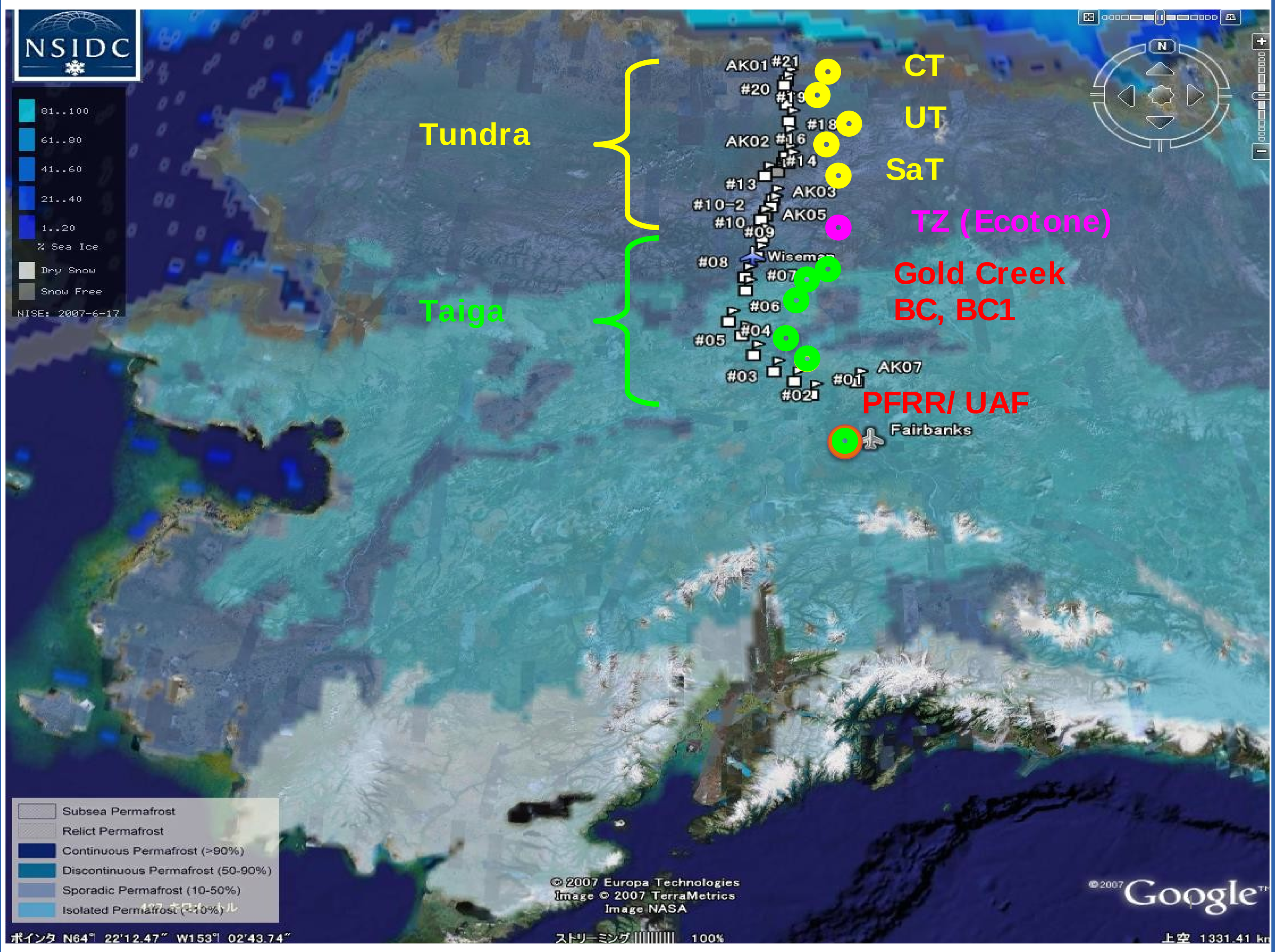


Fig 1. Snow survey sites along Dalton Highway. Small squares and circles denote snow pit-wall observation and environmental data observation sites across North-South transect.

1. *Total distance: 663 km (2-30 mile interval);*
2. *Tundra site (12); Boreal forest site (10);*
3. *Snow pit-wall observation: snow depth and SWE;*
4. *Observation period: Feb 2006, Feb 2007, Mar 2008, Mar 2009; Mar 2010; Feb 2011; ~~Mar 2012~~; Mar 2013; Mar 2014;*
5. *AMSR-E (2006-2011); AMSR2 (2013-2014).*

2. Results and Discussion

2.1. *In-situ* Snow Depth

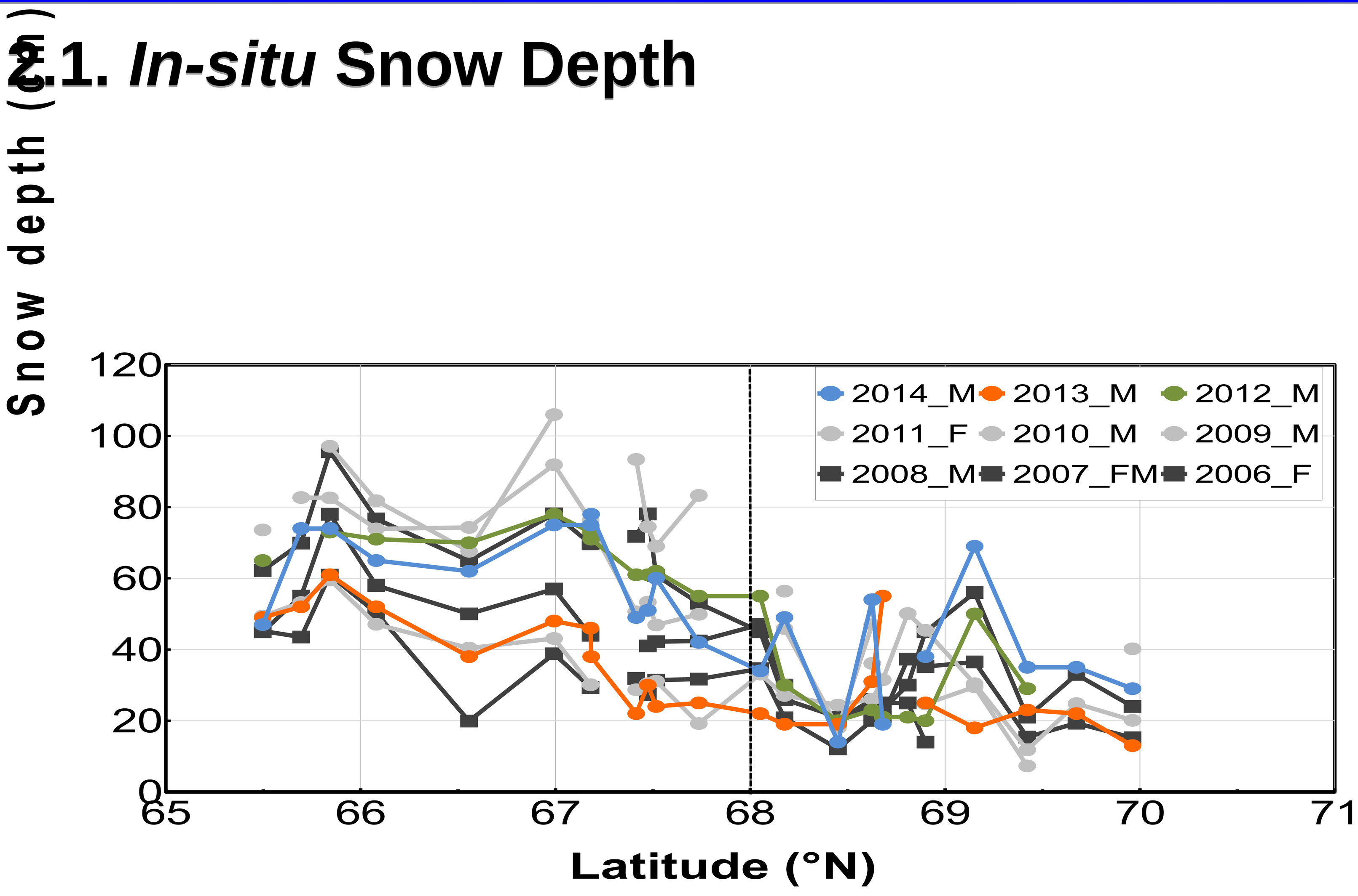
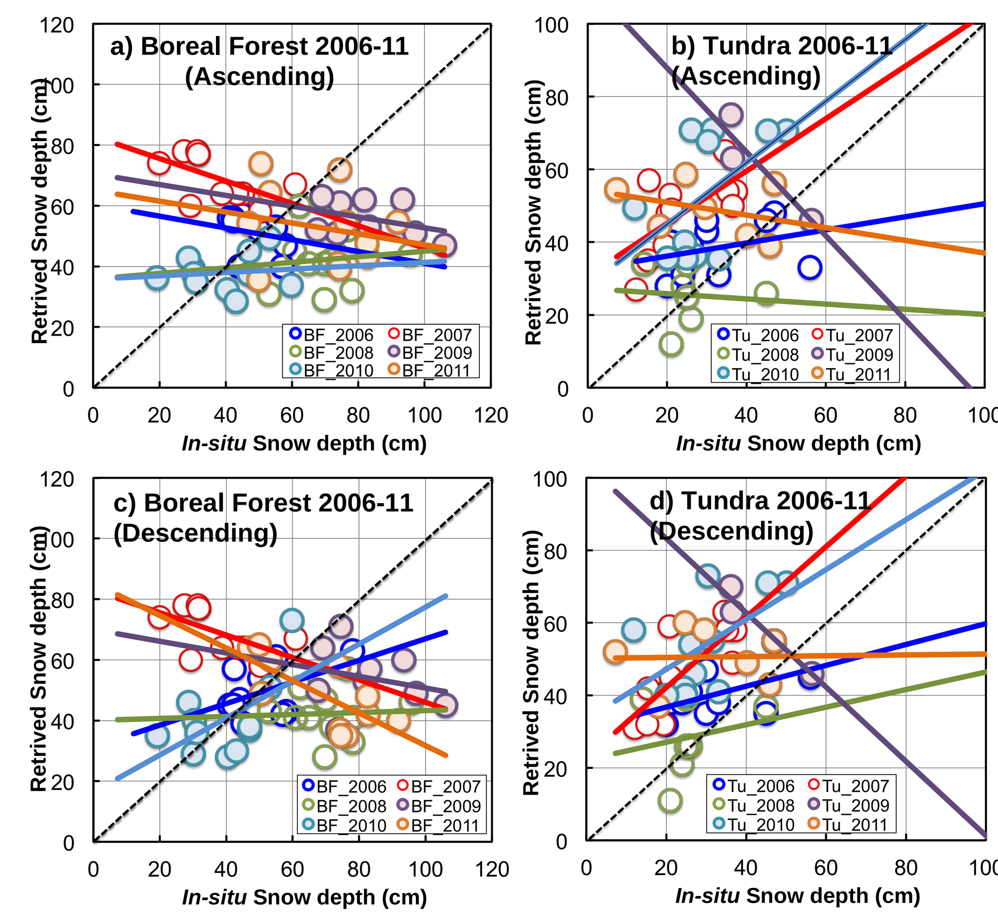


Fig 2. Spatial and inter-annual variations of *in-situ* snow depth across North-South Transect, indicating that boreal forest is below the 68 °N and the north is tundra site from February 2006 to March 2014, except for 2012.

2.2. In-situ and Retrieved Snow Depth



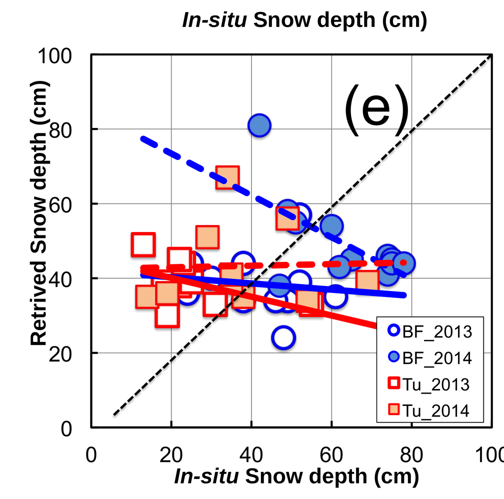


Fig. 3. Relationship between in-situ and retrieved snow depth from 2006 to 2011 for AMSR-E, and from 2013-2014 for AMSR2 (e). The dotted line is 1:1 line. Most of data denote negative or slight lines in tundra and boreal forest. This suggests that the algorithm may be not fitted to high northern latitude hemisphere due to the incorrect parameter.

1. *Needs for re-construction of adequate algorithm to NHL;*
2. *Needs for temporal variation of snow depth with time-lapsed camera at representative sites.*

2.3. *In-situ* Snow Depth and SWE

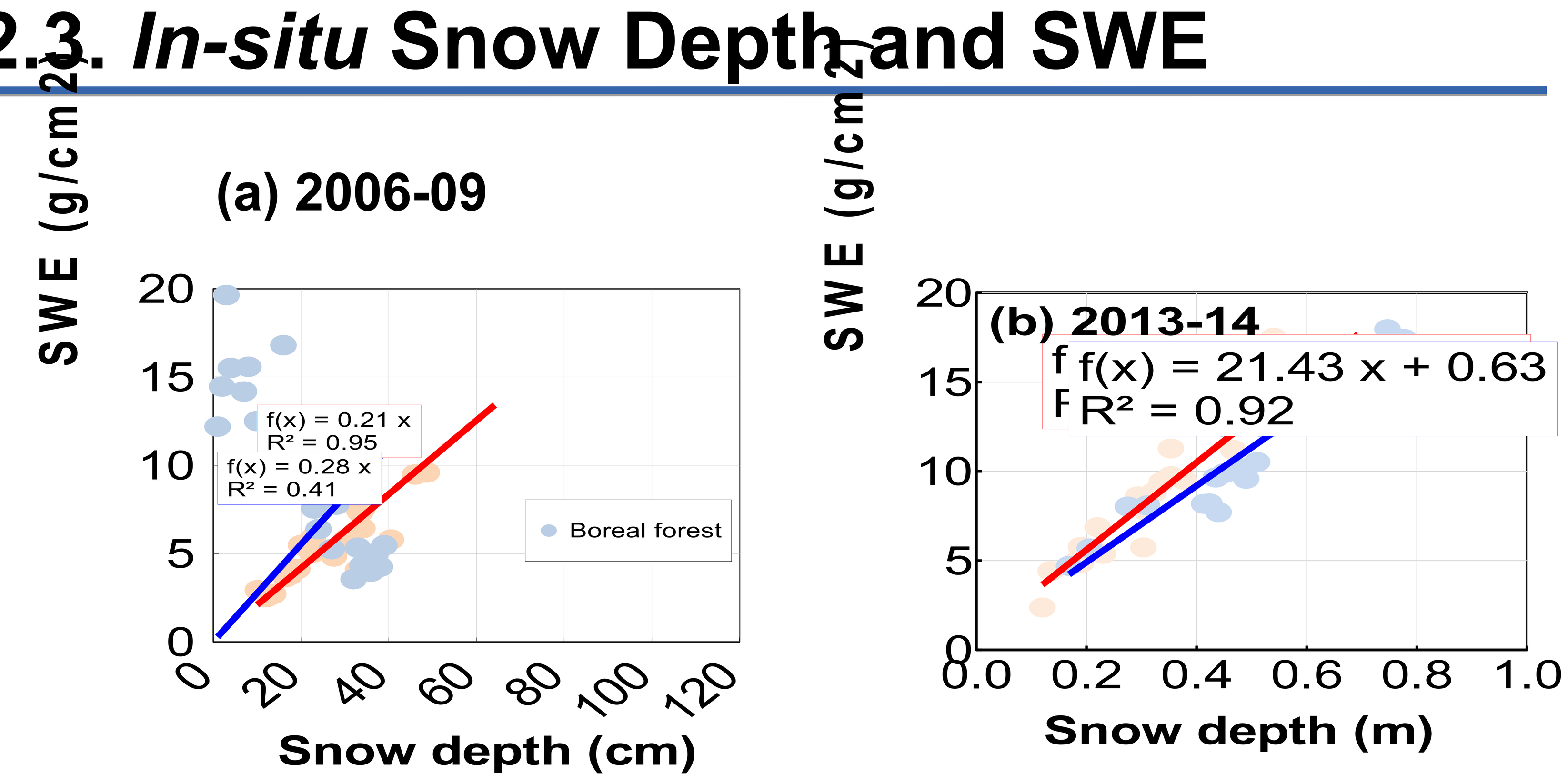


Fig 4. Relationship between in-situ snow depth and SWE (snow water equivalent).

2.4. *AMSR-2 Images of 2013/14*

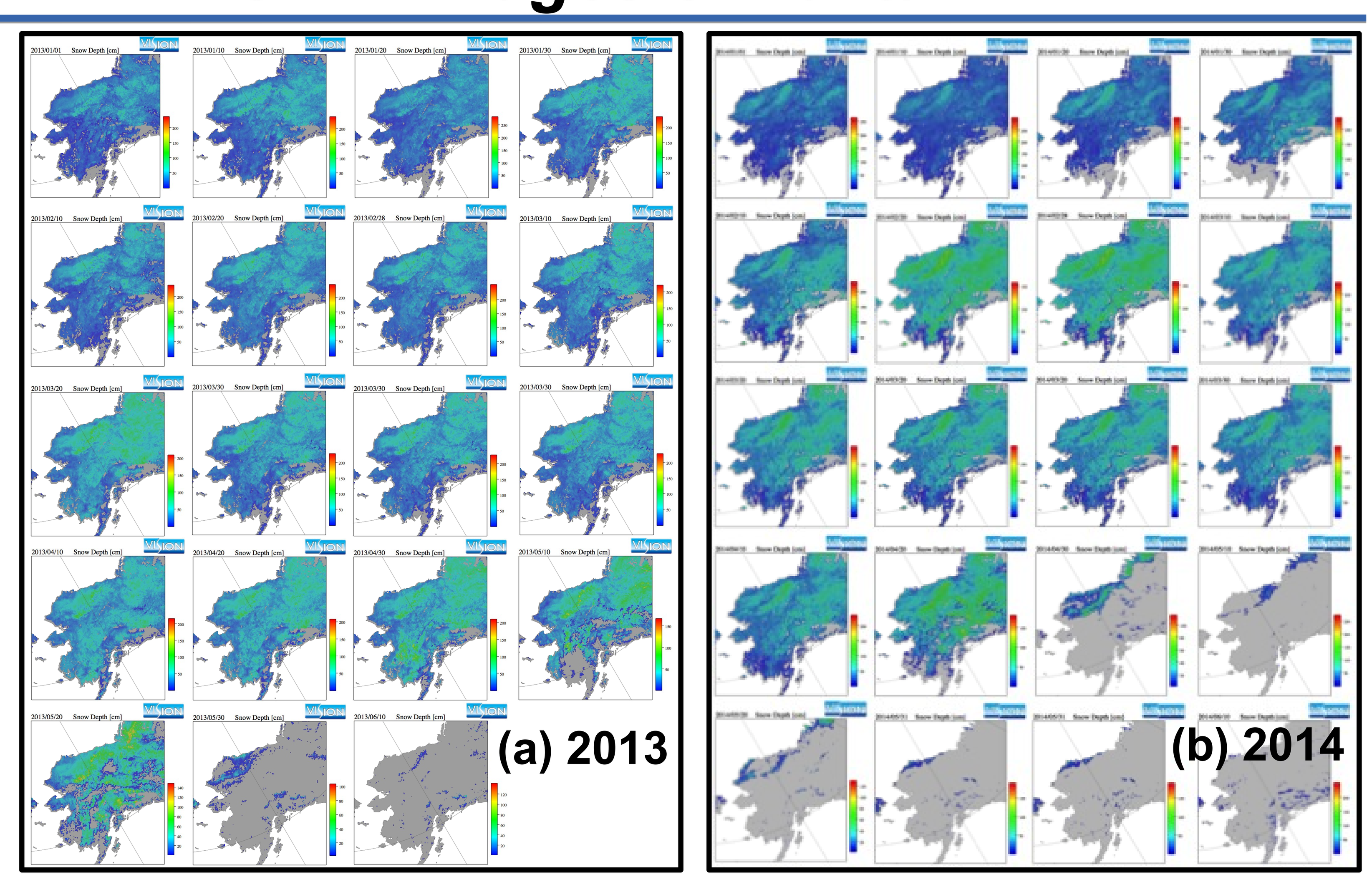


Fig 5. Temporal variations of snowpack extents at an interval 10-day during the snow-covered periods of a) 2013 and b) 2014. This suggests that the snow disappearance timing in 2014 is much early than 2013.

CONCLUSIONS

1) ***In-situ*** **snow depth in boreal forest is higher than tundra ecosystem,**
2) ***<u>Algorithm retrieved by AMSR-E and AMSR2 is needed to revise with adequate input parameters that is fitted to Alaska</u>*****,**
3) ***In-situ*** **SWE (snow water equivalent) is a function of snow depth across the North-South Transect, Alaska, and**
4) **Snow is a significant driver in affecting ecosystem, hydrology, biogeochemistry.**

ACKNOWLEDGEMENTS

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