Daily Lake Ice Phenology Data Record Time Series Derived from AMSR-E and AMSR2, Version 1 (2002-2015)

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I. Introduction

The Version 1 AMSR-E/2 Lake Ice Phenology Data Record (LIP) was generated from RSS (Remote Sensing Systems) Version 7 brightness temperature (T_b) observations from the Advanced Microwave Scanning Radiometer for EOS (AMSR-E) and JAXA L1R orbital swath T_b observations from the Advanced Microwave Scanning Radiometer 2 (AMSR2) on the JAXA GCOM-W1 satellite. The 5-km ice phenology retrievals extending from Jun. 4, 2002 to Dec. 31, 2015 describe daily lake ice conditions (ice-on/ice-off) for 76671 lake pixels over the Northern Hemisphere.

The data set was produced by a moving *t* test method (MTT) using AMSR-E/2 36.5 GHz orbital swath T_b data, which were spatially resampled to a 5 km resolution polar EASE-Grid (version 2) format using an inverse distance squared weighting method. The MTT-based retrieval process was carried out in three steps: (1) using MTT to detect abrupt changing point; (2) determining reference T_b values for lake ice conditions and (3) deriving lake ice status.

The satellite-based data set allows for rapid assessment and regional monitoring of seasonal ice cover changes over large lakes, with resulting accuracy suitable for global change studies.

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II. Data Format

The data are stored in one file for each year from 2002 to 2015. Each file contains a 2D binary array (**76671** columns, **366** rows) representing lake ice conditions of the **76671** lake pixels (lake coverage ≥ 50%) of the Northern Hemisphere and each day of the given year. The lake pixels were identified in the Global Lakes and Wetlands Database (GLWD) (Lehner and Döll, 2004). The data file contains retrieved lake ice conidtion in **byte** data type. The data descriptions are listed in Table 1.

Table 1. Description of data

Value	Description
0	ice-on
1	ice-off
3	un-identified ice state with no retrieval process carried out
4	no satellite observations available for all the pixels
10	ice-on condition assumed for the whole year with no ice-on/ice-off events detected
11	ice-off condition assumed for the whole year with no ice-on/ice-off events detected
12	not retrievable
254	no satellite observations available for the given pixel

III. File naming convention

AMSR_Lake_Ice_Phen_5KM_{year}_v{x}.bin

AMSR represents AMSR-E or AMSR2 observations.
Lake_Ice_Phen represents lake ice phenology.
year (format yyyy) is the year the data represented
v is for data version
x is the data version number

IV. Ancillary code and data

An idl code “LakeIce_Phen_Data_Reader.pro” was provided for reading the LIP data set and converting the ice phenology data for lake pixels (water coverage ≥ 50%) into 2-D map under 5-km Polar EASE-Grid (Version 2) projection.

Ancillary data:

“fw_lake.bin” describes the lake coverage for the 76671 lake pixels. The data were stored as a 1-D binary array with 76671 elsements in 4-byte float type.

“pos2D.bin” links the lake pixels in the described data set to 5-km 2D grids under EASE-GRID (version 2) projection. The data were stored as a 2-D binary array with 3600 columns and 3600 rows in 4-byte long integer type.

“Land_Ocean_Coast_5KM_1Pix.bin” is the land-ocean mask used for mapping purpose. The data were stored as a 2-D binary array with 3600 columns and 3600 rows in byte type.

V. Accuracy

LIP derived lake ice conditions are more accurate for pixels with higher lake coverage. For the pixels with lake coverage ≥ 90%, the LIP results were found to be largely consistent with Global Lake and River Ice Phenology Database (GLRIPD) (Benson and Magnuson, 2000) ground-based observations, with an average agreement of 95.4% for the four lakes examined.

The LIP record also showed favorable correspondence with other lake phenology assessments defined from the Interactive Multisensor Snow and Ice Mapping System (IMS) (Helfrich et al., 2007; http://www.natice.noaa.gov/ims/) and the Canadian Ice Service (CIS) (Howell et al.,2009) products for 12 large study lakes. The LIP, CIS, and IMS differences were attributed to the different data sources and methods used to construct the different products, including differences in spatial and temporal resolutions of observations, and distinct nature of optical and microwave remote sensing.

References:

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