iCUPE Datasets as Products for the Research, Decision-Making, Stakeholders and End-Users Communities

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https://www.atm.helsinki.fi/icupe/index.php/contact

Teasers of the iCUPE Datasets *(including from iCUPE PEEX collaborators)*

https://www.atm.helsinki.fi/icupe/index.php/datasets/submitted-datasets

Some DS are focused on selected areas of the northern latitude regions, other DS - on selected geographical locations (measurement sites).

iCUPE Integrative and Comprehensive Understanding on Polar Environments
ERA-PLANET strand 4

Fractional snow cover area in selected sites of Svalbard islands (Norway)

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WP3: Satellite remote sensing of Arctic surfaces

T3.2: Optical satellite remote sensing

D3.2.2: Novel optical remote sensing products on snow & on vegetation and gas flaring mapping in selected sites

Document version number 1.0

The purpose of this activity is the development of a new snow product focused on the estimation of the fraction of snow cover in selected sites at different spatial resolutions. This dataset will be aimed to support the estimation of cryospheric information using remotely sensed data, with a particular attention to data obtained in the framework of the Copernicus program. The availability of this dataset in a "natural" laboratory such as Svalbard islands will support the reduction of the gap between remotely sensed data and modeling activities. This added value will be very important considering the higher spatial resolution of the sensors recently deployed. The dataset will be based on re-using data obtained from public repositories such as the digital elevation model of Svalbard, the available webcam imageries in Svalbard and satellite products from Landsat, Sentinel and MODIS missions. All the available data will be integrated in order to estimate the fraction of snow cover, at different spatial resolutions, for each satellite mission. These estimations, computed at different sites in Svalbard islands, will offer the opportunity to better integrate results obtained by remote sensing with modeling and air-snow interactions studies. Particular attention will be devoted to the formalization of agreements with raw-data providers in case of not-public licensing policies.

References

Salzano R. Lanconelli C., Salvatori R., Esposito G., Vitale V., 2016: Continuous monitoring of spectral reflectance of snowed surfaces in Ny-Ålesund. Rend Lincei-Sci Fis, 27, 1, 10.1007/s12210-016-0513-y.

Salvatori R., Plini P., Giusto M., Valt M., Salzano R., Montagnoli M., Cagnati A., Crepaz G., Sigismondi D., 2011: Snow cover monitoring with images from digital camera systems. Eur J Remote Sens 43, 2, 10.5721/EuJRS20114321.

February 3, 2018 1

iCUPE Integrative and Comprehensive Understanding on Polar Environments
ERA-PLANET strand 4

Dataset for ground-validation of precipitation measurements in high-latitudes and Arctic region

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WP 4 Integrating in-situ, satellite and model components for improved environmental assessment
DS precipitation in the high-latitudes (R – UHEL; D 4.2.1; T-4.2)
Document version number: 1

The dataset is based on coordinated ground-based observations of precipitation microphysical properties and ground-based radar observations. This way the dataset allows for comprehensive characterization of precipitation, especially winter precipitation, at the measurement site and to extend those measurements spatially by means of weather radar measurements to facilitate validation of satellite based observations.

The dataset consists of particle size distribution, fall velocity, particle shapes and masses as retrieved from the observations collected at the SMEAR II site in Hyytiälä. Additionally, weather and cloud radar, microwave radiometer and lidar data are collected. These data are used for the validation of cloud and precipitation satellite observations by NASA Cloudsat and GPM and upcoming ESA EarthCare missions.

The ground-based remote sensing data is combined with ground-based precipitation measurements to derive precipitation and cloud products. For example, for winter precipitation, which is notoriously difficult to measure quantitatively, ground-based observations are used to guide the conversion from radar reflectivity to precipitation rate. The cloud products are derived using ACTRIS Cloudnet algorithms.

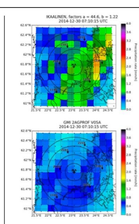

Figure 1. Comparison of the NASA Global Precipitating Measurement Microwave Imager snowfall product (bottom panel) with the ground-based radar observations tuned by the snow measurements carried out in Hyytiälä (top panel). The measurements were taken on 30 December 2014 at 07:10:15 UTC.

References

von Lerber, A., D. Moisseev, D.A. Marks, W. Petersen, A. Harri, and V. Chandrasekar, 2018: Validation of GMI snowfall observations by using a combination of weather radar and surface measurements. J. Appl. Meteor. Climatol., https://doi.org/10.1175/JAMC-D-17-0176.1

February 3, 2018 1

iCUPE Integrative and Comprehensive Understanding on Polar Environments
ERA-PLANET strand 4

Proxies for mixing layer height, condensation sink and gross primary production

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WP 4: Integrating in-situ and satellite components

Deliverable D 4.1.1: A blueprint for novel proxy variables integrating in-situ and satellite remote sensing data with an exemplary dataset

Document version 2 / Helsinki, 22.3.2018

We will produce proxies relying on satellite measurements by parameterizing with satellite retrievals the variables from intensive campaigns or from long-term measurement data sets. We will use satellite data to derive proxies for mixing layer height measured with Doppler lidar, for condensation sink, and gross primary production of the biosphere. These proxies are crucial for quantifying feedback mechanisms and estimating the sources and concentrations of pollutants in the polar environments.

The first step for the mixing layer height and condensation sink proxies is the derivation of an in-situ based proxy. The proxies are derived based on the in-situ data from SMEAR II (Hari and Kulmala, 2005) and SMEAR I (Hari et al., 1994) stations situated in central and Northern Finland, respectively. The primary variables for the proxies are meteorological variables, including different radiation measures. The derived in-situ proxies will be converted to proxies based on satellite and/or re-analysis, which will be evaluated against the available campaign measurements at the Polar regions, both at the Arctic and the Antarctic.

The proxy for gross primary production is based on the fluorescence, i.e. the IR radiation emitted during plant photosynthesis. We are aiming towards parameterizing photosynthesis with solar radiation and satellite-based observations of fluorescence (Porcar-Castell et al., 2014), normalized difference vegetation index (NDVI) and photochemical reflectance index (PRI). The proxies are developed initially at the SMEAR II station, where continuous observations of gross primary production are made.

The proxy data sets will be available at the iCUPE web-site with the required meta-data and documentation.

References

*Hari, P, et al., 1994. Silva Fennica **28**, 1, 29–39.*

Hari, P. and Kulmala, M, 2005.: Boreal Environ. Res., 10, 315–322.

Porcar-Castell et al., 2014. Journal of Experimental Botany, Vol. 65, No. 15, pp. 4065–4095.

March 22, 2018 1

List of the iCUPE Datasets (DS) *(delivering since beginning of the project; M01 = Sep 2017):*

https://www.atm.helsinki.fi/icupe/index.php/datasets/list-of-datasets-as-deliverables

M16 (*Dec 2018*) – DS anthropogenic contaminants in snow from polar regions
M16 – DS Arctic atmospheric Hg(II) observations: updated GMOS database
M16 – DS emerging organic contaminants in air from the Arctic
M20 (*Apr 2019*) – DS ground based measurements for particle number, black carbon mass and ozone concentration
M21 (*May 2019*) – DS Arctic parameters exactly based on ground-based remote sensing and airborne platforms
M22 (*Jun 2019*) – Pilot DS – NRT parameters of Arctic Research Infrastructures
M22 – DS anthropogenic contaminants in ice cores
M22 – DS Arctic atmospheric Hg isotope observations
M22 – DS emerging organic contaminants in snow from the Arctic
M22 – DS emerging organic contaminants in water from the Arctic
M24 (*Aug 2019*) – DS snow spectral reflectance
M24 – DS aerosol vertical profiles from ground-based and satellite observations in Finland and Russia
M29 (*Jan 2020*) – DS blueprint for novel proxy variables integrating in-situ and satellite RS data with a exemplary dataset
M29 – DS precipitation in the high-latitudes
M30 (*Feb 2020*) – DS novel optical remote sensing products on snow & on vegetation and gas flaring mapping in selected sites
M32 (*Apr 2020*) – DS time series of lakes' size changes in Northeast Greenland
M32 – Pilot DS aerosol reanalysis for SMEAR-II
M33 (*May 2020*) – DS organic aerosols in the Arctic (based on source apportionment)

iCUPE Integrative and Comprehensive Understanding on Polar Environments
ERA-PLANET strand 4

Measurements of Elemental and Organic Carbon in Atmospheric Aerosols: Kandalaksha Bay of the White Sea

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iCUPE Collaborators Datasets

DS on elemental and organic carbon over the northwestern coast of the Kandalaksha Bay of the White Sea

Document version number: 1

Atmospheric transport of airborne particles is the fastest channel for supplying of various chemical species (including black carbon, BC) to far-distant regions. This mechanism of matter transfer is of special importance for the Arctic environment. BC is the product of incomplete combustion of various fuels (coal and diesel oil), biomass (wood, grass, agricultural wastes), and biofuel. Aerosol BC is a component of the atmosphere making a significant contribution to climate change in the Arctic region. The main component of black carbon is the elemental carbon (EC). Resulting from the burning of various fuels and from several biological and physicochemical processes, organic carbon (OC) is also supplied into the atmosphere.

Our dataset (DS) presents results of long-term studies performed during 2010-2012 in the area of the White Sea Biological Station under Moscow State University, situated on the Cape Kindo on the northwestern coast of the Kandalaksha Bay (66.55°N, 33.1°E) of the White Sea. The DS contains measurements on spatio-temporal distribution of the elemental and organic carbon in the surface layer of the atmosphere on the area of interest. The atmospheric aerosols were sampled using an UAS-310 air sampler pumping air through Pall A/E glass-fiber filters. The filter retaining the particles finer than 2.5 μm (PM 2.5) was of 225 × 172 mm dimensions, and the speed of air pumping was equal to 270 L/min. The collecting of one sample took about a week. The filters after sampling were kept in sterile packs in a refrigerator. Sampling was discontinued for the winter. The amount of EC and OC on the filters was determined by the technique of reactive gas chromatography.

EC, being a primary component of BC, is responsible for a considerable contribution to climate change in the Arctic region. The concentrations of EC are at the background level for the Arctic and are characterized by minor seasonal and annual variability. A significant source of EC is the western transport from industrial regions of the Northern Europe, including the gas flares of the oil fields in the North Sea. Forest fires during summer months are additional sources.

References

Shevchenko V.P., D.P. Starodymova, A.A. Vinogradova, A.P. Lisitzin, V.I. Makarov, S.A. Popova, V.V. Sivonen, V.P. Sivonen (2015): Doklady Akademii Nauk, 2015, Vol. 461, No. 1, pp. 70–74.

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iCUPE Integrative and Comprehensive Understanding on Polar Environments
ERA-PLANET strand 4

Monitoring, modeling and assessment of potential sources, dynamics and atmospheric transport for low and elevated mercury concentrations in Arctic regions

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Moscow, 23.04.2018

iCUPE Collaborators Datasets
DS on atmospheric mercury measurements at Amderma station
Document version number: 1

The development of a model for the dynamics of mercury (Hg) in the surface layer of the atmosphere is logical extension of the long-term monitoring of Hg in Russian Arctic. The Hg input from the southern and middle latitudes to the Arctic will be assessed using the long-term high-resolution data (concentrations of elemental Hg in the atmosphere with a resolution of 1 hour from 2001 to the present, as well as the meteorological parameters (temperature, wind direction, humidity) with a resolution of 3 hours). Model of the global mercury transport in atmosphere of the northern hemisphere and especially in the Arctic atmosphere will also be tested. These data will be used to calculate the deposition rates of mercury to the underlying tundra surface, and uptake of the organic forms of mercury through biological chains will be assessed subsequently.

At the polar station Amderma the phenomenon of the atmospheric mercury depletion events (AMDEs) was confirmed using the long-term monitoring data. The unique experiment when the atmospheric mercury collection point during the long-term monitoring was consequently moved from the mainland to the coast line of the Kara Sea fixed the increasing number of the AMDEs. The results obtained will be helpful in better understanding of the mercury behavior in the Arctic region.

The obtained long-term monitoring data at the Amderma station are compared with the results of measurements made at other international Polar Stations. High convergence of the results is shown for all polar stations.

The volcanic eruptions in Iceland are identified as the cause of the unusually high atmospheric mercury concentrations in the background layer at the Amderma Station. These data can be used to identify and evaluate local anthropogenic and natural sources that affect Arctic pollution.

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