JAWS

Justified Automated Weather Station Software

https://github.com/jaws/jaws

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Areas of contribution

Polar atmospheric processes
Observations
Data assimilation
Data archiving

Summary

JAWS is a scientific software workflow to ingest Level 2 (L2) data in the multiple formats now distributed, harmonize it into a common format, and deliver value-added Level 3 (L3) output suitable for distribution by the network operator, analysis by the researcher, and curation by the data center. NASA has funded JAWS (project summary) from 2017/10/01–2019/09/30.

Automated Weather Station (AWS) and AWS-like networks are the primary source of surface-level meteorological data in remote polar regions. These networks have developed organically and independently, and deliver data to researchers in idiosyncratic ASCII formats that hinder automated processing and intercomparison among networks. Moreover, station tilt causes significant biases in polar AWS measurements of radiation and wind direction. Researchers, network operators, and data centers would benefit from AWS-like data in a
common format, amenable to automated analysis, and adjusted for known biases.

The immediate target recipient elements are polar AWS network managers, users, and data distributors. L2 borehole data suffers from similar interoperability issues, as does non-polar AWS data. Hence our L3 format will be extensible to global AWS and permafrost networks. JAWS will increase in-situ data accessibility and utility, and enable new derived products.

Description

Automated Weather Station and AWS-like networks are the primary source of surface-level meteorological data in remote polar regions. These networks have developed organically and independently, and deliver data to researchers in idiosyncratic ASCII formats that hinder automated processing and intercomparison among networks. Moreover, station tilt causes significant biases in polar AWS measurements of radiation and wind direction. Researchers, network operators, and data centers would benefit from AWS-like data in a common format, amenable to automated analysis, and adjusted for known biases. This project addresses these needs by developing a scientific software workflow called “Justified AWS” (JAWS) to ingest Level 2 (L2) data in the multiple formats now distributed, harmonize it into a common format, and deliver value-added Level 3 (L3) output suitable for distribution by the network operator, analysis by the researcher, and curation by the data center.

Polar climate researchers currently face daunting problems including how to easily: 1. Automate analysis (subsetting, statistics, unit conversion) of AWS-like L2 ASCII data. 2. Combine or inter-compare data and data quality from among unharmonized L2 datasets. 3. Adjust L2 data for biases such as AWS tilt angle and direction. JAWS addresses these common issues by harmonizing AWS L2 data into a common format, and applying accepted methods to quantify quality and estimate biases. Specifically, JAWS enables users and network operators to 1. Convert L2 data (usually ASCII tables) into a netCDF-based L3 format compliant with metadata conventions (Climate-Forecast and ACDD) that promote automated discovery and analysis. 2. Include value-added L3 features like the Retrospective, Iterative, Geometry-Based (RIGB) tilt angle and direction corrections, solar angles, and standardized quality flags. 3. Provide a scriptable API to extend the initial L2-to-L3 conversion to newer AWS-like networks and instruments. Polar AWS network experts and NSIDC DAAC personnel, each with decades of experience, will help guide and deliberate the L3 conventions implemented in Stages 2–3.

The project started on October 1, 2017 and is funded by NASA. Currently JAWS works with 4 networks including AAWS (Antarctic Automatic Weather Stations), GCNet (Greenland Climate Network), IMAU (Institute for Marine and Atmospheric Research), PROMICE (Programme for Monitoring of the Greenland Ice Sheet). JAWS comprises three modular stages written in or wrapped by Python, installable by Conda: Stage 1 ingests and translates L2 data into netCDF. Stage 2 annotates the netCDF with CF and ACDD metadata. Stage 3 derives value-added scientific and quality information. The labor-intensive tasks include turning our heterogeneous workflow into a robust, standards-compliant, extensible workflow with an API based on best practices of modern scientific information systems and services. The RIGB component of Stage3 requires ongoing assimilation of ancillary NASA data (CERES, AIRS) and use of automated data transfer protocols (DAP, THREDDS).

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will be extensible to global AWS and permafrost networks. JAWS will increase in-situ data accessibility and utility, and enable new derived products. The PI is a long-standing researcher, open source software developer, and educator who understands obstacles to harmonizing disparate datasets with NASA interoperability recommendations. Our team participates in relevant geoscience communities, including ESDS working groups, ESIP, AGU, and EarthCube.

Timeline

2017-10-01 - 2019-09-30

User relevant aspects

The users of JAWS are AWS network managers and data curators who wish to distribute their data in JAWS format, and end-users who wish to use to use JAWS to augment or analyze data they received in JAWS format.

Provider relevant aspects

The JAWS project coordinates software development and cross-network issues, such as naming and metadata conventions.

Regional emphasis

Northern hemisphere: Yes

Southern hemisphere: Yes

Key project deliverables

JAWS provides an easily installable Python software stack to convert raw L2 ASCII data into L3 netCDF format, with value-added fields such as solar zenith angle and tilt correction.

Data management

The JAWS project does not itself measure or archive any data. The primary data archive is with the AWS network providers. Only the network managers produce and archive the data on which JAWS operates. The
networks supported thus far are AAWS (YOPP-endorsed), GCNet, IMAU, and PROMICE. JAWS already transcribes their L2 ASCII files into a common netCDF format. All of these networks are mature and are conducting measurements before, during, and after YOPP. By synthesizing their measurements into a common format JAWS is thus contributing to the interoperability of polar measurements during YOPP.

Is data provided to WMO Global Telecommunication System

No

Real-time provision

JAWS is designed to work with data at any temporal resolution. However, JAWS has only been thoroughly tested on hourly AWS data.

Other information

Information in response to questions posed by the PPP Steering Group:

The PI (Charlie Zender) has worked previously with data from AAWS (YOPP-endorsed), GCNet, IMAU, and PROMICE. Network managers from AAWS (M. Lazzara) and IMAU (C. Reijmer) are JAWS collaborators and are involved in its design. Zender will meet in-person with AAWS, GCNet, IMAU, and PROMICE teams in June and July to obtain their feedback on the beta version of JAWS.

Once station data have been converted to JAWS format, we will conduct analyses to detect outliers in station data quality, and will have the ability to append consistent quality control flags to all datasets.

It must be emphasized that JAWS translates not alters AWS data. Only network operators currently have sufficient expertise to alter their data. The next phase of JAWS, wherein we correct AWS solar radiometric data for biases induced by station tilt detected via the RIGB algorithm (Wang and Zender, 2016, TC doi:10.5194/tc-10-727-2016) has begun and will be complete by 2019. Then JAWS will provide value-added, tilt-corrected solar fluxes. In all cases data will be clearly marked if JAWS alters it. JAWS fully records data provenance and history.