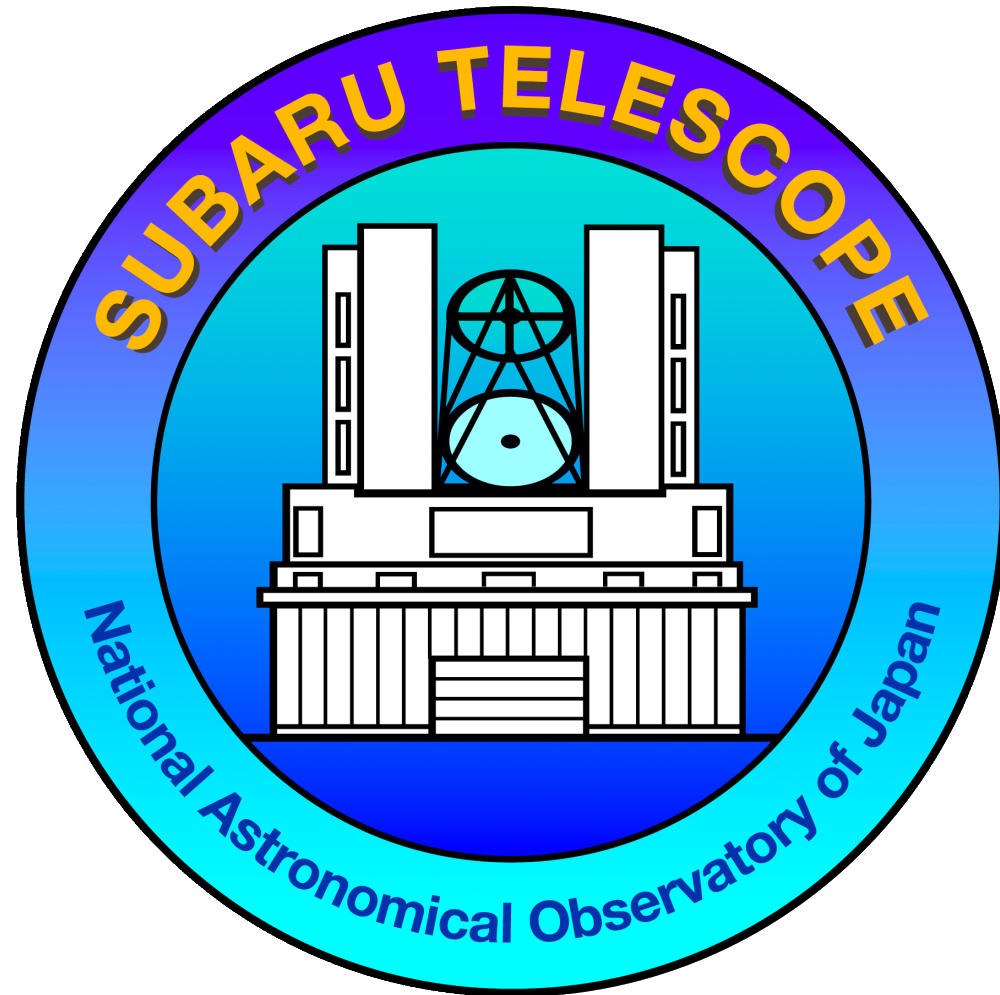


# A New Observation Downtime Analytics System



Andrew Neugarten  
Subaru Telescope, Hilo, Hawai'i

## Introduction

We present Subaru Observational Downtime Aalytics (SODA), a new system for the automatic daily analysis of troubles reported in the observational night logs at the Subaru Telescope. We discuss using SODA to provide both graphical and tabular summaries of troubles that have occurred, including the subsystem responsible for the downtime and the specific faults that occurred, for various date ranges and binning options. The trouble analysis for semester S23A is also presented. We discuss the usage of this system to assist in the transition to fully remote observations at the Subaru Telescope and for other purposes.

## Trouble Classification

When an unexpected behavior, which may result in observational downtime is encountered, it is logged as a trouble. Troubles are categorized by the specific subsystem that they result from and are recorded in the observational night log along with the steps taken to attempt to resolve the trouble and the length of any resulting downtime. The various trouble classifications are presented in Table 1.

Subsystem	Description
Weather	Inclement weather.
Telescope	Telescope malfunction.
Instrument	Instrument malfunction.
SOSS	Observational Control Software (Gen2) malfunction.
Operation	Human error.
Other	Miscellaneous troubles.

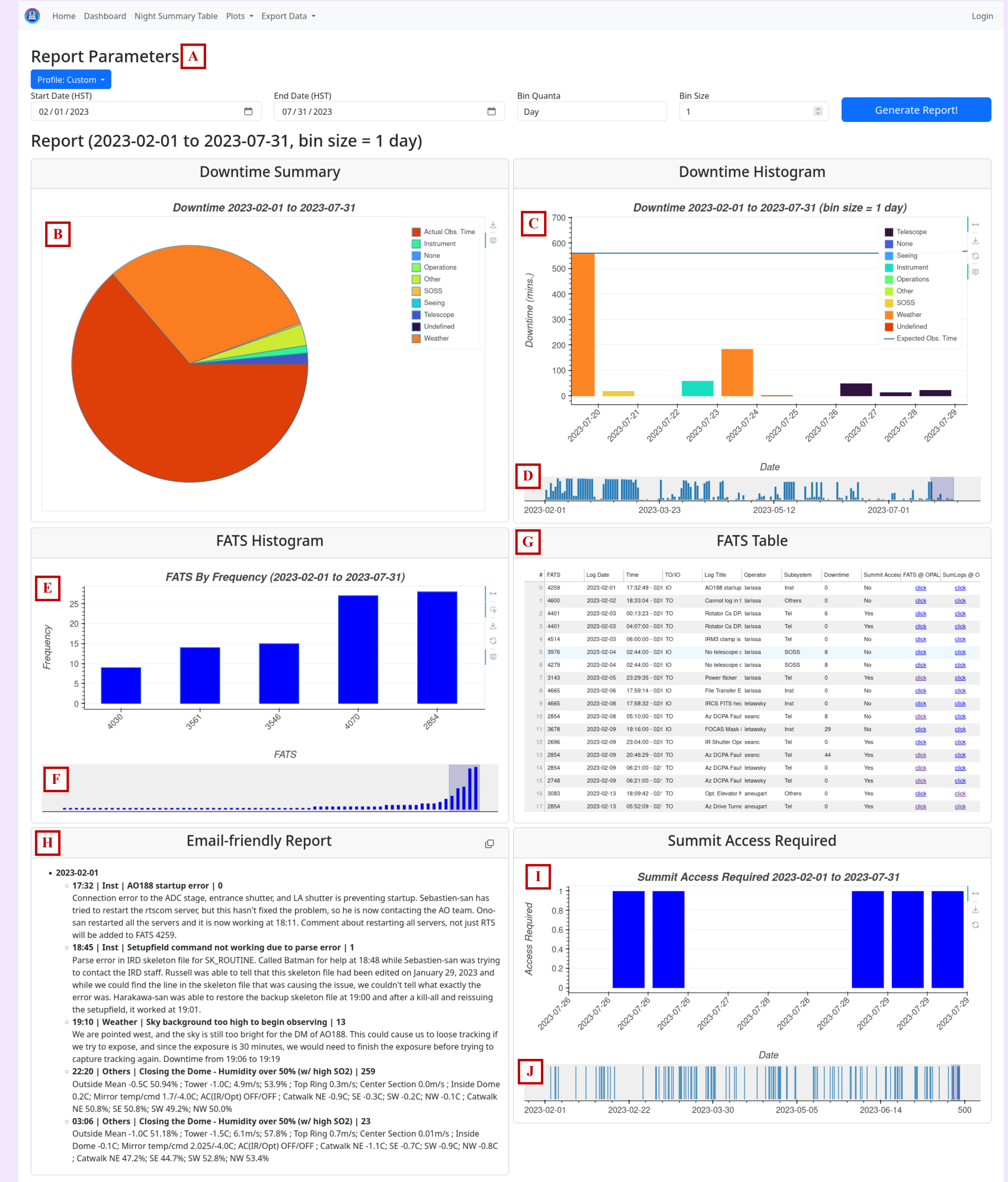
Table 1: Trouble categories.

## SODA Applications

Operation from Hilo at Subaru Telescope (OHia) is a project at the Subaru Telescope that aims to create a safer and more stable observation system in preparation for remote observations. SODA has been used by members of this project in order to determine the most common faults that require a presence at the summit to resolve. This data from SODA can help determine which system repairs or redesigns need to be prioritized.

## SODA Dashboard

The SODA dashboard, presented in Figure 1, is the interface that most SODA users will interact with.



**Figure 1:** SODA’s Dashboard interface. **A:** Parameters used to generate dashboard widgets. **B:** Pie chart displaying total uptime and downtime by subsystem for the supplied date range. **C:** Interactive histogram displaying downtime by subsystem and binning criteria. **D:** Interactive selection tool to modify x-axis scale and range. **E:** Histogram displaying most frequent faults. **F:** Interactive selection tool to modify x-axis scale and range. **G:** Interactive table displaying all faults which are currently selected in histogram E. **H:** The text of all night log entries in the date range that are identified as a trouble. A button to copy the text to the clipboard is provided. **I:** A plot displaying all nights where a physical presence at the summit was required to resolve at least one trouble. **J:** selection tool to modify x-axis scale and range.

## Technical Details

SODA is a web application written primarily in Python using the Flask micro-framework. The application is served by an Apache 2 HTTP server with mod\_wsgi.

The observational night logs are automatically parsed daily and the relevant data are stored in a local MariaDB database on the SODA server for quick retrieval. Interactive plots using the data are generated using the Bokeh framework. The SODA application is only accessible from within the Subaru Intranet.

In addition to allowing users the ability to quickly visualize the data with interactive plots and tables, SODA also allows users to download data as a JSON, CSV, Microsoft Excel, ASCII text, or HTML file.

## S23A Downtime Summary

Subsystem	Time	Percent of Projected Obs. Time
Weather	545h 54m	30.68%
Telescope	25h 54m	1.46%
Instrument	17h 50m	1.00%
SOSS	4h 27m	0.25%
Operation	42m	0.04%
Other	51h 33m	2.90%
<b>Total Downtime</b>	<b>646h 20m</b>	<b>36.33%</b>
<b>Total Uptime</b>	<b>1132h 50m</b>	<b>63.67%</b>

**Table 2:** Downtime by subsystem, total downtime, and total uptime. All percentages are calculated by dividing the subsystem by the expected observational time. All percentages are rounded to two decimal places.

## Acknowledgments

We would like to thank Mr. Kiaina Schubert of the Subaru Telescope Computer and Data Management Division for creating the virtual machine in which we run SODA as well as maintaining the physical hardware on which the virtual machine is run. We would also like to thank Mr. Tom Winegar of the Subaru Telescope Computer and Data Management Division for granting access to the night log database.