# Copernicus FICE 2024

## Training on
## In situ Ocean Colour Above-Water Radiometry towards Satellite Validation

# HyperCP Hands-On

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PROGRAMME OF THE EUROPEAN UNION
Copernicus Europe's eyes on Earth
IMPLEMENTED BY EUMETSAT
FRM4SOC Phase-2
fiducial reference measurements for satellite ocean colour
CNR ISMAR
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# HyperCP Hands-On

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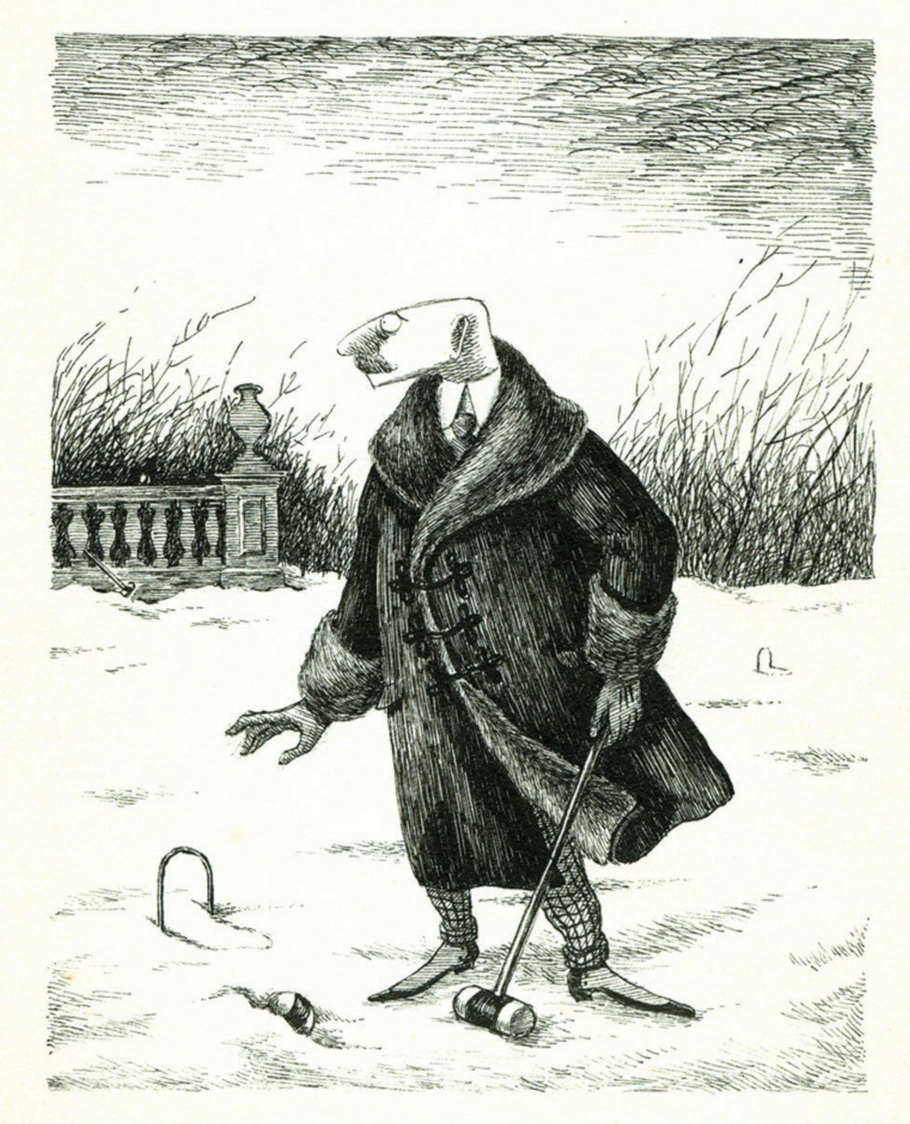
# Overview

- Preamble for pySAS robot
  - prepSAS

- Goals
  1. Use existing sample configurations for processing a file from L0-> L2.
  2. Familiarize with the output data sets, figures, and reports.
  3. Set up a new configuration
  4. Explore different processing pathways (Default, Class, Full).
  5. Explore different glint corrections (M99, Z17) and NIR corrections (None, Flat, SimSpec).
  6. Practice using the low-level filters in the L1AQC Anomaly Analysis tool

- Demonstration

- Work independently on exercises 1 - 6



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# pySAS Output

- Designed for autonomous operation over extended periods of time
- Data are automatically saved in hourly files
- pySAS Output:
  - pySAS_cfg_<date>_<time>.ini
    - Data: Instrument configuration (baud rates, timeouts, pin-outs, preferred RelAz, GPS–ship orientation, etc.)
  - HyperSAS_<date>_<time>.bin:
    - Data: Lt, Li, Es, Tilt from Sea-Bird Scientific HyperOCR and THS sensors
    - Format: Satlantic Log File Standard (ASCII + binary)
  - GPS_<date>_<time>.csv
    - Data: Latitude, Longitude, Elevation, Ship Heading, Accuracy
    - Format: csv
  - IndexingTable_<date>_<time>.csv
    - Data: Radiometer Orientation with respect to the ship
    - Format: csv

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# pySAS Output

- Part of the pySAS repository*, or download at
  wget https://github.com/OceanOptics/pySAS/tree/master/prepSAS
- Install in HyperInSPACE conda environment using:
  pip install -r requirements.txt
- Execute:

```
# Setup parameters in setup.py
python run.py
# Set arguments directly in shell

    # Run a single file
    python prepSAS.py -s 'HyperSAS_20201120_175620.bin' -g 'GPS_20201120_175616.csv' -t …
        'IndexingTable_20201120_175616.csv' --cal 'HyperSAS_Es_20200212.sip' --cfg 'pysas_cfg_002.ini' 'UMSAS002_20201120_175620.raw

    # Run all files within a directory
    python prepSAS.py -d 'test_data/' --cal 'HyperSAS_Es_20200212.sip' --cfg 'pysas_cfg_002.ini' 'test_data'

    # Help
    python prepSAS.py -h

    # Version
    python prepSAS.py -v
```

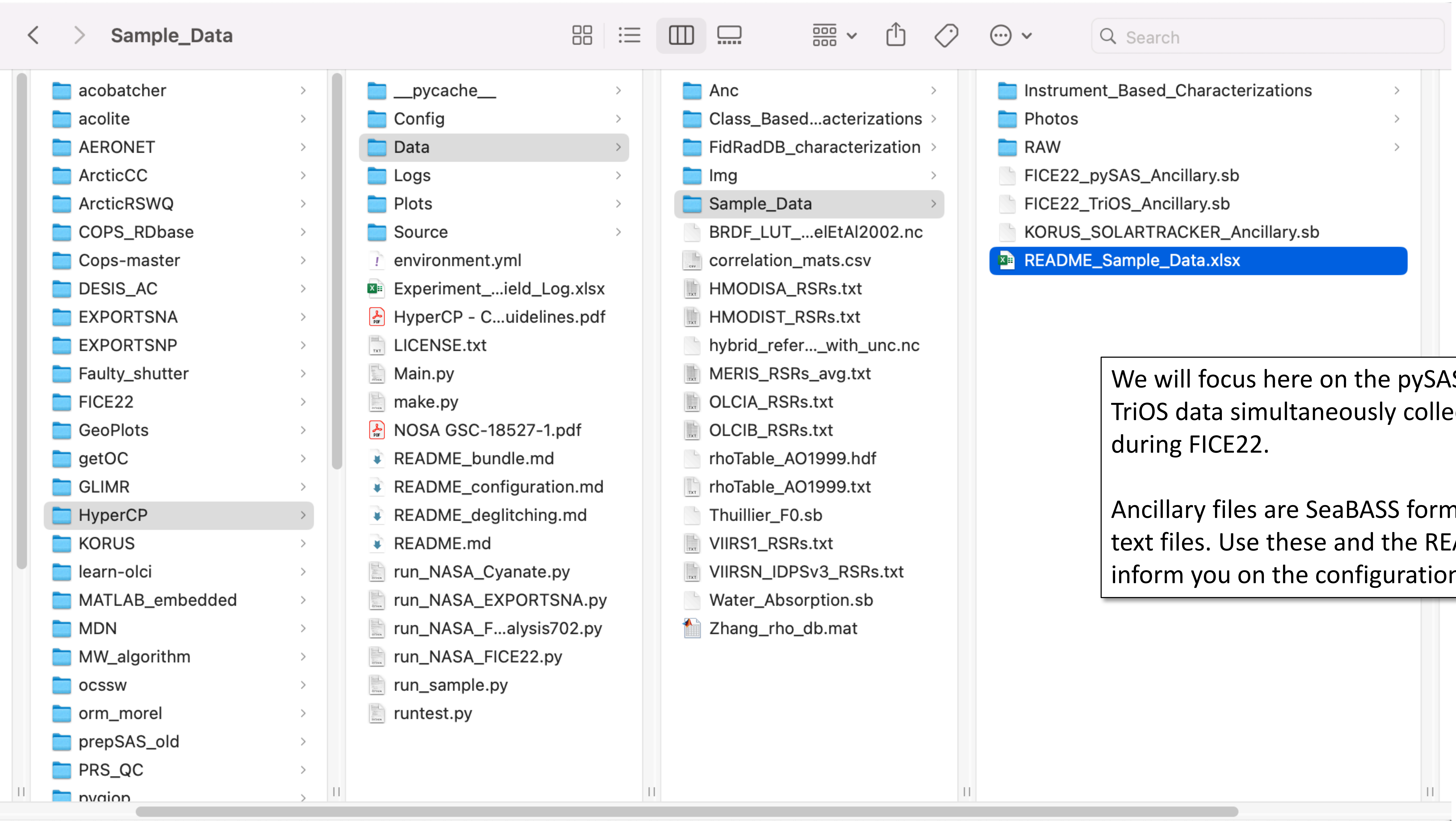
Sea-Bird Factory calibration bundle

*University of Maine Ocean Optics GitHub: https://github.com/OceanOptics/pySAS/tree/master

# Sample Data

Provided in the repository

# Sample Data



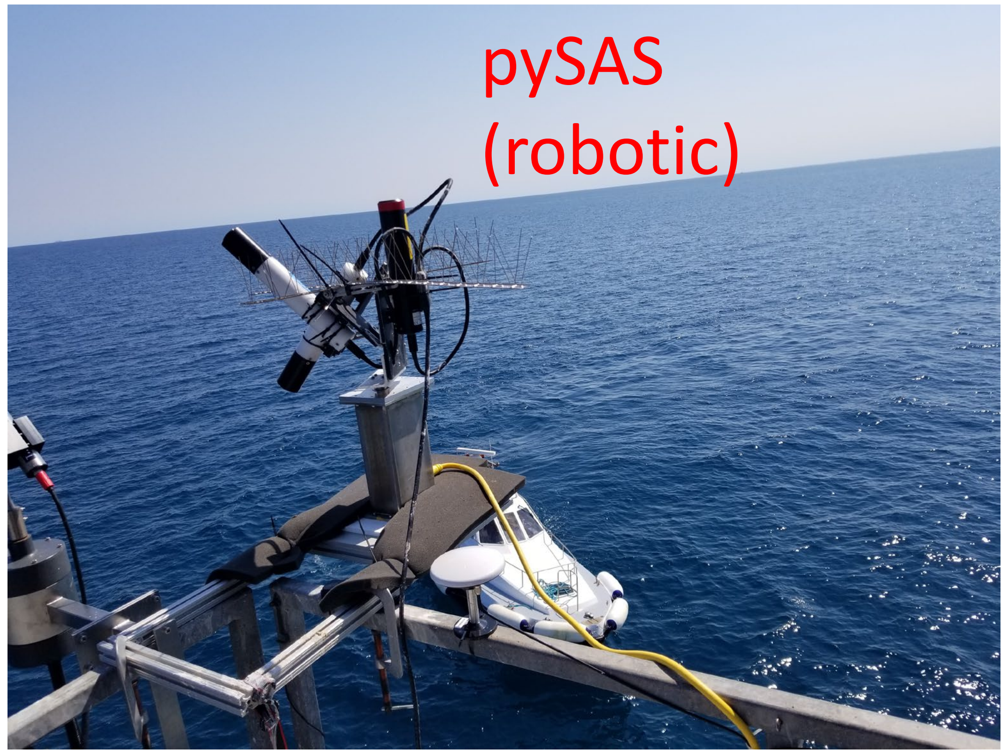

We will focus here on the pySAS and TriOS data simultaneously collected during FICE22.

Ancillary files are SeaBASS formatted text files. Use these and the README to inform you on the configuration of each.

# First Wicket

(Artwork by Edward Gorey)

- Open existing configurations for sample data provided (TriOS & pySAS)
  - (Main) Establish Input/Output paths for the data
  - (Main) Provide the appropriate Ancillary data file
  - Process the two manually acquired TriOS files from L0 to L2
    - (Configuration):
    - L1B Default (“Factory Only”) mode
    - No station extraction
    - M99 glint correction
    - SimSpec NIR offset
    - No BRDF or convolution
    - No Derived Products
  - Process the autonomous pySAS data using the same settings (*don’t forget to switch Ancillary files*)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# Second Wicket

- Locate the processing Reports for the pySAS and TriOS files
  - What percentage of $L_t$ data were removed from each file for the L1BQC spectral filter?
  - In L2, how many spectra remained in each ensemble after the “glitter” correction was performed (retaining only the darkest 10% of $L_t$ measurements)?

- Locate the L2 Plots
  - How do $R_{rs}$ and $E_s$ compare between the TriOS and the SeaBird instruments?
  - What is missing from TriOS plots? Why?

- Repeat pySAS L1BQC to L2 using station extraction.
  - Based on plots and what you know, which pySAS stations correspond to each TriOS file?

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# Third Wicket

- Compose a new configuration for the autonomous pySAS instrument and the manually operated TriOS triplet sample datasets
  - Import configuration and telemetry files. Use the .cal/.tdf (or .sip) files for SeaBird and the .dat/.ini files for TriOS from the appropriate Config/sample_XXX_Calibration folders. (These files will be copied into your new Config/your_Calibration folders.)
  - Follow README description on GitHub to set each parameter in the Configuration Window sensibly
  - Process both datasets L0->L2
    - Include f/Q BRDF, chlor_a, QWIP, and satellite convolution
    - Use glint, NIR, and BRDF appropriate for optically complex waters
    - Set L2 processing to obtain Derived Products for QAA $a_{dg}$ and $b_{bp}$
    - What was $a_{dg}(400)$ at Station 32?

CHAPTER ONE
Embley and Yewbert were hitting one another with croquet mallets

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# Fourth Wicket

(Happenstance Theater)

- Reprocess TriOS sample data (either modify the sample configuration provided or the one you developed) to use the Class-based pathway/mode
  - *Files will need to be reprocessed from Raw or L1AQC to L2 to incorporate updated characterization in L1B.*
  - Add the instrument-based RADCAL (absolute radiometric calibration with uncertainty) files provided in the Sample_Data folder
  - Turn off interpolation (L1B) and spectral filter (L1BQC) plotting to speed up processing
  - How did your L2 results ($E_s$, $L_i$, $L_t$, $L_w$, $R_{rs}$) change compared to running in Default/Factory mode?

- Now change to Full-FRM
  - How did the component spectra ($E_s$, $L_i$, $L_t$, $L_w$, $R_{rs}$) change compared to Default and Class-based pathways?

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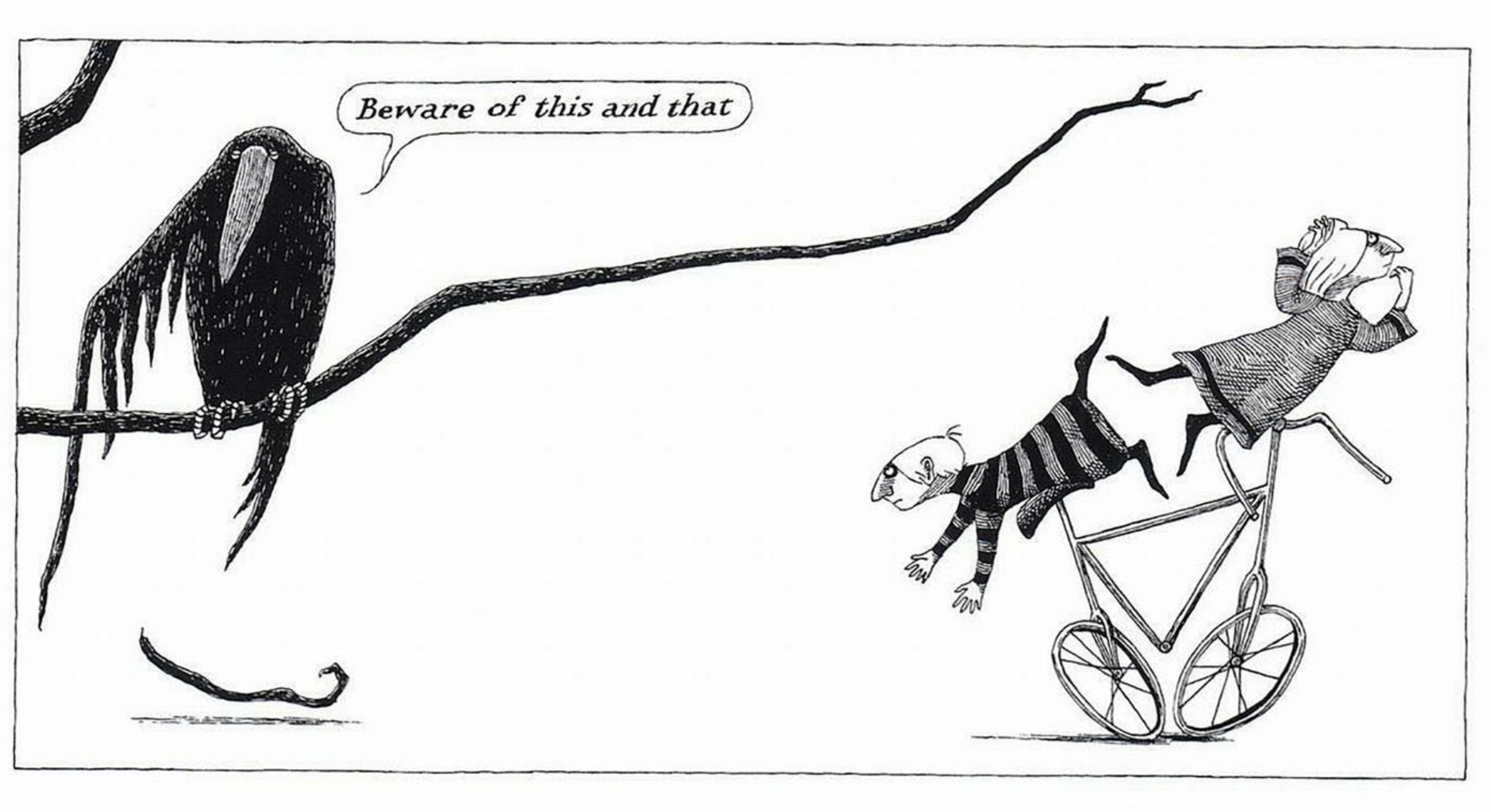
# Fifth Wicket

- Reprocess pySAS sample data in Class-based mode with both M99 and Z17 glint corrections
  - *When changing only the L2 settings, you can re-process L1BQC -> L2 for speed*
  - How does the resulting $R_{rs}$ compare between glint corrections?

- Reprocess pySAS sample data in Class-based mode in Z17 without no NIR correction and compare against processing with NIR correction (SimSpec)
  - How does the resulting $R_{rs}$ compare between NIR offsets?

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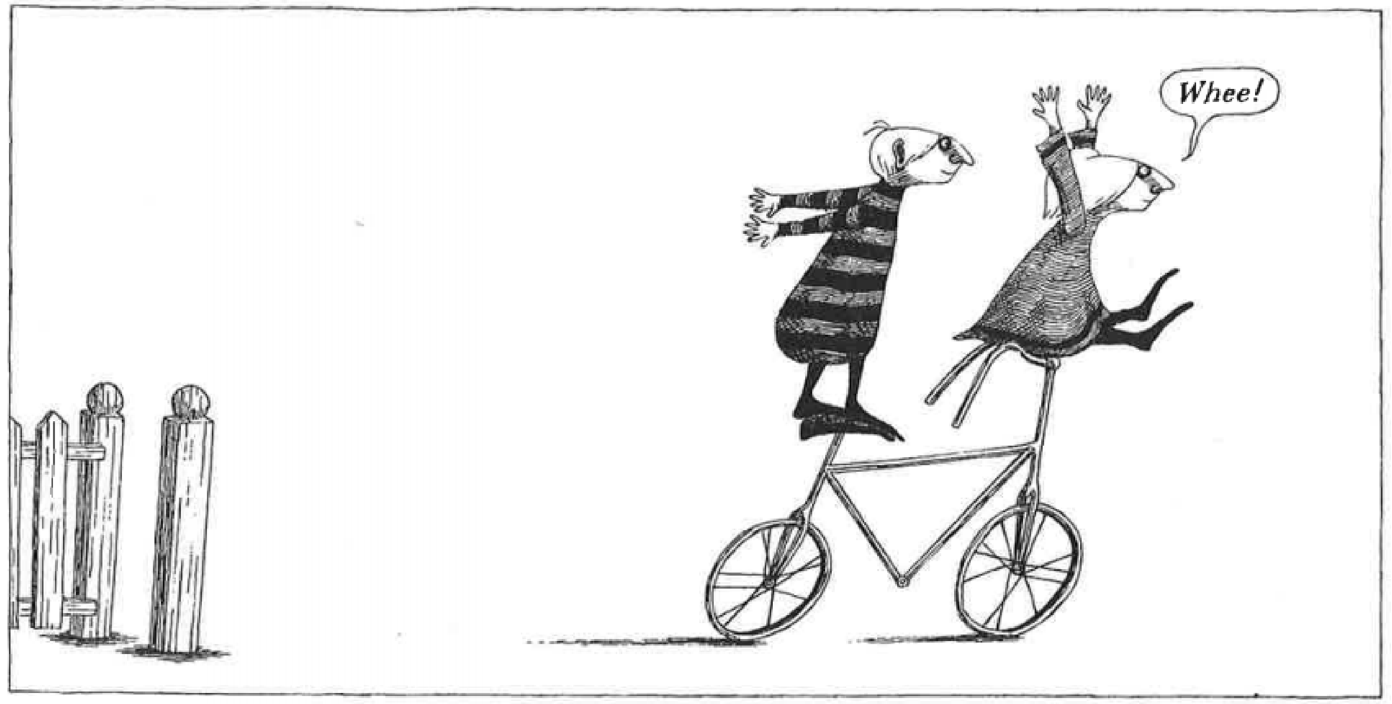
# Sixth Wicket

- Launch the L1AQC Anomaly Analysis tool for the autonomous pySAS dataset
  - How long is the time series?
  - Photos taken during this period are provided but named with UTC+3 hours timestamps. Adjust the format string properly to view the photos.
  - What is the median Solar Zenith Angle for this file?
  - Move the waveband slider to 480 nm and update the figures. With the default sigma and window settings for the *irradiance* sensor, what percentage of the shutter-open spectra in all bands are retained after low-pass filtering? Why are there so few points shown as filtered when the percentage is shown to be so high?

- Change to the skylight radiance and eliminate the erroneous shutter-dark measurements using the threshold tool.
- Change to the total water-leaving radiance and adjust the window and sigma to retain 87.5% of light values.
- Leave a sensible comment, save params, and inspect the resulting CSV file.




so Embley had to sit on the handlebars as they flew out the gate.