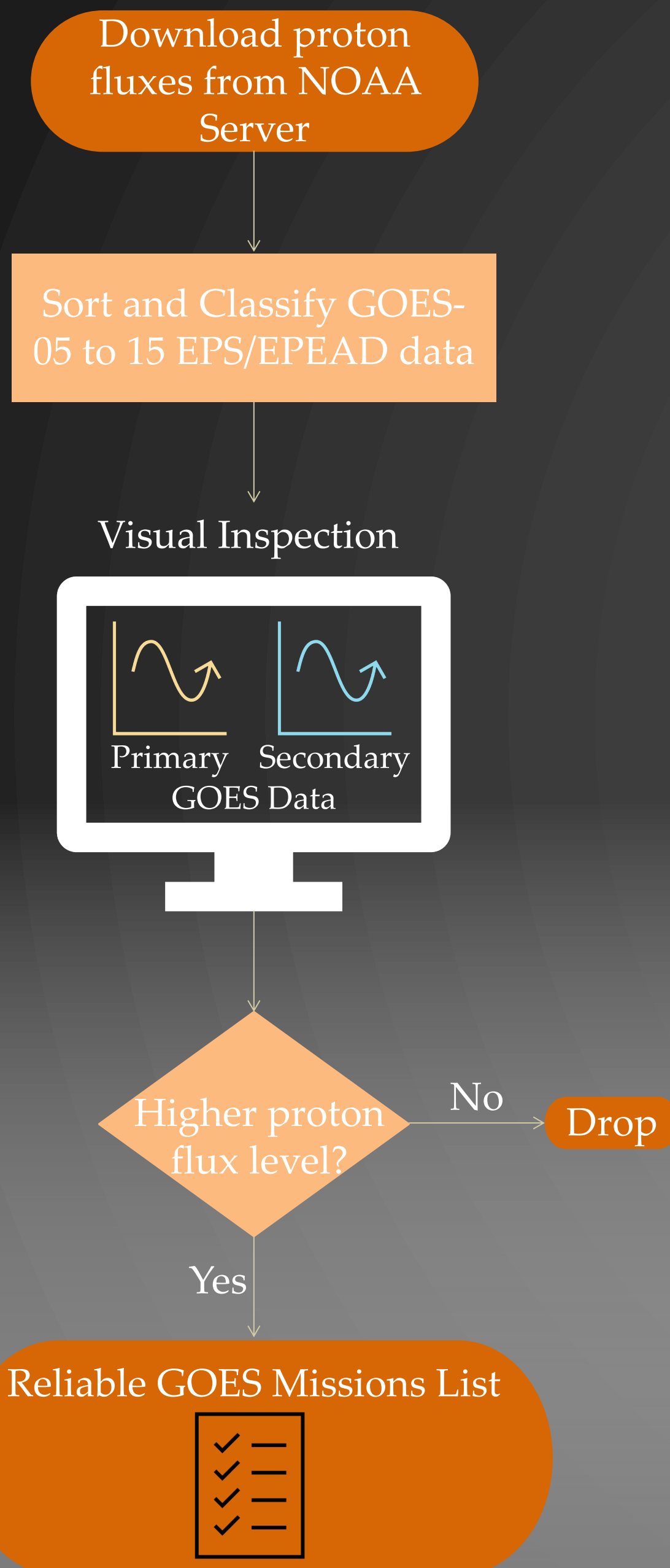


# MACHINE LEARNING DATASET OF SEP EVENTS FROM SOLAR CYCLES 22, 23 AND 24

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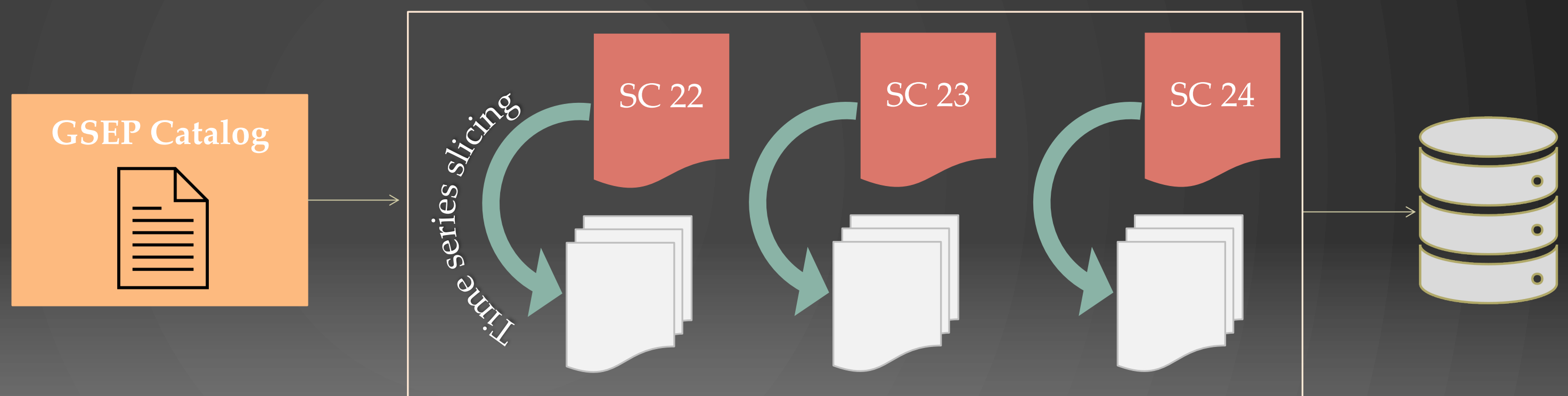
## Data Preparation Schema



## Description

- Period of study: 1986 to 2017
- Integral proton flux data from GOES-SEM<sup>[1]</sup>.
- Proton Channels: P2 to P7 (>10 MeV to >100 MeV)
- Visually inspected the temporal profiles for flux enhancements to identify which GOES satellite (primary or secondary) data has better sensory response.
- If the primary shows higher flux measurements compared to the secondary, then, the primary satellite data is considered as reliable. Else, the secondary.
- The process is repeated for all years to identify reliable GOES data.
- Linear imputation of data gaps.
- Homogenized the dataset across all GOES missions.

## Events Slicing



## Summary

- The GSEP catalog (Rotti et al., paper *in preparation*) integrates the events from Papaioannou et al. (2016)<sup>[2]</sup> and CDAW-SEP<sup>[3]</sup> and cross-checked with the NOAA-SEP list<sup>[4]</sup>.
- There are 342 SEP events in the GSEP list. In that, 246 events have peak proton fluxes >10 pfu in the >10 MeV channel.
- The metadata consists of physical parameters and observables concerning the possible source solar eruptions such as flares and coronal mass ejections for each SEP event.
- The GSEP headers also carry relevant indicators (data quality, observed GOES instrument, and parallel reports.)
- The time series are sliced with respect to the event start and end times as reported in the GSEP metadata
  - Start time: Event onset minus 12 hours
  - End time: Observed event termination.
- The sliced dataset and the metadata will be publicly available on Harvard Dataverse.
- The purpose of this work is to provide a base for experimenting with statistical and machine learning models on SEP events.

## Acknowledgment:

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## References:

- [1] Grubb, R.N., 1975. The SMS/GOES space environment monitor subsystem. *NASA STI/Recon Technical Report N*, 76, p.28260.
- [2] Papaioannou, A., Sandberg, I., Anastasiadis, A., Kouloumvakos, A., Georgoulis, M.K., Tziotziou, K., Tsiropoula, G., Jiggins, P. and Hilgers, A., 2016. Solar flares, coronal mass ejections and solar energetic particle event characteristics. *Journal of Space Weather and Space Climate*, 6, p.A42.
- [3] [https://cdaw.gsfc.nasa.gov/CME\\_list/sepe/](https://cdaw.gsfc.nasa.gov/CME_list/sepe/)
- [4] <https://umbra.nascom.nasa.gov/SEP/>