Overall Evaluation

This manuscript develops a fully integrated open-source Python toolbox (MSDT) for standardized snow drought assessment across yearly, monthly, and daily temporal scales. The authors integrate seven widely adopted snow drought identification algorithms, embed automated SWE data downloading, interactive geospatial visualization, and standardized NetCDF output within a graphical user interface. Global ERA5-Land datasets and three well-documented high-impact snow drought events are used to validate the toolbox performance. The work addresses a clear community gap: fragmented, non-reproducible custom scripts dominate current snow drought research, while no unified platform supports multi-method comparison. The modular software architecture, end-to-end computational optimization, and fully open code/datasets are significant strengths. Overall, this is a valuable methodological contribution to cryosphere and hydrological drought research, but one core issues about the computational performance require substantial revisions, alongside some minor textual, graphical and structural adjustments before acceptance.

Major Concern：

Computational performance benchmarks lack standardized hardware reference and scalability tests.

The manuscript introduces multi-layer computational optimization strategies for MSDT, but performance descriptions remain descriptive without standardized benchmarks.

1. No unified hardware environment is specified for runtime comparisons across yearly, monthly SWEI, and daily PDM modules. Readers cannot replicate or reference the reported efficiency gains.

2. Scalability tests are missing: the paper does not evaluate how processing time and memory consumption scale with spatial resolution (e.g., 0.25°, 0.1°, 0.01°) or temporal length of input datasets.

3. Revision request: Add a standardized performance benchmark table with clear hardware specifications, record runtime and peak memory usage for all three temporal modules under multiple spatial/temporal input configurations, and provide practical hardware recommendations for users running large-domain high-resolution analysis.

Minor Concerns：

1. Abstract & Introduction redundancy: The opening background repeatedly restates identical socio-environmental impacts of snow drought across two paragraphs. Condense repetitive literature summaries and tighten the narrative to highlight the core research gap (lack of unified multi-method toolbox) earlier.

2. Typographical errors in figure labels: Multiple spelling mistakes appear in map captions, e.g., “Muti-year mean daily snow drought intensity” (Figure 5a) should be “Multi-year”. The authors must systematically proofread all figure titles, axis labels and legends for spelling/grammar errors.

3. Ambiguous snow mask preprocessing workflow: Section 2.2 describes snow persistence zone filtering using MODIS and ERA5-Land thresholds, but does not clarify whether users can upload custom snow cover masks into MSDT. Explicitly state this customizable function in the text.

4. Figure annotation clarity: Circled anomalous regions in Figure 6g–h lack clear explanatory text linking peak SWE timing shifts to observed regional storm events. Expand the figure caption to connect visual anomalies to the cited National Weather Service records.

5. Hydrological year setting explanation: The tool automatically assigns winter periods for Northern/Southern Hemispheres, but the manuscript does not explain how users can manually

override the default hydrological calendar. Add a short note on custom winter period configuration in Section 2.3.2.

6. Missing severity classification metadata explanation: Table 2 lists output variables including `intensity_flag` (drought severity level), yet the paper does not detail the default severity tiers for yearly/monthly/daily methods. Add a concise table summarizing severity thresholds for all seven algorithms.

7. Reference formatting inconsistency: Several journal article references use inconsistent abbreviation styles for journal names, and page number ranges are formatted unevenly. Standardize all citations.

8. The phrase “independent yet interconnected modules” should be corrected to “independent but interconnected modules”.

9. The manuscript alternates between “snow drought” and “SD”. Please standardize.

Final Recommendation

The proposed MSDT toolbox delivers substantial value to the cryosphere and hydrology community, and the global/regional case studies effectively demonstrate its core functionality. The manuscript is promising but requires full addressing of all listed concerns. I recommend a Moderate Revision, and look forward a second round of evaluation.