General comments

This manuscript presents SCSORA, a 1/30 deg daily ocean reanalysis dataset for the SCS covering 2001-2024. The long-term, high-resolution 3-D fields have the potential to provide a useful resource for studies of regional ocean dynamics and extreme events. However, the current manuscript places relatively greater emphasis on scientific applications than on comprehensive validation of the reanalysis itself. Several important aspects, particularly the spatial error characteristics, subsurface structure, and circulation would benefit from further evaluation. In addition, some validation datasets are not fully independent from the observations assimilated into SCSORA, which should be carefully considered when interpreting the results. Given the scope of ESSD, I suggest placing greater emphasis on the validation, limitations, and added value of SCSORA, while reducing some of the detailed process-oriented interpretations in Section 4.3. My specific comments are provided below.

1. Description of SCSOFSv2

- The description of SCSOFSv2 in Section 2.1 is currently too brief. Although the system has been documented previously in Zhu et al. (2022), readers should be able to understand the essential configuration and generation procedure of SCSORA without relying heavily on an external paper. I suggest that the authors provide a concise but sufficiently complete summary of the model configuration, SBC/OBCs, initialization or spin-up processes, major mixing parameterizations, and particularly the data assimilation configuration (ensemble construction and size, assimilation cycle and window, localization scheme, observation errors, and assimilation frequency...). In addition, if the SCSOFSv2 configuration used to produce SCSORA differs in any respect from that described in Zhu et al. (2022), these modifications should also be clearly documented.

2. Independent observation data sets

- The validation of SST and SSH/SLA would benefit from a three-way comparison among SCSORA, the observations directly assimilated into the system, and the independent or independently processed observational products used for validation. For SST, for example, OISST, SCSORA, and OSTIA could be compared together. Similarly, the assimilated along-track altimeter, SCSORA, and gridded AVISO could be examined for SSH/SLA. Such comparisons would help clarify (1) how closely the reanalysis follows the assimilated observations, (2) whether the resulting variability is also consistently reproduced in the independent validation product, (3) whether discrepancies between the two observational products themselves may be contributing to what is currently interpreted as model bias or error. This distinction is particularly important because the validation products are not fully independent from the observational systems used in the assimilation.

3. Spatial pattern validation

- The current SST (Fig. 2) and SSH/SLA (Fig. 3) evaluations are largely focused on temporal variations and domain-averaged statistics. Given the high spatial resolution and regional nature of SCSORA, I suggest that the authors also provide spatial evaluations of the reanalysis performance, for example, maps of bias, RMSE, and correlations. For the subsurface fields, comparisons of temperature and salinity distributions along representative vertical sections would also provide a more direct assessment of how well SCSORA reproduces the observed 3-D ocean structure.

4. Comparison with previous regional reanalysis data

- The manuscript would benefit from a clearer discussion of how SCSORA differs from previously available regional reanalysis products for the South China Sea (ex. https://www.nature.com/articles/sdata201452) in Introduction.

5. Validation of circulation
- Although SCSORA provides 3-D current velocity fields, the validation of the circulation is limited. I suggest including additional validation metrics for the regional circulation and/or volume transport through key straits, where appropriate estimates are available.

6. Use of glider data
- Since the Argo profiles are assimilated into SCSORA, their comparison mainly represents analysis-observation consistency rather than independent validation. I suggest making greater use of the independent glider observations, for example by comparing vertical sections of temperature and salinity. The glider data could also be used for MLD validation, while retaining the current GLORYS comparison to assess consistency between reanalysis products.

7. Validation of high-wavenumber variability
- The spectral analysis (Fig.7 & 8) shows that SCSORA contains substantially more energy at high wavenumbers than the coarser reanalysis and observation products. However, the presence of high-wavenumber energy alone does not necessarily show that these small-scale signals are realistically reproduced. The authors are encouraged to provide further validation against available high-resolution observations, where feasible (e.g., SWOT), or otherwise discuss the effective spatial resolution and limitations of interpreting the high-wavenumber spectral energy.

8. MHW analysis
- The MHW analysis in Section 4.2 is useful as an application example of SCSORA. However, the differences between SCSORA and OSTIA may partly reflect multiple factors, including the influence of assimilated OISST and the model dynamics. Therefore, statements suggesting superior temporal continuity or event stability of SCSORA (ex. L401) should be interpreted more cautiously, as these differences do not necessarily indicate better representation of MHWs. Without additional independent observations, it is difficult to determine which representation is more realistic.

9. Scientific applications
- Section 4.3 goes considerably beyond demonstrating the potential applications of SCSORA and attempts to provide detailed interpretations of eddy dynamics and their modulation of MHWs. However, some of these process-oriented interpretations are not sufficiently supported by the analyses presented. Given that this is primarily a data paper, I suggest reducing the scope and level of interpretation in Section 4.3 and placing greater emphasis on the validation and characterization of SCSORA in Section 3. Section 4.3 could instead be more concisely presented as an example demonstrating the potential utility of the 3-D reanalysis for studying mesoscale eddies and their relationship with MHWs.