Response to community comment by Laurent de Rham:

Thank-you for this global scale work on river ice the transparency of methods and sharing data with the community. As reported in the abstract, the mean absolute error (MAE) values for the three metrics (freeze-up, breakup, duration) are larger numbers than the trend values. Some discussion of the results is warranted in-so-far as the robustness of reported trends within the modelling framework error. A colleague with a climate background refers to this as "signal versus noise" issue.

Response:

Thank you for your interest in our work and for your acknowledgement and suggestion.

We reported the MAE values against both in situ records and referenced dataset of two phenological metrics (freeze-up date and breakup date), the corresponding values are 10.8 days/10.5 days and 11.4/16.0 days for freeze-up and breakup events, respectively, which is indeed larger than the trend values, which are accumulated to 9.0 days/7.8 days over the 24 years. This is also reflected in previous similar work carried out by Wang and Feng (2024), of which they reported the trend values of 2.7 days/2.5 days per decade, much smaller than the errors (9.5 days/8.9 days) for freeze-up and breakup events, respectively.

We acknowledge that the bigger random measurement/modelling error (noise) may pose the detected long-term trend (signal) practically fragile, especially in the context of trend detection in atmospheric time series data (Chang et al., 2021). We have explictly made revision in the discussion acknowledging the signal-to-noise concern when evaluating confidence in detected trends amid noise from variability and errors (Scaife and Smith, 2018).

References:

Chang, K. L., Schultz, M. G., Lan, X., McClure-Begley, A., Petropavlovskikh, I., Xu, X. and Ziemke, J. R.: Trend detection of atmospheric time series: Incorporating appropriate uncertainty estimates and handling extreme events, Elem Sci Anth, 9(1), 00035, 2021.

Scaife, A. A., and Smith, D.: A signal-to-noise paradox in climate science. npj clim. atmos. sci., 1(1), 28, 2018.

Wang, X. and Feng, L.: Patterns and Trends in Northern Hemisphere River Ice Phenology from 2000 to 2021, Remote Sens. Environ., 313, 114346, 2024.