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Supplement of

A dynamic informed deep-learning method for future estimation of laboratory stick–slip

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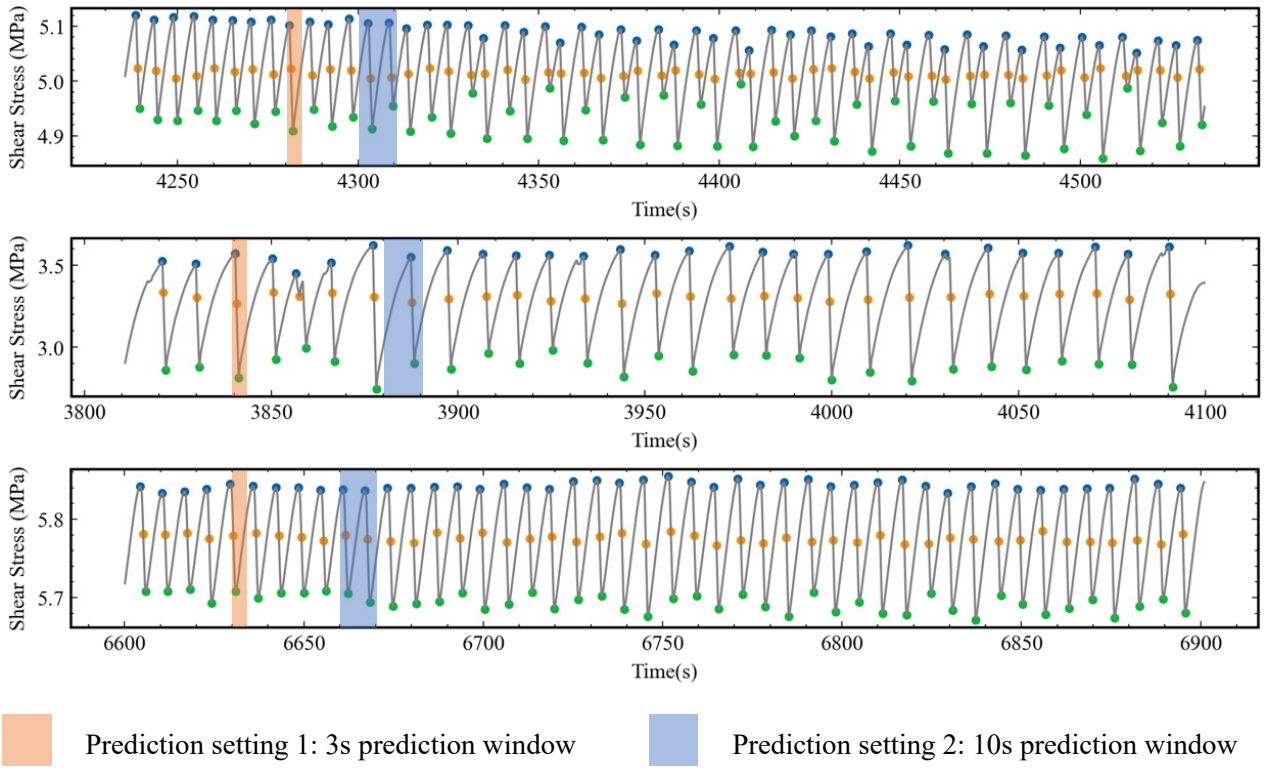


Figure S1: Illustration of lead prediction horizons for 3 experimental data.

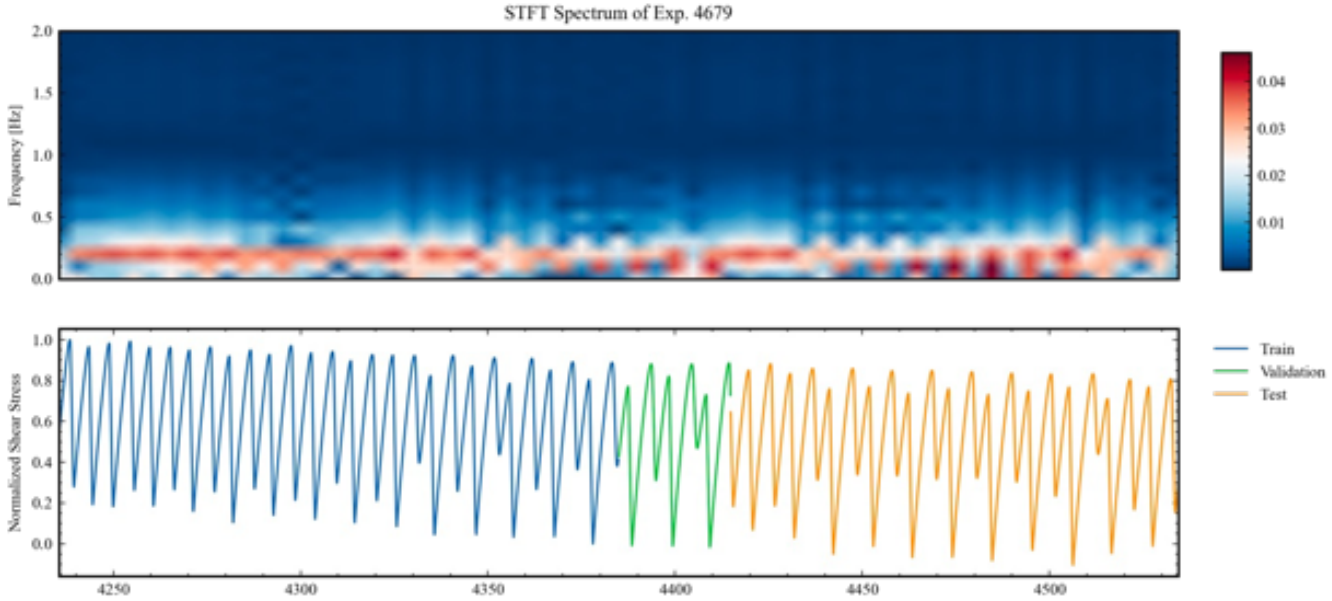
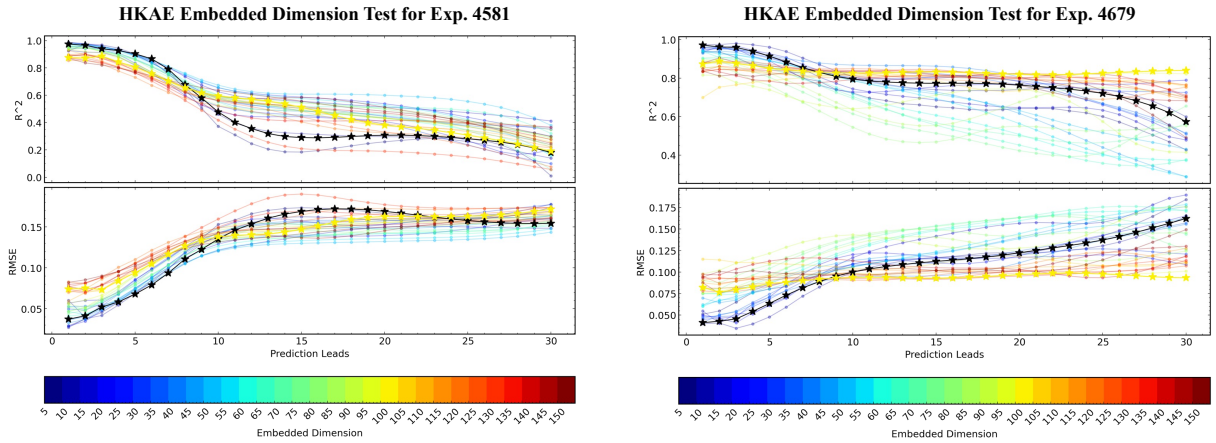


Figure S2: Short-Time Fourier Transform for Exp. 4679. Red box indicates the changes in frequency components in the test set.



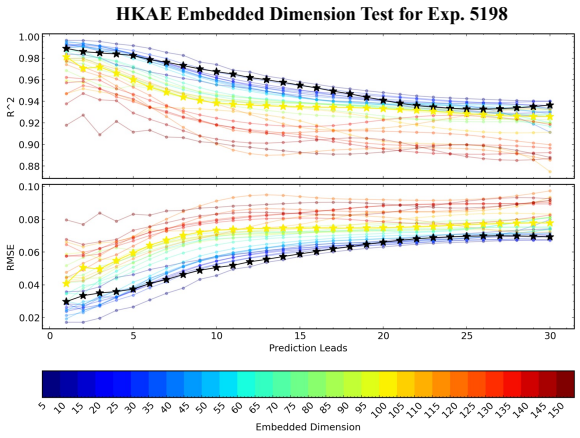


Figure S3: Embedded dimension (d) test for HKAE. The Optimized d= 11 and d=100 adopted in the manuscript are highlighted in black star and yellow star respectively.

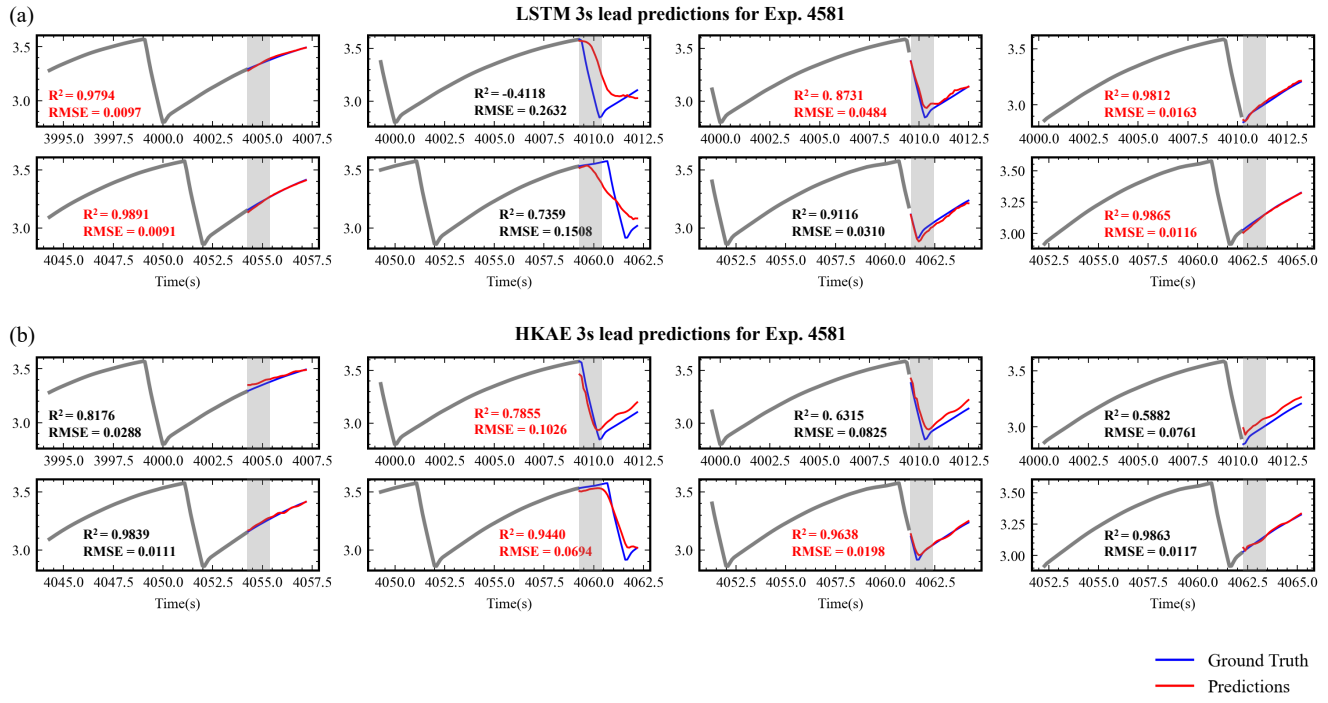


Figure S4: Historical 10s predict future 3s experiment details extension, more sections are added to show prediction difference between HKAE and LSTM. The first 10 steps (1s) lead predictions are masked in grey patches. Using R2 and RMSE as evaluation metrics, and predictions with higher metrics are highlighted in red.

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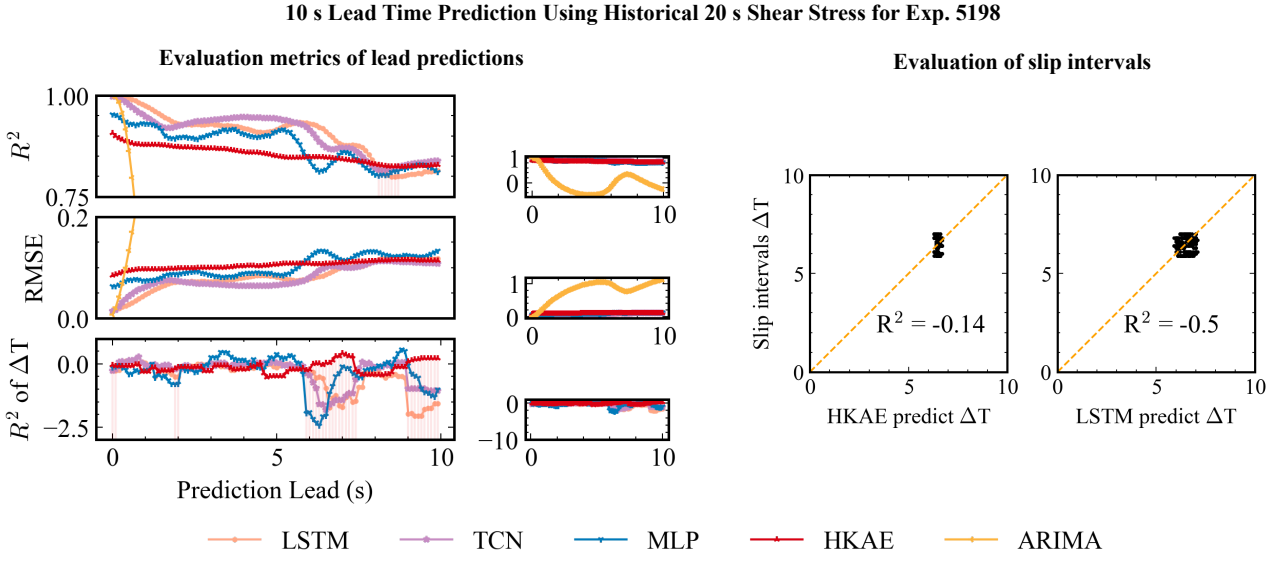

Figure S5: General evaluation for 10 s lead prediction using historical 20 s shear stress, with R2, RMSE and R2 of event intervals used as evaluation metrics. Noticed that the R^2 for slip intervals are both negative for HKAE and LSTM, which means the dynamical feature of slow slips is also challenging.

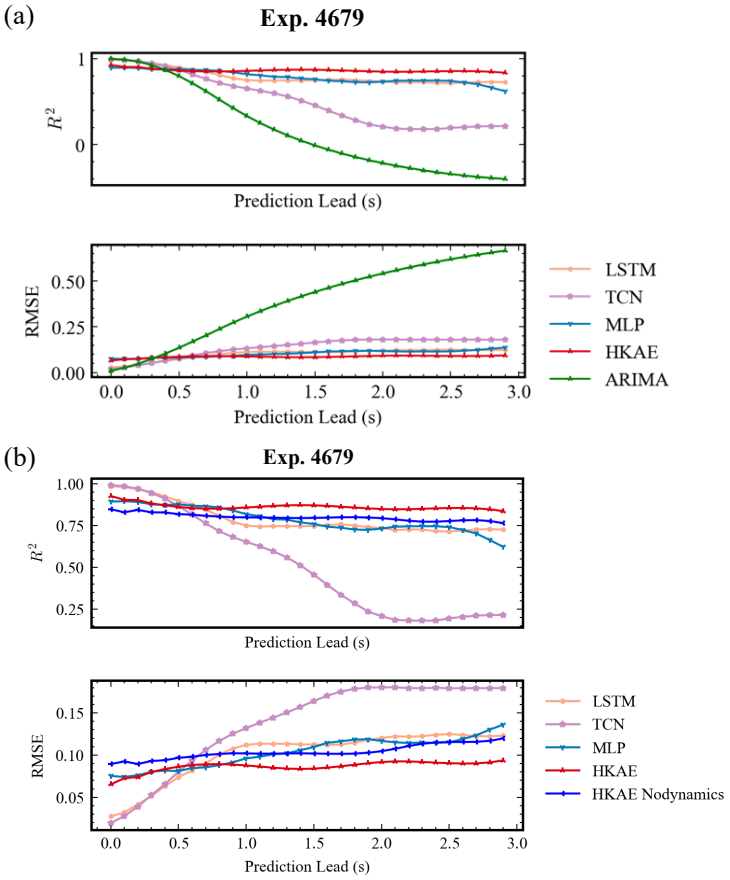

Figure S6: An example for accurate data representation & universal readability of figures.

Table S2: Observables in shear experiments.

No.	Observables	Dimension (unit)
1	LP Displacement	mic
2	Shear Stress	MPa
3	Normal Displacement	Micron
4	Normal Stress	MPa
5	Friction Coefficient (Mu)	/

6	Layer Thickness	Mircon
7	Sample Frequency	Hz
8	Time	sec

Table S2: Parameters combination results calculated based on Cao's methods (1997). Parameters searching with τ = [1,2…,10] and d = [1,2,3…,150]. With the increase of delay time, the embedded dimension become null, which is not listed in this table.

	Exp. 4679		Exp. 4581		Exp. 5198	
# No.	**Delay time (τ)**	**Embedded Dimension (d)**	**Delay time (τ)**	**Embedded Dimension (d)**	**Delay time (τ)**	**Embedded Dimension (d)**
1	**1**	**11**	**1**	**11**	**1**	**11**
2	2	26	2	26	2	11
3	3	21	3	36	3	21
4	4	16	4	26	4	16
5	5	21	5	26	5	16
6	6	36	6	21	6	21
7	7	31	7	16	7	11
8	8	21	8	26	8	16
9	9	26	9	36	9	16
10	10	26			10	16

References

Cao, L.: Practical method for determining the minimum embedding dimension of a scalar time series., Physica D: Nonlinear Phenomena, 110(1-2), 43-50, https://doi.org/10.1016/S0167-2789(97)00118-8, 1997.