

# TED4STL: Trend-Error Decomposition for Self-Supervised Time Series Learning

## Technical Report

Sara Pederzoli, Francesco Del Buono, Maurizio Vincini, Francesco Guerra  
University of Modena and Reggio Emilia

Modena, Italy  
first\_name.last\_name@unimore.it

### Abstract

Self-Supervised Learning (SSL) has become a powerful paradigm in Artificial Intelligence, enabling the training of machine learning models using unlabeled data. However, in time series forecasting, SSL models are generally less effective than supervised models due to the complexity of temporal patterns, including trends, seasonality, and noise. To address this, we introduce TED4STL (Trend-Error Decomposition for Self-supervised Time-series Learning), a pipeline that decomposes each time series into two additive components, trend and error, and empirically test whether this decomposition improves the performance of SSL models. We adapt it to four SSL forecasting models and evaluate it on ten datasets.

### Keywords

Self-Supervised Learning, Time Series Forecasting, Time Series Decomposition, Data-Centric AI, Data Preprocessing

### ACM Reference Format:

Sara Pederzoli, Francesco Del Buono, Maurizio Vincini, Francesco Guerra. 2025. TED4STL: Trend-Error Decomposition for Self-Supervised Time Series Learning: Technical Report. In . ACM, New York, NY, USA, 17 pages. <https://doi.org/10.1145/nnnnnnnn.nnnnnnn>

## 1 Experimental Evaluation

The following sections present supplementary results in the form of tables, offering additional insights that complement and enrich the main findings.

**Settings.** The experiments have been performed on a Workstation with an NVIDIA L40S GPU with 48 GB of VRAM, 256 GB of RAM, and a dual AMD EPYC 9254 24-Core Processor. According to the literature in the field, the predictions are computed via direct multi-step forecasting [1]. Moreover, we used the hyperparameters defined for each model as indicated in the original papers. The only exception was the moving average, whose kernel size we determined through a grid search, exploring the values {9, 25, 64, 96, 128, 224} on the validation set. Finally, all experiments

---

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than the author(s) must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from [permissions@acm.org](mailto:permissions@acm.org).

Conference'17, July 2017, Washington, DC, USA

© 2025 Copyright held by the owner/author(s). Publication rights licensed to ACM.

ACM ISBN 978-x-xxxx-xxxx-x/YY/MM

<https://doi.org/10.1145/nnnnnnnn.nnnnnnn>

Table 1: The datasets used in the experiments.

Datasets	Signals	Series	Timestamps		Gran.
			Train	Val & Test	
ETTh1 & ETTh2	7	1	8640	2880	1hour
ETTm1 & ETTm2	7	1	34560	11520	15min
Exchange	8	1	4552	1518	1day
Electricity	1	321	15782	5261	1hour
Traffic	862	1	17544	10526	1hour
Weather	21	1	31617	10539	10min
ILI	7	1	579	193	1week
WTH	12	1	21038	7013	1hour

were performed using five seeds  $S = \{0, 1, 2, 36, 42\}$  to ensure the robustness and reproducibility of the results.

**Datasets.** We conducted experiments on ten widely used in literature real-world datasets in the field of time series forecasting (see Table 1 for a quantitative description):

**ETT (Electricity Transformer Temperature)<sup>1</sup>:** It consists of two hourly sampled datasets (ETTh1/ETTh2) and two 15-minute-sampled datasets (ETTm1/ETTm2) of electricity transformer temperatures, containing features such as oil temperature and load.

**Exchange<sup>2</sup>:** It collects daily exchange rates of 8 countries from 1990 to 2016.

**WTH<sup>3</sup>:** The dataset contains hourly observations of 12 climate-related variables, including temperature, humidity, wind speed, and solar radiation, across nearly 1,600 locations in the United States.

**Electricity<sup>4</sup>:** The dataset consists of hourly electricity consumption data from 321 residential and industrial clients from 2012 to 2014.

**Traffic<sup>5</sup>:** It describes 48 months of hourly road occupancy rates, gathered between 2015 and 2016 by 862 sensors from the California Department of Transportation in the San Francisco Bay area.

**Weather<sup>6</sup>:** It includes 21 indicators of weather, such as air temperature, and humidity.

**ILI (Influenza-like Illness)<sup>7</sup>:** It contains weekly reports from the Centers for Disease Control (CDC) in the U.S., tracking the number of patients with influenza-like illness (ILI) from 1997 to 2022.

<sup>1</sup><https://github.com/zhouhaoyi/ETDataset>

<sup>2</sup><https://github.com/laiguokun/multivariate-time-series-data>

<sup>3</sup><https://drive.google.com/drive/folders/1ohGYWWohJlOlbg2gsGTeEq3Wii2egnP>

<sup>4</sup><https://archive.ics.uci.edu/ml/datasets/ElectricityLoadDiagrams20112014>

<sup>5</sup><http://pems.dot.ca.gov/>

<sup>6</sup><https://www.bgc-jena.mpg.de/wetter/>

<sup>7</sup><https://gis.cdc.gov/grasp/fluvview/fluportalashboard.html>

*Supervised Forecasting Baselines.* We selected PatchTST [3] and DLinear [5] as supervised forecasting models. PatchTST is a state-of-the-art transformer-based model; DLinear achieves competitive accuracy through moving average decomposition and a linear layer. Table 1 shows a quantitative description of the datasets regarding the number of signals, series, timestamps and granularity.

## 1.1 Forecasting Evaluation

The effectiveness of our decomposition pipeline is evaluated using Mean Squared Error (MSE) and Mean Absolute Error (MAE), defined as  $MSE = \frac{1}{N} \sum_{i=1}^N (y_i - \hat{y}_i)^2$  and  $MAE = \frac{1}{N} \sum_{i=1}^N |y_i - \hat{y}_i|$ , where  $y$  and  $\hat{y}$  denote the true and predicted values, respectively. The experiment measures the forecasting error of SSL models with and without TED4STL across five prediction lengths, which vary by dataset and are chosen according to the literature for SSL forecasting models.

*List of Tables.* . The following list provides an overview of the tables included in this document.

- **Table 2:** MSE values for each dataset and prediction length, evaluated using grid search with a moving average kernel size.
- **Table 3:** MAE values for each dataset and prediction length, evaluated using grid search with a moving average kernel size.
- **Table 4:** Percentage improvements for each dataset in terms of MAE and MSE.
- **Table 5:** Results for TS2Vec with different kernel size  $K$ .
- **Table 6:** Results for SimTS with different kernel size  $K$ .
- **Table 7:** Results for CoST with different kernel size  $K$ .
- **Table 8:** Results for MaskAE with different kernel size  $K$ .
- **Table 9:** Short-term forecasting results across models for the first pipeline application and baselines with a fixed kernel size of 25.
- **Table 10:** Short-term forecasting results across models for the second pipeline application and baselines with a fixed kernel size of 25.
- **Table 11:** Analysis on learning rate sensitivity for the first pipeline application (MSE metric).
- **Table 12:** Analysis on learning rate sensitivity for the second pipeline application (MSE metric).

## 1.2 Ablation Study

To understand the contribution of the time series decomposition, we run the selected SSL models again using the embeddings generated by the trend and the error components of the decomposition pipeline alone. In this case, we selected the same kernel size (25 timestamps) for the moving average in all experiments. The findings do not change considering different kernel sizes.

*List of Tables.* . The following list provides an overview of the tables included in this document.

- **Table 13:** Ablation for TS2Vec and SimTS in terms of MSE.
- **Table 14:** Ablation for TS2Vec and SimTS in terms of MAE.
- **Table 15:** Ablation for CoST and MaskAE in terms of MSE.
- **Table 16:** Ablation for CoST and MaslAE in terms of MAE.

## 1.3 Exploring Other Decomposition Strategies

This Section investigates whether different types of time series decomposition can provide improvements comparable to those obtained with the trend-error decomposition. In particular, we consider two additional decomposition methods: the **STL** (Seasonal-Trend decomposition using Loess) [2], which separates a series into seasonal, trend, and residual components, and the **Wavelet** decomposition. For the latter, we adopt a *Discrete Wavelet Decomposition*, which represents the signal through a finite set of coefficients at different resolution levels. Compared to the Continuous Wavelet Transform (CWT), the Discrete Wavelet Transform (DWT) offers a more compact representation, reducing redundancy and making it preferable for integration within deep learning architectures. In our implementation, we employ a first-order *Haar* discrete wavelet decomposition, which corresponds to a single-level transform capturing both low- and high-frequency components of the signal. This choice follows SWIFT [4], where the Haar basis is shown to effectively capture sharp transitions and local discontinuities, which are often crucial in time series forecasting tasks involving abrupt changes or short-term pattern shifts.

*List of Figures.* The following list provides an overview of the Figures included in this Section of the document.

- **Figure 1:** MAE for all the decomposition types used (STL, Wavelet, and Moving Average).

## References

- [1] Chevillon, G.: Direct multi-step estimation and forecasting. *Journal of Economic Surveys* **21**(4), 746–785 (2007). <https://doi.org/https://doi.org/10.1111/j.1467-6419.2007.00518.x>
- [2] Cleveland, R.B., Cleveland, W.S., McRae, J.E., Terpenning, I., et al.: Stl: A seasonal-trend decomposition. *J. off. Stat* **6**(1), 3–73 (1990)
- [3] Nie, Y., Nguyen, N.H., Sindhong, P., Kalagnanam, J.: A time series is worth 64 words: Long-term forecasting with transformers. In: ICLR. OpenReview.net (2023)
- [4] Xie, W., Cao, F.: SWIFT: mapping sub-series with wavelet decomposition improves time series forecasting. *CoRR* **abs/2501.16178** (2025)
- [5] Zeng, A., Chen, M., Zhang, L., Xu, Q.: Are transformers effective for time series forecasting? In: AAAI. pp. 11121–11128. AAAI Press (2023)

**Table 2: MSE comparison of SSL (with and without TED4STL) and supervised models. Best SSL results for each model are bolded; overall best per dataset and prediction length  $L$  are underlined.**

D	L	TS2Vec		SimTS		CoST		MaskAE		PatchTST	DLinear
		TED4STL	Orig.	TED4STL	Orig.	TED4STL	Orig.	TED4STL	Orig.		
ETTh1	24	<b>0.342±0.009</b>	0.590±0.042	<b>0.231±0.001</b>	0.377±0.006	<b>0.300±0.008</b>	0.380±0.009	<b>0.863±0.023</b>	1.565±0.069	0.329±0.001	0.330±0.001
	48	<b>0.386±0.011</b>	0.635±0.041	<b>0.286±0.003</b>	0.430±0.007	<b>0.401±0.010</b>	0.434±0.008	<b>1.059±0.101</b>	1.410±0.141	0.351±0.001	0.362±0.005
	168	<b>0.517±0.013</b>	0.768±0.039	<b>0.496±0.008</b>	0.644±0.005	<b>0.577±0.022</b>	0.630±0.010	<b>1.149±0.006</b>	1.309±0.036	<u>0.404±0.001</u>	0.489±0.014
	336	<b>0.799±0.033</b>	0.923±0.039	<b>0.800±0.032</b>	0.831±0.009	0.895±0.052	<b>0.789±0.005</b>	<u>1.174±0.016</u>	1.344±0.021	0.424±0.003	0.533±0.101
ETTh1	720	1.124±0.026	<b>1.053±0.024</b>	1.038±0.018	<b>0.985±0.020</b>	0.996±0.034	<b>0.898±0.021</b>	<u>1.181±0.031</u>	1.350±0.053	0.443±0.000	0.688±0.015
	24	<b>0.163±0.014</b>	0.437±0.037	<b>0.121±0.005</b>	0.347±0.017	<b>0.168±0.017</b>	0.456±0.067	<b>1.430±0.261</b>	2.801±0.114	0.171±0.001	0.222±0.003
	48	<b>0.291±0.041</b>	0.623±0.058	<b>0.172±0.010</b>	0.579±0.016	<b>0.306±0.027</b>	0.695±0.064	<b>1.931±0.137</b>	2.789±0.158	0.219±0.001	0.320±0.030
	168	<b>1.159±0.091</b>	1.800±0.104	<b>1.107±0.072</b>	1.656±0.028	<b>1.359±0.282</b>	1.608±0.076	<b>2.644±0.554</b>	2.954±0.165	0.324±0.000	0.678±0.379
ETTm1	336	<b>1.765±0.096</b>	2.161±0.094	<b>1.581±0.037</b>	1.940±0.029	<b>1.513±0.129</b>	1.819±0.083	2.778±0.289	<b>2.716±0.072</b>	<u>0.328±0.000</u>	0.638±0.075
	720	2.123±0.156	2.593±0.092	<b>1.804±0.015</b>	2.113±0.024	<b>1.766±0.122</b>	2.019±0.075	<b>2.684±0.069</b>	3.193±0.152	<u>0.379±0.000</u>	1.445±0.128
	24	<b>0.147±0.008</b>	0.456±0.023	<b>0.077±0.001</b>	0.245±0.005	<b>0.117±0.007</b>	0.245±0.005	<b>0.190±0.022</b>	1.893±0.108	0.195±0.000	0.318±0.003
	48	<b>0.244±0.014</b>	0.598±0.030	<b>0.123±0.003</b>	0.327±0.007	<b>0.181±0.015</b>	0.329±0.004	<b>0.282±0.038</b>	1.835±0.146	0.259±0.000	0.334±0.002
ETTm2	96	<b>0.333±0.009</b>	0.634±0.037	<b>0.209±0.004</b>	0.375±0.008	<b>0.274±0.019</b>	0.377±0.002	<b>0.426±0.025</b>	1.715±0.065	0.289±0.000	0.325±0.000
	288	<b>0.467±0.016</b>	0.700±0.032	<b>0.370±0.004</b>	0.467±0.008	<b>0.438±0.013</b>	0.473±0.009	<b>0.798±0.030</b>	1.797±0.128	<u>0.358±0.000</u>	0.406±0.000
	672	<b>0.616±0.013</b>	0.789±0.025	<b>0.555±0.002</b>	0.623±0.009	<b>0.612±0.007</b>	0.624±0.009	<b>1.072±0.070</b>	1.701±0.253	<u>0.414±0.000</u>	0.508±0.003
	24	<b>0.083±0.008</b>	0.198±0.036	<b>0.054±0.002</b>	0.115±0.002	<b>0.075±0.005</b>	0.128±0.009	<b>0.373±0.048</b>	2.569±0.232	0.096±0.000	0.138±0.002
Exch.	48	<b>0.106±0.004</b>	0.267±0.038	<b>0.071±0.002</b>	0.170±0.003	<b>0.100±0.002</b>	0.191±0.014	<b>0.468±0.092</b>	2.580±0.175	0.127±0.000	0.194±0.022
	96	<b>0.164±0.006</b>	0.372±0.042	<b>0.106±0.007</b>	0.273±0.004	<b>0.148±0.011</b>	0.307±0.021	<b>0.660±0.218</b>	2.557±0.051	0.165±0.000	0.269±0.057
	288	<b>0.588±0.026</b>	0.746±0.035	<b>0.592±0.021</b>	0.714±0.011	<b>0.622±0.051</b>	0.765±0.025	<b>1.326±0.174</b>	2.539±0.057	<u>0.261±0.000</u>	0.479±0.165
	672	1.950±0.164	<b>1.790±0.087</b>	<b>1.583±0.074</b>	1.715±0.045	1.850±0.762	<b>1.641±0.064</b>	<b>2.989±0.153</b>	3.160±0.154	0.353±0.000	0.648±0.067
WTH	24	<b>0.053±0.012</b>	0.095±0.004	<b>0.033±0.007</b>	0.092±0.006	<b>0.069±0.013</b>	0.125±0.024	2.366±0.106	<b>2.069±0.043</b>	0.027±0.000	0.042±0.001
	48	<b>0.112±0.024</b>	0.173±0.009	<b>0.057±0.003</b>	0.200±0.011	<b>0.122±0.028</b>	0.233±0.039	2.573±0.082	<b>2.150±0.044</b>	<u>0.048±0.000</u>	0.093±0.019
	96	<b>0.318±0.044</b>	0.425±0.030	<b>0.165±0.014</b>	0.451±0.023	<b>0.336±0.096</b>	0.484±0.069	2.527±0.088	<b>2.204±0.045</b>	0.092±0.001	0.162±0.009
	288	<b>1.198±0.157</b>	1.478±0.234	1.329±0.080	<b>1.306±0.048</b>	<b>1.196±0.145</b>	1.236±0.029	2.771±0.126	<b>2.221±0.058</b>	<u>0.299±0.004</u>	0.498±0.079
Electr.	672	<b>2.153±0.240</b>	2.288±0.197	2.433±0.099	<b>1.920±0.100</b>	2.083±0.358	<b>1.857±0.214</b>	3.612±0.434	<b>2.403±0.059</b>	0.828±0.002	1.491±0.202
	24	<b>0.222±0.003</b>	0.307±0.002	<b>0.205±0.001</b>	0.294±0.001	<b>0.204±0.003</b>	0.299±0.001	<b>0.247±0.004</b>	1.698±0.016	0.322±0.000	0.430±0.001
	48	<b>0.253±0.002</b>	0.373±0.003	<b>0.236±0.001</b>	0.356±0.001	<b>0.237±0.002</b>	0.360±0.001	<b>0.283±0.004</b>	1.578±0.053	0.398±0.000	0.512±0.000
	168	<b>0.376±0.003</b>	0.494±0.005	<b>0.355±0.001</b>	0.464±0.001	<b>0.352±0.002</b>	0.464±0.001	<b>0.546±0.010</b>	1.422±0.053	0.515±0.000	0.543±0.001
Weath.	336	<b>0.459±0.004</b>	0.528±0.006	<b>0.441±0.002</b>	0.499±0.002	<b>0.437±0.001</b>	0.497±0.002	<b>0.593±0.008</b>	1.532±0.054	0.555±0.000	0.594±0.001
	720	<b>0.517±0.001</b>	0.561±0.006	<b>0.505±0.003</b>	0.535±0.003	<b>0.503±0.005</b>	0.534±0.003	<b>0.573±0.007</b>	1.462±0.049	0.642±0.000	0.725±0.001
	24	<b>0.200±0.003</b>	0.285±0.007	<b>0.093±0.002</b>	0.138±0.001	0.149±0.004	<b>0.135±0.001</b>	<b>0.979±0.012</b>	1.150±0.010	0.117±0.021	0.123±0.000
	48	<b>0.226±0.004</b>	0.308±0.007	<b>0.107±0.001</b>	0.155±0.000	0.170±0.004	<b>0.152±0.001</b>	<b>0.963±0.026</b>	1.165±0.019	0.144±0.019	0.144±0.000
Weath.	168	<b>0.258±0.003</b>	0.334±0.007	<b>0.140±0.001</b>	0.175±0.000	0.199±0.004	<b>0.175±0.001</b>	<b>0.980±0.006</b>	1.129±0.005	0.146±0.000	0.170±0.000
	336	<b>0.284±0.003</b>	0.351±0.007	<b>0.171±0.001</b>	0.195±0.000	0.220±0.005	<b>0.195±0.001</b>	<b>0.976±0.004</b>	1.129±0.008	<u>0.164±0.000</u>	0.209±0.000
	672	<b>0.320±0.003</b>	0.377±0.006	<b>0.214±0.001</b>	0.232±0.001	0.254±0.004	<b>0.232±0.001</b>	<b>0.973±0.007</b>	1.135±0.021	0.202±0.000	0.288±0.001
	24	<b>0.142±0.006</b>	0.292±0.074	<b>0.073±0.002</b>	0.259±0.033	<b>0.106±0.016</b>	0.254±0.025	<b>0.355±0.037</b>	1.904±0.143	0.091±0.000	0.145±0.000
Traf.	48	<b>0.198±0.016</b>	0.748±0.189	<b>0.109±0.004</b>	0.542±0.044	<b>0.155±0.019</b>	0.476±0.041	<b>0.443±0.066</b>	2.076±0.195	0.117±0.000	0.189±0.000
	96	<b>0.247±0.035</b>	1.538±0.274	<b>0.123±0.008</b>	0.955±0.050	<b>0.182±0.019</b>	0.770±0.080	<b>0.765±0.084</b>	1.966±0.154	0.151±0.000	0.224±0.001
	288	<b>1.038±0.105</b>	1.925±0.303	<b>1.068±0.030</b>	1.278±0.055	<b>1.029±0.167</b>	<b>1.050±0.082</b>	1.459±0.205	1.540±0.200	<u>0.232±0.000</u>	0.321±0.001
	672	<b>2.057±0.177</b>	2.720±0.312	1.872±0.074	<b>1.710±0.071</b>	1.673±0.362	<b>1.486±0.087</b>	<b>1.581±0.258</b>	1.596±0.315	0.316±0.000	0.403±0.002
Ili	24	<b>0.820±0.021</b>	0.973±0.023	<b>0.730±0.006</b>	0.755±0.006	0.789±0.020	<b>0.722±0.004</b>	<b>0.884±0.031</b>	1.816±0.139	0.320±0.000	0.382±0.001
	48	<b>0.851±0.023</b>	1.005±0.027	<b>0.770±0.007</b>	0.789±0.005	0.816±0.020	<b>0.744±0.002</b>	<b>0.909±0.016</b>	1.852±0.078	0.342±0.000	0.418±0.002
	96	<b>0.890±0.016</b>	1.038±0.021	<b>0.792±0.005</b>	0.810±0.007	0.834±0.022	<b>0.754±0.003</b>	<b>0.931±0.018</b>	1.763±0.160	0.366±0.000	0.428±0.003
	288	<b>0.900±0.014</b>	1.075±0.016	<b>0.805±0.004</b>	0.814±0.005	0.844±0.021	<b>0.763±0.001</b>	<b>0.956±0.013</b>	1.704±0.079	0.395±0.000	0.481±0.001
Ili	672	<b>0.913±0.015</b>	1.128±0.066	<b>0.820±0.004</b>	0.826±0.005	0.859±0.021	<b>0.776±0.002</b>	<b>1.009±0.018</b>	1.747±0.093	0.428±0.001	0.531±0.005
	24	4.393±1.575	<b>4.367±1.780</b>	1.957±0.013	2.699±0.045	<b>2.347±0.129</b>	2.873±0.086	<b>7.424±0.608</b>	8.583±0.254	<u>1.390±0.000</u>	3.389±0.166
	36	<b>3.502±0.448</b>	3.857±0.254	<b>2.064±0.047</b>	2.971±0.043	<b>2.185±0.068</b>	3.165±0.057	<b>7.489±0.258</b>	8.846±0.474	2.647±0.000	3.069±0.097
	48	<b>3.613±0.358</b>	4.126±0.250	<b>2.518±0.034</b>	3.240±0.033	<b>2.405±0.106</b>	3.449±0.065	<b>7.554±0.703</b>	8.772±0.335	1.718±0.000	3.188±0.094
	60	<b>3.710±0.283</b>	4.350±0.225	<b>3.331±0.005</b>	3.621±0.030	<b>2.611±0.187</b>	3.849±0.072	<b>8.068±0.468</b>	9.223±0.116	3.066±0.000	3.824±0.075

**Table 3: MAE comparison of SSL (with and without TED4STL) and forecasting models. Best SSL results for each model are bolded; overall best per dataset and prediction length  $L$  are underlined.**

D	L	TS2Vec		SimTS		CoST		MaskAE		PatchTST	DLinear
		TED4STL	Orig.	TED4STL	Orig.	TED4STL	Orig.	TED4STL	Orig.		
ETTh1	24	<b>0.397±0.004</b>	0.531±0.021	<b>0.337±0.001</b>	0.421±0.005	<b>0.382±0.006</b>	0.426±0.008	<b>0.678±0.012</b>	0.997±0.035	0.373±0.001	0.367±0.001
	48	<b>0.425±0.007</b>	0.562±0.022	<b>0.371±0.002</b>	0.456±0.006	<b>0.439±0.006</b>	0.464±0.007	<b>0.783±0.061</b>	0.936±0.049	0.385±0.001	0.387±0.008
	168	<b>0.493±0.007</b>	0.642±0.019	<b>0.490±0.006</b>	0.583±0.003	<b>0.541±0.011</b>	0.579±0.007	<b>0.832±0.007</b>	0.905±0.009	<b>0.415±0.001</b>	0.468±0.008
	336	<b>0.640±0.018</b>	0.724±0.019	<b>0.647±0.017</b>	0.686±0.004	0.708±0.028	<b>0.672±0.005</b>	<b>0.850±0.014</b>	0.922±0.008	0.430±0.004	0.517±0.069
	720	0.797±0.009	<b>0.794±0.012</b>	0.778±0.005	<b>0.777±0.007</b>	0.776±0.012	<b>0.748±0.006</b>	<b>0.855±0.028</b>	0.930±0.020	0.462±0.000	0.642±0.008
ETTh2	24	<b>0.297±0.013</b>	0.489±0.027	<b>0.259±0.008</b>	0.439±0.008	<b>0.306±0.019</b>	0.509±0.043	<b>0.957±0.089</b>	1.302±0.026	0.266±0.001	0.301±0.005
	48	<b>0.406±0.030</b>	0.602±0.033	<b>0.311±0.011</b>	0.582±0.007	<b>0.410±0.015</b>	0.640±0.038	<b>1.122±0.038</b>	1.308±0.032	<b>0.300±0.002</b>	0.378±0.025
	168	<b>0.828±0.027</b>	1.051±0.032	<b>0.730±0.024</b>	1.007±0.018	<b>0.860±0.058</b>	0.992±0.015	<b>1.257±0.127</b>	1.350±0.035	0.369±0.000	0.575±0.159
	336	<b>1.067±0.031</b>	1.178±0.026	<b>0.992±0.022</b>	1.107±0.018	<b>0.963±0.056</b>	1.061±0.016	1.306±0.079	<b>1.305±0.014</b>	<b>0.384±0.000</b>	0.588±0.039
	720	1.222±0.060	1.344±0.036	<b>1.081±0.017</b>	1.174±0.013	<b>1.047±0.052</b>	1.097±0.012	<b>1.250±0.028</b>	1.421±0.035	0.422±0.000	0.909±0.041
ETTm1	24	<b>0.270±0.007</b>	0.446±0.016	<b>0.195±0.002</b>	0.326±0.004	<b>0.242±0.004</b>	0.329±0.004	<b>0.321±0.020</b>	1.070±0.029	0.275±0.000	0.361±0.003
	48	<b>0.336±0.006</b>	0.524±0.017	<b>0.245±0.003</b>	0.383±0.005	<b>0.296±0.006</b>	0.387±0.003	<b>0.383±0.023</b>	1.051±0.052	0.318±0.000	0.368±0.002
	96	<b>0.393±0.003</b>	0.553±0.020	<b>0.320±0.003</b>	0.417±0.006	<b>0.360±0.007</b>	0.421±0.002	<b>0.470±0.015</b>	1.019±0.020	0.340±0.000	0.359±0.001
	288	<b>0.471±0.006</b>	0.599±0.016	<b>0.423±0.003</b>	0.483±0.006	<b>0.466±0.008</b>	0.489±0.006	<b>0.658±0.018</b>	1.049±0.044	0.387±0.000	0.407±0.001
	672	<b>0.560±0.007</b>	0.655±0.010	<b>0.535±0.002</b>	0.576±0.006	<b>0.573±0.005</b>	0.578±0.006	<b>0.798±0.043</b>	1.034±0.081	0.422±0.000	0.469±0.005
ETTm2	24	<b>0.207±0.010</b>	0.317±0.034	<b>0.165±0.006</b>	0.234±0.003	<b>0.198±0.006</b>	0.253±0.010	<b>0.472±0.033</b>	1.181±0.056	0.192±0.000	0.244±0.004
	48	<b>0.236±0.005</b>	0.376±0.030	<b>0.191±0.005</b>	0.296±0.003	<b>0.232±0.002</b>	0.315±0.013	<b>0.551±0.067</b>	1.215±0.029	0.224±0.000	0.294±0.028
	96	<b>0.302±0.006</b>	0.447±0.032	<b>0.240±0.011</b>	0.383±0.003	<b>0.285±0.012</b>	0.406±0.015	<b>0.636±0.109</b>	1.228±0.017	0.255±0.000	0.345±0.049
	288	<b>0.575±0.016</b>	0.660±0.024	<b>0.561±0.015</b>	0.645±0.004	<b>0.580±0.025</b>	0.669±0.012	<b>0.922±0.068</b>	1.262±0.016	<b>0.320±0.000</b>	0.474±0.099
	672	1.057±0.040	<b>1.030±0.026</b>	<b>0.973±0.028</b>	1.020±0.020	1.025±0.177	<b>0.991±0.014</b>	<b>1.375±0.028</b>	1.414±0.032	0.377±0.000	0.571±0.037
Exch.	24	<b>0.170±0.018</b>	0.229±0.005	<b>0.138±0.015</b>	0.223±0.010	<b>0.195±0.020</b>	0.264±0.028	1.178±0.019	<b>1.145±0.007</b>	0.114±0.000	0.150±0.002
	48	<b>0.248±0.024</b>	0.311±0.004	<b>0.180±0.008</b>	0.329±0.011	<b>0.259±0.027</b>	0.364±0.037	1.220±0.026	<b>1.161±0.014</b>	0.152±0.000	0.228±0.029
	96	<b>0.427±0.043</b>	0.486±0.023	<b>0.299±0.013</b>	0.502±0.012	<b>0.427±0.058</b>	0.531±0.053	1.244±0.018	<b>1.182±0.016</b>	0.213±0.001	0.316±0.011
	288	<b>0.850±0.070</b>	0.918±0.076	0.915±0.016	<b>0.912±0.015</b>	<b>0.866±0.074</b>	0.870±0.022	1.303±0.023	<b>1.179±0.008</b>	0.395±0.003	0.568±0.050
	672	<b>1.124±0.076</b>	1.166±0.061	1.235±0.020	<b>1.106±0.020</b>	1.147±0.101	<b>1.059±0.054</b>	1.474±0.098	<b>1.213±0.026</b>	0.677±0.001	0.954±0.070
WTH	24	<b>0.290±0.002</b>	0.363±0.001	<b>0.278±0.001</b>	0.356±0.001	<b>0.283±0.002</b>	0.362±0.001	<b>0.327±0.004</b>	1.015±0.005	0.361±0.000	0.449±0.000
	48	<b>0.325±0.002</b>	0.418±0.001	<b>0.310±0.001</b>	0.407±0.001	<b>0.319±0.002</b>	0.412±0.001	<b>0.360±0.003</b>	0.983±0.017	0.422±0.001	0.510±0.000
	168	<b>0.427±0.002</b>	0.507±0.002	<b>0.412±0.001</b>	0.491±0.001	<b>0.417±0.001</b>	0.492±0.001	<b>0.549±0.005</b>	0.942±0.021	0.507±0.000	0.536±0.000
	336	<b>0.488±0.002</b>	0.532±0.002	<b>0.476±0.002</b>	0.517±0.002	<b>0.475±0.001</b>	0.517±0.001	<b>0.578±0.005</b>	0.980±0.019	0.535±0.000	0.567±0.001
	720	<b>0.530±0.001</b>	0.555±0.003	<b>0.521±0.002</b>	0.543±0.002	<b>0.520±0.003</b>	0.543±0.002	<b>0.569±0.004</b>	0.954±0.023	0.583±0.000	0.655±0.001
Electr.	24	<b>0.315±0.003</b>	0.374±0.006	<b>0.210±0.002</b>	0.242±0.001	0.265±0.005	<b>0.240±0.002</b>	<b>0.801±0.004</b>	0.876±0.004	0.218±0.026	0.220±0.000
	48	<b>0.339±0.004</b>	0.390±0.006	<b>0.225±0.001</b>	0.258±0.000	0.283±0.004	<b>0.256±0.001</b>	0.793±0.015	0.882±0.007	0.242±0.021	0.241±0.000
	168	<b>0.361±0.003</b>	0.409±0.005	<b>0.252±0.001</b>	0.275±0.000	0.307±0.004	<b>0.275±0.001</b>	<b>0.803±0.001</b>	0.867±0.002	<b>0.237±0.000</b>	0.263±0.000
	336	<b>0.380±0.003</b>	0.422±0.005	<b>0.279±0.001</b>	0.296±0.000	0.326±0.005	<b>0.296±0.001</b>	0.799±0.001	0.867±0.003	<b>0.259±0.000</b>	0.302±0.000
	672	<b>0.406±0.003</b>	0.440±0.004	<b>0.317±0.001</b>	0.328±0.001	0.354±0.004	<b>0.329±0.001</b>	<b>0.801±0.003</b>	0.872±0.009	0.293±0.000	0.369±0.001
Weath.	24	<b>0.255±0.008</b>	0.331±0.035	<b>0.158±0.003</b>	0.324±0.027	<b>0.204±0.021</b>	0.334±0.022	<b>0.439±0.028</b>	1.016±0.041	0.121±0.000	0.208±0.000
	48	<b>0.307±0.015</b>	0.550±0.064	<b>0.199±0.006</b>	0.497±0.025	<b>0.255±0.017</b>	0.479±0.024	<b>0.500±0.039</b>	1.085±0.060	<b>0.159±0.000</b>	0.256±0.001
	96	<b>0.352±0.030</b>	0.849±0.067	<b>0.217±0.009</b>	0.697±0.020	<b>0.290±0.018</b>	0.634±0.036	<b>0.672±0.044</b>	1.086±0.035	0.199±0.000	0.285±0.002
	288	<b>0.726±0.041</b>	1.013±0.081	<b>0.702±0.010</b>	0.857±0.022	<b>0.709±0.058</b>	0.778±0.036	<b>0.968±0.072</b>	0.980±0.062	0.271±0.000	0.361±0.003
	672	<b>1.088±0.048</b>	1.291±0.087	1.076±0.025	<b>1.024±0.023</b>	0.983±0.115	<b>0.959±0.031</b>	1.007±0.089	<b>1.002±0.100</b>	0.330±0.000	0.426±0.004
Traf.	24	<b>0.485±0.021</b>	0.567±0.009	<b>0.433±0.006</b>	0.435±0.006	0.474±0.017	<b>0.423±0.005</b>	<b>0.497±0.013</b>	0.923±0.051	0.231±0.000	0.272±0.002
	48	<b>0.501±0.023</b>	0.579±0.010	<b>0.451±0.007</b>	0.456±0.007	0.485±0.016	<b>0.437±0.004</b>	<b>0.505±0.009</b>	0.936±0.029	0.240±0.000	0.289±0.005
	96	<b>0.511±0.008</b>	0.580±0.014	<b>0.471±0.004</b>	0.472±0.006	0.489±0.017	<b>0.438±0.005</b>	<b>0.509±0.008</b>	0.901±0.060	0.250±0.000	0.292±0.004
	288	<b>0.511±0.007</b>	0.600±0.012	<b>0.463±0.007</b>	0.468±0.006	0.488±0.017	<b>0.434±0.004</b>	<b>0.511±0.008</b>	0.875±0.030	0.264±0.001	0.323±0.002
	672	<b>0.514±0.010</b>	0.618±0.024	<b>0.471±0.004</b>	0.472±0.002	0.492±0.017	<b>0.436±0.006</b>	<b>0.535±0.009</b>	0.888±0.035	0.285±0.001	0.354±0.005
Ili	24	<b>1.370±0.286</b>	1.373±0.378	<b>0.895±0.013</b>	1.051±0.007	<b>0.984±0.019</b>	1.078±0.015	<b>1.954±0.083</b>	2.112±0.043	0.787±0.000	1.354±0.067
	36	<b>1.243±0.109</b>	1.279±0.063	<b>0.943±0.011</b>	1.082±0.007	<b>0.991±0.020</b>	1.123±0.011	<b>1.958±0.050</b>	2.134±0.069	1.076±0.000	1.278±0.037
	48	<b>1.244±0.083</b>	1.330±0.047	<b>1.009±0.013</b>	1.129±0.005	<b>1.029±0.013</b>	1.179±0.011	<b>1.965±0.107</b>	2.126±0.047	0.887±0.000	1.316±0.036
	60	<b>1.260±0.063</b>	1.366±0.038	<b>1.148±0.005</b>	1.210±0.004	<b>1.043±0.027</b>	1.262±0.010	<b>2.032±0.083</b>	2.181±0.015	1.179±0.000	1.521±0.013

**Table 4: Percentage improvements in terms of MSE and MAE referred to Table 3 and Table 2**

(a) MSE percentage Improvements

(b) MAE percentage Improvements

	MSE				Avg
	TS2Vec	SimTS	CoST	MaskAE	
ETTh1	20.13%	12.73%	-1.23%	22.23%	13.47%
ETTh2	27.74%	27.87%	22.51%	20.66%	24.70%
ETTm1	43.10%	34.53%	20.85%	69.04%	41.88%
ETTm2	14.32%	19.46%	7.80%	56.61%	24.55%
exchange	14.04%	-1.20%	3.26%	-25.37%	-2.32%
WTH	19.24%	18.92%	19.58		

**Table 5: TS2Vec with different kernel size**

D	L	ks=9		ks=25		ks=64		ks=96		ks=128		ks=224		Orig.	
		MAE	MSE												
ETTh1	24	0.464±0.006	0.467±0.011	0.418±0.009	0.377±0.017	0.397±0.004	0.342±0.009	0.406±0.004	0.360±0.009	0.412±0.003	0.370±0.007	0.427±0.007	0.399±0.012	0.531±0.021	0.590±0.042
	48	0.512±0.011	0.547±0.019	0.478±0.010	0.479±0.022	0.437±0.008	0.412±0.017	0.425±0.007	0.386±0.011	0.425±0.005	0.389±0.009	0.439±0.008	0.414±0.012	0.562±0.022	0.635±0.041
	168	0.618±0.012	0.729±0.025	0.599±0.009	0.686±0.018	0.561±0.009	0.623±0.021	0.545±0.010	0.600±0.026	0.527±0.007	0.573±0.018	0.493±0.007	0.517±0.013	0.642±0.019	0.768±0.039
	336	0.713±0.010	0.904±0.026	0.703±0.008	0.878±0.020	0.686±0.005	0.855±0.014	0.679±0.010	0.849±0.022	0.665±0.017	0.832±0.034	0.640±0.018	0.799±0.033	0.724±0.019	0.923±0.039
ETTh2	720	0.802±0.011	1.073±0.038	0.800±0.10	1.066±0.030	0.796±0.005	1.078±0.018	0.798±0.007	1.093±0.025	0.798±0.009	1.101±0.029	0.797±0.009	1.124±0.026	0.794±0.012	1.053±0.024
	24	0.390±0.019	0.295±0.026	0.324±0.008	0.202±0.008	0.297±0.013	0.163±0.014	0.310±0.016	0.180±0.018	0.352±0.033	0.232±0.042	0.460±0.066	0.398±0.102	0.489±0.027	0.437±0.037
	48	0.522±0.020	0.484±0.030	0.472±0.007	0.414±0.011	0.420±0.015	0.318±0.018	0.406±0.030	0.291±0.041	0.425±0.032	0.317±0.050	0.493±0.062	0.418±0.091	0.602±0.033	0.623±0.058
	168	1.000±0.022	1.669±0.045	1.002±0.018	1.679±0.052	1.063±0.099	1.998±0.445	0.978±0.044	1.598±0.118	0.952±0.053	1.515±0.176	0.828±0.027	1.159±0.091	1.051±0.032	1.800±0.104
ETTm1	336	1.149±0.022	2.077±0.046	1.160±0.028	2.102±0.071	1.301±0.196	2.796±0.985	1.161±0.041	2.087±0.095	1.140±0.041	2.016±0.119	1.067±0.031	1.765±0.096	1.178±0.026	2.161±0.094
	720	1.265±0.018	2.342±0.025	1.277±0.035	2.358±0.064	1.311±0.048	2.446±0.098	1.282±0.059	2.355±0.100	1.269±0.049	2.310±0.082	1.222±0.060	2.123±0.156	1.344±0.036	2.593±0.092
	24	0.387±0.006	0.371±0.012	0.315±0.013	0.237±0.023	0.270±0.007	0.147±0.008	0.313±0.012	0.212±0.016	0.324±0.008	0.235±0.019	0.339±0.007	0.262±0.007	0.446±0.016	0.456±0.023
	48	0.481±0.011	0.520±0.016	0.427±0.018	0.417±0.031	0.353±0.009	0.278±0.013	0.332±0.004	0.233±0.008	0.336±0.006	0.244±0.014	0.375±0.009	0.314±0.015	0.524±0.017	0.598±0.030
ETTm2	96	0.520±0.009	0.570±0.016	0.480±0.015	0.495±0.025	0.429±0.011	0.401±0.018	0.409±0.008	0.361±0.018	0.393±0.003	0.333±0.009	0.392±0.006	0.334±0.012	0.553±0.020	0.634±0.037
	288	0.583±0.010	0.667±0.020	0.553±0.010	0.609±0.017	0.526±0.011	0.560±0.020	0.513±0.006	0.529±0.018	0.499±0.006	0.505±0.014	0.471±0.006	0.467±0.016	0.599±0.016	0.700±0.032
	672	0.650±0.010	0.782±0.021	0.628±0.013	0.736±0.023	0.605±0.013	0.694±0.027	0.602±0.006	0.682±0.015	0.594±0.006	0.670±0.015	0.560±0.007	0.616±0.013	0.655±0.010	0.789±0.025
	24	0.258±0.015	0.140±0.012	0.231±0.017	0.108±0.011	0.207±0.010	0.083±0.008	0.215±0.008	0.090±0.006	0.221±0.008	0.096±0.005	0.232±0.005	0.107±0.005	0.317±0.034	0.198±0.036
Exch.	48	0.328±0.017	0.217±0.018	0.300±0.022	0.179±0.018	0.260±0.020	0.130±0.016	0.237±0.008	0.107±0.007	0.236±0.005	0.106±0.004	0.256±0.006	0.124±0.006	0.376±0.030	0.267±0.038
	96	0.416±0.015	0.337±0.022	0.386±0.020	0.292±0.021	0.345±0.018	0.229±0.016	0.317±0.015	0.195±0.014	0.303±0.008	0.174±0.009	0.302±0.006	0.164±0.006	0.447±0.032	0.372±0.042
	288	0.653±0.024	0.733±0.045	0.628±0.013	0.687±0.030	0.596±0.007	0.626±0.007	0.588±0.015	0.618±0.033	0.586±0.020	0.616±0.046	0.575±0.016	0.588±0.026	0.660±0.024	0.746±0.035
	672	1.041±0.030	1.846±0.094	1.052±0.025	1.897±0.084	1.052±0.028	1.919±0.111	1.053±0.032	1.929±0.127	1.057±0.040	1.950±0.164	1.135±0.053	2.326±0.341	1.030±0.026	1.790±0.087
WTH	24	0.193±0.017	0.068±0.010	0.178±0.019	0.058±0.010	0.170±0.018	0.053±0.012	0.181±0.024	0.059±0.017	0.191±0.019	0.065±0.014	0.198±0.017	0.074±0.014	0.229±0.005	0.095±0.004
	48	0.285±0.019	0.147±0.013	0.274±0.020	0.141±0.019	0.255±0.016	0.120±0.012	0.248±0.024	0.112±0.024	0.252±0.015	0.109±0.014	0.261±0.027	0.119±0.018	0.311±0.004	0.173±0.009
	96	0.464±0.035	0.379±0.031	0.463±0.038	0.380±0.047	0.440±0.028	0.352±0.045	0.427±0.031	0.331±0.052	0.427±0.043	0.318±0.044	0.404±0.032	0.288±0.043	0.486±0.023	0.425±0.030
	288	0.846±0.069	1.185±0.156	0.850±0.070	1.198±0.157	0.840±0.078	1.193±0.154	0.855±0.078	1.263±0.203	0.866±0.077	1.301±0.224	0.878±0.061	1.338±0.200	0.918±0.076	1.478±0.234
Elect.	672	1.124±0.076	2.153±0.240	1.144±0.084	2.238±0.285	1.157±0.044	2.335±0.209	1.183±0.056	2.479±0.260	1.223±0.064	2.664±0.332	1.234±0.078	2.682±0.503	1.166±0.061	2.288±0.197
	24	0.334±0.002	0.275±0.003	0.307±0.001	0.242±0.001	0.290±0.002	0.222±0.003	0.307±0.001	0.239±0.002	0.320±0.002	0.253±0.002	0.340±0.002	0.275±0.003	0.363±0.001	0.307±0.002
	48	0.397±0.003	0.348±0.005	0.376±0.002	0.320±0.003	0.338±0.003	0.273±0.002	0.325±0.002	0.253±0.002	0.332±0.001	0.261±0.002	0.364±0.002	0.297±0.002	0.418±0.001	0.373±0.003
	96	0.492±0.004	0.472±0.007	0.484±0.003	0.462±0.006	0.467±0.002	0.437±0.004	0.455±0.002	0.420±0.004	0.446±0.002	0.408±0.004	0.427±0.002	0.376±0.003	0.507±0.002	0.494±0.005
Weath.	336	0.518±0.003	0.508±0.007	0.515±0.002	0.502±0.005	0.507±0.002	0.489±0.005	0.501±0.001	0.479±0.002	0.496±0.002	0.473±0.004	0.488±0.002	0.459±0.004	0.532±0.002	0.528±0.006
	720	0.541±0.003	0.541±0.006	0.543±0.002	0.541±0.005	0.540±0.002	0.536±0.004	0.537±0.002	0.530±0.003	0.535±0.002	0.526±0.002	0.530±0.001	0.517±0.001	0.555±0.003	0.561±0.006
	24	0.317±0.004	0.213±0.004	0.315±0.003	0.200±0.003	0.324±0.002	0.206±0.003	0.331±0.004	0.218±0.004	0.334±0.005	0.225±0.005	0.346±0.005	0.244±0.006	0.374±0.006	0.285±0.007
	48	0.339±0.005	0.241±0.005	0.341±0.003	0.235±0.003	0.338±0.003	0.227±0.003	0.339±0.004	0.226±0.004	0.339±0.005	0.227±0.005	0.351±0.004	0.247±0.005	0.390±0.006	0.308±0.007
Iii	168	0.368±0.004	0.277±0.004	0.373±0.003	0.279±0.003	0.372±0.003	0.277±0.004	0.375±0.004	0.366±0.004	0.266±0.004	0.361±0.003	0.258±0.003	0.409±0.005	0.334±0.007	
	336	0.384±0.003	0.297±0.003	0.389±0.003	0.300±0.003	0.389±0.002	0.299±0.002	0.389±0.004	0.299±0.004	0.384±0.004	0.291±0.004	0.380±0.003	0.284±0.003	0.422±0.005	0.351±0.007
	720	0.406±0.002	0.327±0.003	0.403±0.003	0.331±0.003	0.412±0.002	0.332±0.002	0.413±0.003	0.332±0.004	0.409±0.003	0.326±0.004	0.404±0.003	0.320±0.003	0.440±0.004	0.377±0.006
	24	0.335±0.071	0.295±0.113	0.286±0.053	0.218±0.080	0.255±0.008	0.142±0.006	0.269±0.039	0.160±0.038	0.270±0.048	0.166±0.051	0.245±0.015	0.144±0.011	0.331±0.035	0.292±0.074
Traf.	48	0.597±0.108	0.837±0.258	0.514±0.091	0.631±0.197	0.350±0.010	0.288±0.008	0.307±0.015	0.198±0.016	0.285±0.027	0.177±0.027	0.289±0.024	0.182±0.020	0.550±0.064	0.748±0.189
	96	0.861±0.095	1.562±0.307	0.788±0.182	1.337±0.257	0.637±0.011	0.909±0.015	0.542±0.043	0.654±0.119	0.460±0.040	0.462±0.080	0.352±0.030	0.247±0.035	0.849±0.067	1.538±0.274
	288	1.037±0.033	1.990±0.133	0.985±0.039	1.817±0.150	0.875±0.010	1.486±0.016	0.820±0.033	1.319±0.113	0.781±0.037	1.204±0.111	0.726±0.041	1.038±0.105	1.013±0.081	1.925±0.303
	672	1.309±0.057	2.910±0.189	1.290±0.039	2.813±0.182	1.204±0.005	2.940±0.014	1.169±0.043	2.361±0.182	1.138±0.053	2.250±0.210	1.088±0.048	2.057±0.177	1.291±0.087	2.720±0.312
Iii	24	0.562±0.013	0.940±0.018	0.536±0.032	0.887±0.029	0.503±0.025	0.841±0.018	0.525±0.019	0.875±0.017	0.485±0.021	0.820±0.021	0.500±0.019	0.855±0.035	0.567±0.009	0.973±0.023
	48	0.573±0.013	0.978±0.018	0.533±0.013	0.923±0.016	0.517±0.040	0.881±0.079	0.542±0.025	0.915±0.024	0.501±0.023	0.851±0.023	0.516±0.018	0.886±0.035	0.579±0.010	1.005±0.027
	96	0.588±0.013	1.025±0.019	0.551±0.015	0.969±0.023	0.530±0.060	0.927±0.181	0.545±0.008	0.956±0.012	0.511±0.008	0.890±0.016	0.			

**Table 6: SimTS with different kernel size**

D L	ks=9		ks=25		ks=64		ks=96		ks=128		ks=224		Orig.	
	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE
ETTh1	24 0.393±0.006 0.338±0.008 0.350±0.005 0.270±0.006 0.337±0.001 0.231±0.001 0.346±0.004 0.250±0.003 0.353±0.003 0.265±0.003 0.365±0.003 0.289±0.003 0.421±0.005 0.377±0.006													
	48 0.440±0.006 0.406±0.007 0.416±0.004 0.369±0.005 0.388±0.003 0.318±0.003 0.371±0.002 0.286±0.003 0.373±0.002 0.294±0.002 0.380±0.002 0.313±0.002 0.456±0.006 0.430±0.007													
	168 0.578±0.004 0.635±0.007 0.565±0.004 0.617±0.010 0.547±0.003 0.591±0.009 0.532±0.004 0.569±0.009 0.524±0.007 0.558±0.014 0.490±0.006 0.496±0.008 0.583±0.003 0.644±0.005													
	336 0.684±0.005 0.827±0.010 0.676±0.005 0.814±0.009 0.665±0.005 0.795±0.009 0.659±0.007 0.797±0.020 0.654±0.008 0.798±0.022 0.647±0.017 0.800±0.032 0.686±0.004 0.831±0.009													
	720 0.780±0.008 0.996±0.026 0.773±0.006 0.978±0.015 0.771±0.005 0.976±0.015 0.769±0.005 0.975±0.015 0.767±0.005 0.974±0.015 0.778±0.005 1.038±0.018 0.777±0.007 0.985±0.020													
	24 0.414±0.011 0.315±0.017 0.344±0.009 0.227±0.013 0.259±0.008 0.121±0.005 0.266±0.006 0.130±0.009 0.277±0.008 0.141±0.008 0.330±0.027 0.201±0.027 0.439±0.008 0.347±0.017													
ETTh2	48 0.568±0.009 0.559±0.016 0.522±0.006 0.494±0.007 0.395±0.012 0.296±0.020 0.335±0.004 0.202±0.009 0.311±0.011 0.172±0.010 0.351±0.016 0.223±0.018 0.582±0.007 0.579±0.016													
	168 1.004±0.018 1.652±0.025 0.995±0.018 1.624±0.027 0.966±0.019 1.538±0.031 0.943±0.021 1.469±0.046 0.925±0.025 1.427±0.060 0.730±0.024 1.107±0.072 1.007±0.018 1.656±0.028													
	336 1.103±0.017 1.936±0.030 1.099±0.017 1.921±0.030 1.078±0.017 1.859±0.019 1.062±0.018 1.806±0.021 1.043±0.019 1.747±0.021 0.992±0.022 1.581±0.037 1.107±0.018 1.940±0.029													
	720 1.168±0.015 2.106±0.023 1.164±0.016 2.091±0.023 1.155±0.016 2.051±0.021 1.144±0.017 2.011±0.020 1.132±0.017 1.970±0.019 1.081±0.017 1.804±0.015 1.174±0.013 2.113±0.024													
	24 0.297±0.005 0.210±0.005 0.239±0.004 0.137±0.003 0.195±0.002 0.077±0.001 0.221±0.002 0.101±0.002 0.241±0.004 0.122±0.004 0.281±0.003 0.168±0.003 0.326±0.004 0.245±0.005													
	48 0.369±0.005 0.311±0.007 0.335±0.003 0.266±0.003 0.269±0.001 0.165±0.001 0.245±0.003 0.123±0.003 0.254±0.003 0.132±0.004 0.302±0.003 0.189±0.003 0.383±0.005 0.327±0.007													
ETTm1	96 0.412±0.006 0.370±0.008 0.394±0.007 0.346±0.010 0.358±0.004 0.291±0.005 0.336±0.004 0.254±0.006 0.319±0.005 0.223±0.007 0.320±0.003 0.209±0.004 0.417±0.006 0.375±0.008													
	288 0.481±0.006 0.466±0.008 0.474±0.006 0.456±0.009 0.457±0.004 0.428±0.005 0.446±0.003 0.411±0.004 0.437±0.003 0.395±0.004 0.423±0.003 0.370±0.004 0.483±0.006 0.467±0.008													
	672 0.575±0.005 0.621±0.007 0.570±0.005 0.614±0.007 0.559±0.003 0.596±0.005 0.553±0.003 0.587±0.004 0.547±0.003 0.576±0.004 0.535±0.002 0.555±0.002 0.576±0.006 0.623±0.009													
	24 0.221±0.005 0.102±0.003 0.194±0.008 0.078±0.004 0.165±0.006 0.054±0.002 0.173±0.002 0.060±0.001 0.178±0.002 0.064±0.001 0.199±0.007 0.080±0.003 0.234±0.003 0.115±0.002													
	48 0.286±0.005 0.161±0.004 0.266±0.007 0.141±0.005 0.218±0.007 0.094±0.004 0.197±0.005 0.075±0.003 0.191±0.005 0.071±0.002 0.211±0.008 0.087±0.004 0.296±0.003 0.170±0.003													
	96 0.376±0.004 0.267±0.004 0.362±0.007 0.249±0.006 0.325±0.008 0.205±0.005 0.297±0.008 0.173±0.006 0.273±0.010 0.145±0.007 0.240±0.011 0.106±0.007 0.383±0.003 0.273±0.004													
ETTm2	288 0.640±0.002 0.705±0.006 0.633±0.002 0.696±0.007 0.621±0.005 0.682±0.016 0.609±0.005 0.666±0.013 0.603±0.007 0.662±0.012 0.561±0.015 0.592±0.021 0.645±0.004 0.714±0.011													
	672 1.017±0.022 1.714±0.045 1.016±0.022 1.709±0.046 1.008±0.022 1.690±0.050 1.002±0.023 1.673±0.053 0.996±0.024 1.655±0.056 0.973±0.028 1.583±0.074 1.020±0.020 1.715±0.045													
	24 0.217±0.010 0.088±0.007 0.196±0.012 0.074±0.008 0.141±0.009 0.036±0.003 0.138±0.015 0.033±0.007 0.146±0.011 0.037±0.004 0.180±0.009 0.055±0.005 0.223±0.010 0.092±0.006													
	48 0.327±0.010 0.196±0.010 0.312±0.010 0.183±0.009 0.256±0.010 0.132±0.010 0.206±0.007 0.085±0.009 0.180±0.008 0.057±0.003 0.211±0.006 0.076±0.006 0.329±0.011 0.200±0.011													
	96 0.502±0.011 0.449±0.021 0.493±0.012 0.436±0.020 0.459±0.014 0.396±0.023 0.426±0.012 0.348±0.018 0.390±0.013 0.298±0.015 0.299±0.013 0.165±0.014 0.502±0.012 0.451±0.023													
	288 0.922±0.020 1.346±0.076 0.920±0.020 1.343±0.075 0.915±0.018 1.332±0.070 0.914±0.016 1.329±0.068 0.913±0.016 1.327±0.069 0.915±0.016 1.329±0.080 0.912±0.015 1.306±0.048													
Exch.	672 1.100±0.038 1.902±0.122 1.110±0.034 1.943±0.133 1.118±0.036 1.969±0.139 1.128±0.038 2.004±0.145 1.141±0.039 2.050±0.155 1.235±0.020 2.433±0.099 1.106±0.020 1.920±0.100													
	24 0.335±0.002 0.268±0.002 0.301±0.001 0.230±0.001 0.278±0.001 0.205±0.001 0.292±0.001 0.221±0.000 0.305±0.001 0.234±0.001 0.328±0.001 0.259±0.001 0.356±0.001 0.294±0.001													
	48 0.394±0.001 0.339±0.001 0.370±0.001 0.309±0.001 0.326±0.001 0.256±0.001 0.310±0.001 0.236±0.001 0.314±0.001 0.241±0.001 0.346±0.001 0.275±0.001 0.407±0.001 0.356±0.001													
	168 0.487±0.001 0.459±0.001 0.479±0.001 0.449±0.002 0.460±0.001 0.424±0.001 0.447±0.001 0.406±0.001 0.435±0.001 0.430±0.001 0.412±0.001 0.355±0.001 0.491±0.001 0.464±0.001													
	336 0.515±0.002 0.496±0.002 0.511±0.002 0.491±0.003 0.501±0.002 0.478±0.002 0.494±0.002 0.468±0.002 0.488±0.002 0.460±0.002 0.476±0.002 0.441±0.002 0.517±0.002 0.499±0.002													
	720 0.540±0.002 0.533±0.003 0.538±0.002 0.530±0.003 0.534±0.002 0.524±0.003 0.530±0.002 0.519±0.003 0.527±0.002 0.515±0.003 0.521±0.002 0.505±0.003 0.543±0.002 0.535±0.003													
Elect.	24 0.231±0.001 0.128±0.001 0.212±0.001 0.104±0.001 0.210±0.002 0.093±0.002 0.218±0.002 0.102±0.002 0.224±0.002 0.109±0.002 0.233±0.001 0.120±0.002 0.242±0.001 0.138±0.001													
	48 0.254±0.001 0.151±0.001 0.242±0.001 0.136±0.001 0.230±0.001 0.115±0.001 0.225±0.001 0.107±0.001 0.228±0.001 0.111±0.001 0.237±0.001 0.123±0.001 0.258±0.000 0.155±0.000													
	168 0.278±0.001 0.177±0.001 0.274±0.001 0.172±0.001 0.269±0.001 0.164±0.001 0.265±0.001 0.158±0.001 0.261±0.001 0.152±0.001 0.252±0.001 0.140±0.001 0.275±0.000 0.175±0.000													
	336 0.300±0.000 0.198±0.000 0.297±0.001 0.195±0.000 0.293±0.001 0.189±0.001 0.290±0.001 0.185±0.001 0.287±0.001 0.181±0.001 0.279±0.001 0.171±0.001 0.296±0.000 0.195±0.000													
	720 0.332±0.001 0.235±0.001 0.329±0.000 0.232±0.000 0.327±0.000 0.228±0.000 0.325±0.001 0.225±0.001 0.323±0.001 0.222±0.001 0.317±0.001 0.214±0.001 0.328±0.001 0.232±0.001													
	24 0.304±0.001 0.226±0.002 0.249±0.008 0.157±0.019 0.158±0.003 0.073±0.002 0.160±0.005 0.078±0.004 0.162±0.005 0.082±0.002 0.171±0.006 0.092±0.004 0.324±0.002 0.259±0.033													
Weath.	48 0.490±0.003 0.353±0.004 0.463±0.022 0.438±0.037 0.273±0.009 0.196±0.010 0.199±0.006 0.109±0.004 0.179±0.005 0.093±0.004 0.189±0.008 0.103±0.005 0.497±0.025 0.542±0.044													
	96 0.705±0.005 0.991±0.077 0.671±0.025 0.922±0.068 0.544±0.020 0.679±0.055 0.440±0.022 0.480±0.045 0.345±0.014 0.309±0.023 0.217±0.009 0.123±0.008 0.697±0.020 0.955±0.050													
	288 1.015±0.003 1.802±0.061 1.012±0.023 1.839±0.076 0.948±0.021 1.680±0.070 0.881±0.024 1.495±0.080 0.826±0.016 1.355±0.048 0.702±0.010 1.068±0.030 0.857±0.022 1.278±0.055													
	672 1.210±0.003 2.349±0.092 1.205±0.025 2.334±0.093 1.175±0.025 2.235±0.094 1.138±0.028 2.082±0.097 1.112±0.027 1.980±0.087 1.076±0.025 1.872±0.074 1.024±0.023 1.710±0.071													
	24 0.440±0.023 0.741±0.003 0.433±0.006 0.730±0.002 0.440±0.007 0.734±0.003 0.444±0.005 0.739±0.003 0.446±0.004 0.745±0.003 0.442±0.006 0.751±0.002 0.435±0.006 0.755±0.006													
	48 0.460±0.025 0.781±0.005 0.451±0.007 0.770±0.004 0.457±0.006 0.770±0.004 0.459±0.006 0.770±0.004 0.461±0.005 0.773±0.005 0.460±0.005 0.777±0.005 0.456±0.007 0.789±0.005													
Traf.	96 0.473±0.029 0.808±0.008 0.461±0.006 0.799±0.005 0.467±0.008 0.801±0.003 0.465±0.008 0.801±0.003 0.467±0.007 0.799±0.004 0.471±0.004 0.792±0.005 0.472±0.006 0.810±0.007													
	288 0.470±0.019 0.814±0.005 0.467±0.003 0.808±0.005 0.467±0.006 0.810±0.003 0.465±0.007 0.810±0.003 0.468±0.005 0.810±0.004 0.463±0.007													

**Table 7: CoST with different kernel size**

D L	ks=9		ks=25		ks=64		ks=96		ks=128		ks=224		Orig.	
	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE
ETTh1	24 0.419±0.003 0.369±0.003 0.441±0.004 0.414±0.003 0.382±0.006 0.300±0.008 0.425±0.004 0.398±0.004 0.436±0.003 0.402±0.004 0.450±0.009 0.436±0.012 0.426±0.008 0.380±0.009													
	48 0.459±0.003 0.429±0.004 0.484±0.005 0.483±0.004 0.434±0.006 0.387±0.008 0.436±0.005 0.407±0.005 0.439±0.006 0.401±0.010 0.455±0.010 0.440±0.011 0.464±0.007 0.434±0.008													
	168 0.584±0.004 0.640±0.010 0.602±0.006 0.674±0.011 0.585±0.007 0.646±0.014 0.572±0.008 0.627±0.013 0.568±0.010 0.621±0.020 0.541±0.011 0.577±0.022 0.579±0.007 0.630±0.010													
	336 0.682±0.011 0.826±0.027 0.699±0.011 0.857±0.021 0.691±0.014 0.847±0.029 0.685±0.013 0.839±0.025 0.697±0.017 0.869±0.031 0.708±0.028 0.895±0.052 0.672±0.005 0.789±0.005													
	720 0.776±0.012 0.996±0.034 0.799±0.016 1.041±0.047 0.800±0.018 1.052±0.046 0.795±0.013 1.037±0.034 0.800±0.022 1.056±0.058 0.809±0.028 1.106±0.075 0.748±0.006 0.898±0.021													
	24 0.437±0.014 0.343±0.011 0.389±0.018 0.277±0.019 0.306±0.019 0.168±0.017 0.309±0.011 0.171±0.013 0.359±0.003 0.233±0.043 0.395±0.023 0.274±0.030 0.509±0.043 0.456±0.067													
ETTh2	48 0.589±0.017 0.598±0.026 0.558±0.023 0.542±0.036 0.465±0.026 0.398±0.045 0.410±0.015 0.306±0.027 0.421±0.014 0.310±0.022 0.410±0.009 0.288±0.012 0.640±0.012 0.603±0.064													
	168 1.003±0.065 1.663±0.163 0.996±0.060 1.635±0.143 0.967±0.060 1.539±0.137 0.941±0.059 1.457±0.134 0.918±0.056 1.455±0.229 0.860±0.058 1.359±0.282 0.992±0.015 1.608±0.076													
	336 1.077±0.071 1.913±0.191 1.081±0.070 1.925±0.192 1.053±0.058 1.853±0.174 1.040±0.060 1.809±0.191 1.026±0.064 1.757±0.202 0.963±0.056 1.513±0.129 1.061±0.016 1.819±0.083													
	720 1.141±0.048 2.108±0.141 1.140±0.049 2.095±0.136 1.125±0.052 2.036±0.132 1.122±0.052 1.988±0.135 1.097±0.051 1.931±0.131 1.047±0.052 1.766±0.122 1.097±0.012 2.019±0.075													
	24 0.304±0.006 0.215±0.006 0.266±0.005 0.161±0.009 0.242±0.004 0.174±0.007 0.374±0.006 0.319±0.010 0.300±0.005 0.187±0.013 0.362±0.005 0.282±0.015 0.329±0.004 0.245±0.005													
	48 0.375±0.005 0.316±0.007 0.354±0.004 0.285±0.008 0.302±0.006 0.198±0.014 0.384±0.006 0.328±0.012 0.296±0.006 0.181±0.015 0.364±0.007 0.283±0.018 0.387±0.003 0.329±0.004													
ETTm1	96 0.418±0.005 0.375±0.006 0.409±0.005 0.363±0.008 0.391±0.005 0.331±0.011 0.440±0.003 0.422±0.008 0.361±0.008 0.279±0.016 0.360±0.007 0.274±0.019 0.421±0.002 0.377±0.002													
	288 0.489±0.005 0.475±0.006 0.486±0.005 0.471±0.006 0.486±0.004 0.467±0.005 0.515±0.006 0.531±0.005 0.477±0.005 0.453±0.007 0.466±0.008 0.438±0.013 0.489±0.006 0.473±0.009													
	672 0.579±0.004 0.626±0.006 0.579±0.004 0.627±0.007 0.585±0.005 0.633±0.009 0.602±0.005 0.667±0.009 0.582±0.005 0.626±0.005 0.573±0.005 0.612±0.007 0.578±0.006 0.624±0.009													
	24 0.235±0.006 0.114±0.004 0.222±0.010 0.100±0.009 0.198±0.006 0.075±0.005 0.214±0.005 0.087±0.005 0.223±0.002 0.094±0.002 0.243±0.010 0.115±0.008 0.253±0.010 0.128±0.009													
	48 0.299±0.006 0.176±0.005 0.287±0.010 0.161±0.010 0.253±0.009 0.123±0.006 0.239±0.010 0.107±0.008 0.232±0.002 0.100±0.002 0.248±0.005 0.117±0.006 0.315±0.013 0.191±0.014													
	96 0.390±0.010 0.288±0.020 0.380±0.010 0.275±0.021 0.349±0.006 0.237±0.011 0.329±0.003 0.209±0.004 0.307±0.009 0.182±0.004 0.285±0.012 0.148±0.011 0.406±0.015 0.307±0.021													
ETTm2	288 0.654±0.025 0.746±0.077 0.646±0.019 0.732±0.061 0.633±0.015 0.712±0.054 0.623±0.015 0.693±0.052 0.608±0.014 0.671±0.031 0.580±0.025 0.622±0.051 0.669±0.012 0.765±0.025													
	672 1.067±0.165 1.959±0.663 1.063±0.170 1.969±0.695 1.063±0.172 1.957±0.716 1.059±0.177 1.945±0.735 1.050±0.176 1.922±0.744 1.025±0.177 1.850±0.762 0.991±0.014 1.641±0.064													
	24 0.256±0.027 0.117±0.021 0.238±0.026 0.104±0.020 0.195±0.020 0.069±0.013 0.184±0.017 0.058±0.009 0.185±0.019 0.058±0.011 0.240±0.037 0.096±0.028 0.264±0.028 0.125±0.024													
	48 0.362±0.030 0.232±0.031 0.347±0.034 0.216±0.035 0.310±0.033 0.177±0.034 0.282±0.025 0.148±0.029 0.259±0.027 0.122±0.028 0.286±0.042 0.137±0.038 0.364±0.037 0.233±0.039													
	96 0.529±0.034 0.489±0.051 0.525±0.035 0.482±0.052 0.495±0.041 0.438±0.058 0.479±0.043 0.411±0.060 0.459±0.042 0.377±0.060 0.427±0.058 0.336±0.096 0.531±0.053 0.484±0.069													
	288 0.889±0.063 1.260±0.131 0.888±0.064 1.257±0.132 0.882±0.064 1.244±0.130 0.874±0.073 1.227±0.145 0.871±0.073 1.219±0.144 0.866±0.074 1.196±0.145 0.870±0.022 1.236±0.029													
Exch.	672 1.075±0.067 1.846±0.219 1.077±0.069 1.849±0.226 1.081±0.072 1.865±0.234 1.089±0.077 1.889±0.254 1.112±0.088 1.971±0.285 1.147±0.101 0.283 1.059±0.054 1.857±0.214													
	24 0.337±0.001 0.272±0.001 0.305±0.002 0.231±0.002 0.283±0.002 0.204±0.003 0.314±0.002 0.235±0.003 0.345±0.002 0.265±0.002 0.387±0.002 0.309±0.002 0.362±0.001 0.299±0.001													
	48 0.397±0.001 0.343±0.001 0.375±0.002 0.315±0.002 0.325±0.002 0.250±0.003 0.319±0.002 0.237±0.002 0.343±0.001 0.262±0.002 0.385±0.002 0.307±0.002 0.412±0.001 0.360±0.001													
	168 0.488±0.001 0.460±0.001 0.481±0.001 0.452±0.001 0.461±0.001 0.426±0.001 0.426±0.001 0.408±0.001 0.440±0.001 0.393±0.002 0.417±0.001 0.352±0.002 0.492±0.001 0.464±0.001													
	336 0.515±0.001 0.495±0.002 0.511±0.001 0.490±0.002 0.501±0.002 0.477±0.002 0.495±0.002 0.468±0.002 0.490±0.002 0.461±0.002 0.475±0.001 0.437±0.001 0.517±0.001 0.497±0.002													
	720 0.540±0.002 0.532±0.003 0.539±0.003 0.530±0.004 0.534±0.003 0.523±0.004 0.530±0.003 0.518±0.004 0.528±0.003 0.515±0.004 0.520±0.003 0.503±0.005 0.543±0.002 0.534±0.003													
WTH	24 0.265±0.005 0.149±0.004 0.387±0.022 0.271±0.027 0.306±0.015 0.180±0.016 0.465±0.002 0.371±0.004 0.374±0.026 0.262±0.034 0.435±0.016 0.342±0.022 0.240±0.002 0.135±0.001													
	48 0.283±0.004 0.170±0.004 0.401±0.017 0.293±0.020 0.320±0.014 0.196±0.016 0.464±0.002 0.369±0.004 0.366±0.025 0.245±0.029 0.427±0.016 0.325±0.023 0.256±0.001 0.152±0.001													
	168 0.307±0.004 0.199±0.004 0.425±0.018 0.332±0.023 0.354±0.012 0.246±0.014 0.489±0.002 0.418±0.003 0.395±0.023 0.292±0.028 0.435±0.017 0.338±0.023 0.275±0.001 0.175±0.001													
	336 0.326±0.005 0.220±0.005 0.440±0.018 0.354±0.024 0.373±0.012 0.270±0.014 0.501±0.001 0.440±0.003 0.413±0.020 0.319±0.026 0.451±0.015 0.367±0.022 0.296±0.001 0.195±0.001													
	720 0.354±0.004 0.254±0.004 0.459±0.017 0.383±0.023 0.398±0.010 0.305±0.013 0.517±0.001 0.469±0.002 0.435±0.018 0.352±0.024 0.472±0.014 0.401±0.021 0.329±0.001 0.232±0.001													
	24 0.282±0.024 0.194±0.026 0.244±0.028 0.152±0.032 0.204±0.021 0.106±0.016 0.219±0.021 0.117±0.015 0.276±0.028 0.163±0.023 0.296±0.053 0.193±0.054 0.334±0.022 0.254±0.025													
Weath.	48 0.437±0.045 0.422±0.076 0.395±0.077 0.294±0.026 0.214±0.041 0.255±0.017 0.155±0.019 0.290±0.026 0.179±0.023 0.292±0.037 0.188±0.039 0.479±0.024 0.476±0.041													
	96 0.631±0.044 0.788±0.102 0.602±0.044 0.736±0.099 0.519±0.038 0.588±0.090 0.451±0.031 0.466±0.064 0.431±0.021 0.413±0.031 0.290±0.018 0.182±0.019 0.634±0.036 0.770±0.080													
	288 0.871±0.061 1.353±0.169 0.861±0.063 1.331±0.173 0.818±0.065 1.232±0.179 0.810±0.088 1.250±0.271 0.810±0.037 1.287±0.106 0.709±0.058 1.029±0.167 0.778±0.036 1.050±0.082													
	672 1.130±0.103 2.091±0.350 1.123±0.105 2.069±0.355 1.088±0.109 1.970±0.361 1.057±0.108 1.881±0.360 1.017±0.104 1.753±0.337 0.983±0.115 1.673±0.362 0.959±0.031 1.486±0.087													
	24 0.474±0.017 0.789±0.020 0.636±0.045 1.045±0.080 0.563±0.049 0.933±0.082 0.714±0.065 1.197±0.142 0.623±0.051 1.027±0.081 0.685±0.080 1.177±0.126 0.423±0.005 0.722±0.004													
	48 0.485±0.016 0.816±0.020 0.631±0.047 1.055±0.085 0.560±0.042 0.954±0.068 0.730±0.084 1.233±0.193 0.627±0.063 1.039±0.101 0.676±0.071 1.164±0.116 0.437±0.004 0.744±0.002													
Traf.	96 0.489±0.017 0.834±0.022 0.637±0.052 1.085±0.088 0.561±0.036 0.974±0.051 0.720±0.055 1.258±0.137 0.619±0.077 1.056±0.125 0.679±0.075 1.164±0.119 0.438±0.005 0.754±0.003													
	288 0.488±0.017 0.844±0.021 0.639±0.042 1.101±0.076 0.570±0.038 0.991±0.052 0.733±0.049 1.299±0.115 0.616±0.069 1.082±0.113 0.682±0.064 1.192±0.105 0.434±0.													

**Table 8: MaskAE with different kernel size**

D L	ks=9		ks=25		ks=64		ks=96		ks=128		ks=224		Orig.		
	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	MAE	MSE	
ETTh1	24	0.787±0.052	1.063±0.093	0.745±0.070	0.975±0.134	0.685±0.026	0.871±0.047	0.676±0.018	0.862±0.033	0.678±0.012	0.863±0.023	0.665±0.009	0.844±0.024	0.997±0.035	1.565±0.069
	48	0.838±0.009	1.153±0.018	0.838±0.009	1.148±0.016	0.809±0.043	1.097±0.070	0.806±0.052	1.088±0.088	0.783±0.061	1.059±0.101	1.074±0.073	1.058±0.127	0.936±0.049	1.410±0.141
	168	0.832±0.007	1.149±0.006	0.832±0.008	1.150±0.006	0.837±0.009	1.157±0.009	0.835±0.008	1.156±0.008	0.835±0.009	1.156±0.009	0.839±0.010	1.164±0.011	0.905±0.009	1.309±0.036
	336	0.847±0.012	1.171±0.014	0.850±0.012	1.175±0.014	0.847±0.014	1.174±0.015	0.849±0.013	1.176±0.014	0.850±0.014	1.174±0.016	0.854±0.017	1.180±0.022	0.922±0.008	1.344±0.021
	720	0.855±0.028	1.181±0.031	0.848±0.013	1.171±0.012	0.844±0.015	1.169±0.014	0.841±0.006	1.165±0.004	0.842±0.005	1.168±0.005	0.859±0.033	1.194±0.048	0.930±0.020	1.350±0.053
	24	1.073±0.125	1.816±0.470	1.049±0.125	1.722±0.419	0.969±0.089	1.447±0.264	0.970±0.143	1.460±0.404	0.957±0.089	1.430±0.261	0.952±0.088	1.460±0.265	1.302±0.026	2.801±0.114
ETTh2	48	1.181±0.055	2.161±0.228	1.122±0.038	1.931±0.137	1.116±0.066	1.915±0.198	1.110±0.050	1.919±0.184	1.083±0.036	1.847±0.203	1.012±0.016	1.626±0.113	1.308±0.032	2.789±0.158
	168	1.432±0.116	3.264±0.471	1.383±0.075	3.069±0.355	1.342±0.122	2.928±0.528	1.297±0.102	2.773±0.444	1.257±0.127	2.644±0.554	1.250±0.136	2.583±0.589	1.350±0.035	2.954±0.165
	336	1.337±0.040	2.851±0.154	1.386±0.037	3.034±0.139	1.368±0.024	2.979±0.164	1.350±0.048	2.921±0.194	1.344±0.053	2.927±0.196	1.306±0.079	2.778±0.289	1.305±0.014	2.716±0.072
	720	1.285±0.026	2.778±0.127	1.303±0.056	2.863±0.179	1.305±0.049	2.882±0.168	1.297±0.046	2.870±0.149	1.288±0.040	2.839±0.122	1.250±0.028	2.684±0.069	1.421±0.035	3.193±0.152
	24	0.516±0.041	1.547±0.073	0.395±0.048	0.342±0.055	0.321±0.020	0.190±0.022	0.367±0.022	0.264±0.034	0.381±0.018	0.293±0.031	0.423±0.026	0.353±0.041	1.070±0.029	1.893±0.108
	48	0.632±0.045	1.807±0.104	0.552±0.038	0.635±0.073	0.441±0.016	0.392±0.027	0.383±0.023	0.282±0.038	0.390±0.025	0.297±0.032	0.416±0.017	0.338±0.014	1.051±0.052	1.835±0.146
ETTm1	96	0.663±0.017	1.849±0.042	0.639±0.018	1.804±0.038	0.592±0.006	0.670±0.010	0.557±0.031	0.615±0.062	0.517±0.025	0.526±0.048	0.470±0.015	0.426±0.025	1.019±0.020	1.715±0.065
	288	0.755±0.028	1.014±0.044	0.735±0.014	0.975±0.018	0.753±0.053	0.976±0.088	0.717±0.021	0.892±0.022	0.712±0.032	0.884±0.052	0.658±0.018	0.798±0.030	1.049±0.044	1.797±0.128
	672	0.797±0.048	1.094±0.076	0.810±0.046	1.116±0.066	0.812±0.035	1.109±0.070	0.801±0.060	1.077±0.096	0.798±0.043	1.072±0.070	0.759±0.042	1.010±0.063	1.034±0.081	1.701±0.253
	24	0.628±0.082	0.624±0.156	0.551±0.081	0.487±0.123	0.519±0.080	0.433±0.128	0.472±0.033	0.373±0.048	0.457±0.032	0.347±0.054	0.545±0.063	0.486±0.099	1.181±0.056	2.569±0.232
	48	0.809±0.142	1.005±0.347	0.766±0.114	0.910±0.234	0.654±0.020	0.656±0.057	0.590±0.066	0.534±0.105	0.608±0.061	0.566±0.098	0.551±0.067	0.468±0.092	1.215±0.029	2.580±0.175
	96	0.872±0.038	1.194±0.088	0.910±0.031	1.267±0.089	0.858±0.067	1.129±0.130	0.804±0.088	1.002±0.201	0.765±0.056	0.911±0.133	0.636±0.109	0.660±0.218	1.228±0.017	2.557±0.051
ETTm2	288	0.939±0.023	1.367±0.106	0.925±0.041	1.308±0.106	0.930±0.038	1.303±0.097	0.957±0.056	1.398±0.176	0.981±0.060	1.461±0.163	0.922±0.068	1.326±0.174	1.262±0.016	2.539±0.057
	672	1.231±0.040	2.399±0.141	1.279±0.026	2.568±0.106	1.341±0.099	2.849±0.438	1.379±0.119	3.077±0.505	1.375±0.028	2.989±0.153	1.387±0.063	2.958±0.215	1.414±0.032	3.160±0.154
	24	1.179±0.023	2.366±0.123	1.178±0.019	2.366±0.106	1.224±0.050	2.431±0.168	1.252±0.047	2.514±0.149	1.287±0.045	2.633±0.177	1.338±0.031	2.811±0.142	1.145±0.007	2.069±0.043
	48	1.220±0.026	2.573±0.082	1.222±0.026	2.581±0.090	1.258±0.023	2.595±0.099	1.306±0.031	2.743±0.138	1.334±0.037	2.844±0.193	1.388±0.035	3.060±0.197	1.161±0.014	2.150±0.044
	96	1.244±0.018	2.527±0.088	1.248±0.018	2.532±0.078	1.299±0.052	2.664±0.210	1.346±0.047	2.852±0.220	1.371±0.052	2.958±0.250	1.416±0.055	3.168±0.284	1.182±0.016	2.204±0.045
	288	1.303±0.023	2.771±0.126	1.299±0.023	2.752±0.131	1.290±0.025	2.701±0.155	1.326±0.023	2.851±0.126	1.358±0.022	2.997±0.115	1.340±0.047	2.845±0.227	1.179±0.008	2.221±0.058
Exch.	672	1.469±0.101	3.592±0.442	1.470±0.096	3.594±0.419	1.457±0.100	3.531±0.437	1.474±0.098	3.612±0.434	1.475±0.072	3.615±0.312	1.465±0.053	3.576±0.242	1.213±0.026	2.403±0.059
	24	0.388±0.005	0.319±0.004	0.358±0.008	0.280±0.007	0.327±0.004	0.247±0.004	0.348±0.007	0.269±0.006	0.365±0.003	0.289±0.004	0.392±0.011	0.322±0.012	1.015±0.005	1.698±0.016
	48	0.474±0.032	0.440±0.047	0.438±0.010	0.384±0.013	0.371±0.001	0.298±0.002	0.360±0.003	0.283±0.004	0.370±0.006	0.296±0.005	0.422±0.008	0.359±0.011	0.983±0.017	1.578±0.053
	168	0.576±0.008	0.590±0.010	0.581±0.007	0.597±0.011	0.576±0.010	0.589±0.013	0.570±0.010	0.585±0.017	0.559±0.008	0.569±0.015	0.549±0.005	0.546±0.010	0.942±0.021	1.422±0.053
	336	0.578±0.005	0.593±0.008	0.574±0.002	0.588±0.002	0.576±0.008	0.589±0.010	0.576±0.007	0.589±0.008	0.575±0.004	0.587±0.007	0.579±0.008	0.594±0.014	0.980±0.019	1.532±0.054
	720	0.565±0.005	0.566±0.008	0.564±0.002	0.563±0.003	0.565±0.003	0.566±0.005	0.569±0.004	0.573±0.007	0.566±0.003	0.569±0.003	0.573±0.007	0.577±0.012	0.954±0.023	1.462±0.049
WTH	24	0.800±0.003	0.979±0.008	0.801±0.003	0.978±0.009	0.801±0.003	0.981±0.013	0.801±0.004	0.979±0.012	0.801±0.003	0.981±0.013	0.801±0.002	0.981±0.010	0.876±0.004	1.150±0.010
	48	0.800±0.002	0.981±0.004	0.801±0.002	0.982±0.006	0.799±0.002	0.980±0.004	0.800±0.002	0.980±0.005	0.793±0.015	0.963±0.026	0.800±0.001	0.982±0.007	0.882±0.007	1.165±0.019
	168	0.801±0.002	0.986±0.009	0.801±0.001	0.982±0.004	0.801±0.002	0.982±0.007	0.802±0.002	0.982±0.008	0.803±0.001	0.980±0.006	0.867±0.002	0.129±0.005	0.873±0.002	1.129±0.005
	336	0.799±0.001	0.976±0.004	0.799±0.002	0.976±0.009	0.800±0.002	0.978±0.004	0.800±0.003	0.981±0.004	0.802±0.005	0.984±0.012	0.867±0.003	0.129±0.008	0.873±0.002	1.129±0.008
	720	0.801±0.003	0.974±0.006	0.801±0.003	0.973±0.007	0.801±0.002	0.970±0.003	0.802±0.002	0.974±0.005	0.802±0.003	0.972±0.004	0.801±0.004	0.973±0.004	0.872±0.009	1.135±0.021
	24	0.660±0.070	0.497±0.146	0.549±0.049	0.542±0.086	0.439±0.028	0.355±0.037	0.448±0.040	0.376±0.058	0.445±0.049	0.375±0.071	0.603±0.069	0.648±0.143	1.016±0.040	1.404±0.143
Weath.	48	0.811±0.097	0.505±0.265	0.782±0.106	0.600±0.266	0.629±0.031	0.677±0.066	0.500±0.039	0.443±0.066	0.493±0.071	0.446±0.121	0.588±0.054	0.624±0.110	1.085±0.060	2.076±0.195
	96	0.913±0.057	0.509±0.199	0.994±0.043	1.663±0.146	0.838±0.078	1.178±0.208	0.760±0.068	0.965±0.146	0.748±0.090	0.956±0.213	0.672±0.044	0.765±0.084	1.086±0.035	1.966±0.154
	288	0.975±0.089	0.511±0.247	1.023±0.044	1.624±0.138	0.992±0.068	1.526±0.187	0.977±0.080	1.471±0.241	0.980±0.131	1.510±0.404	0.968±0.072	1.459±0.205	0.980±0.062	1.540±0.200
	672	1.039±0.096	0.535±0.256	1.007±0.089	1.581±0.258	1.000±0.088	1.562±0.237	1.097±0.050	1.837±0.162	1.123±0.049	1.913±0.159	1.109±0.026	1.910±0.112	1.002±0.100	1.596±0.315
	24	0.497±0.013	0.884±0.031	0.693±0.094	1.258±0.177	0.556±0.005	0.995±0.007	0.743±0.097	1.352±0.189	0.597±0.025	1.075±0.038	0.661±0.092	1.192±0.176	0.923±0.051	1.816±0.139
	48	0.505±0.009	0.909±0.016	0.742±0.092	1.353±0.177	0.594±0.070	1.074±0.127	0.673±0.108	1.217±0.211	0.597±0.019	1.083±0.035	0.642±0.098	1.173±0.188	0.936±0.029	1.852±0.078
Traffic	96	0.509±0.008	0.931±0.018	0.759±0.070	1.387±0.143	1.065±0.103	1.096±0.197	0.752±0.063	1.372±0.128	0.594±0.014	1.086±0.033	0.633±0.069	1.149±0.132	0.901±0.	

**Table 9: Short-term forecasting for prediction length from 6 to 22 timestamps with kernel size  $k = 25$ . Models of the first pipeline application.**

D	L	TS2Vec				SimTS				PatchTST				DLinear	
		TED4STL		Orig.		TED4STL		Orig.		MAE		MSE		MAE	
		MAE	MSE												
ETH1	6	0.334±0.008	0.244±0.013	0.457±0.005	0.473±0.017	0.241±0.004	0.115±0.004	0.345±0.005	0.264±0.006	0.120±0.001	0.081±0.001	0.120±0.001	0.081±0.001	0.120±0.001	0.081±0.001
	8	0.332±0.007	0.237±0.012	0.479±0.010	0.512±0.023	0.245±0.003	0.118±0.003	0.367±0.006	0.297±0.007	0.126±0.000	0.089±0.000	0.126±0.003	0.089±0.002	0.126±0.003	0.089±0.002
	10	0.336±0.006	0.241±0.012	0.499±0.014	0.545±0.030	0.253±0.002	0.126±0.003	0.383±0.005	0.321±0.005	0.131±0.001	0.097±0.002	0.131±0.005	0.097±0.004	0.131±0.005	0.097±0.004
	12	0.348±0.006	0.261±0.011	0.516±0.018	0.576±0.036	0.266±0.003	0.141±0.003	0.393±0.004	0.336±0.005	0.137±0.001	0.104±0.002	0.137±0.003	0.104±0.002	0.137±0.003	0.104±0.002
	14	0.361±0.008	0.283±0.013	0.525±0.018	0.593±0.038	0.284±0.004	0.167±0.004	0.401±0.004	0.347±0.005	0.142±0.000	0.112±0.001	0.142±0.002	0.112±0.003	0.142±0.002	0.112±0.003
	16	0.374±0.009	0.304±0.015	0.527±0.019	0.595±0.039	0.301±0.005	0.194±0.006	0.407±0.005	0.356±0.006	0.147±0.001	0.120±0.001	0.147±0.001	0.120±0.002	0.147±0.001	0.120±0.002
	18	0.388±0.010	0.328±0.017	0.529±0.019	0.596±0.040	0.317±0.005	0.219±0.006	0.411±0.005	0.363±0.006	0.151±0.001	0.127±0.001	0.151±0.004	0.127±0.003	0.151±0.004	0.127±0.003
	20	0.399±0.010	0.347±0.017	0.533±0.021	0.599±0.041	0.330±0.005	0.240±0.006	0.415±0.005	0.369±0.006	0.155±0.001	0.132±0.001	0.155±0.001	0.132±0.001	0.155±0.001	0.132±0.001
	22	0.411±0.011	0.366±0.020	0.534±0.022	0.597±0.041	0.341±0.005	0.256±0.007	0.418±0.005	0.374±0.006	0.158±0.000	0.137±0.000	0.158±0.003	0.137±0.002	0.158±0.003	0.137±0.002
ETH2	6	0.225±0.012	0.099±0.009	0.348±0.036	0.231±0.039	0.197±0.005	0.073±0.003	0.279±0.011	0.151±0.011	0.105±0.000	0.055±0.000	0.105±0.003	0.055±0.002	0.105±0.003	0.055±0.002
	8	0.231±0.014	0.103±0.012	0.369±0.033	0.256±0.037	0.203±0.004	0.077±0.003	0.305±0.010	0.177±0.011	0.111±0.000	0.061±0.000	0.111±0.002	0.061±0.001	0.111±0.002	0.061±0.001
	10	0.239±0.018	0.110±0.015	0.390±0.031	0.284±0.035	0.215±0.004	0.085±0.003	0.327±0.009	0.201±0.010	0.117±0.000	0.067±0.000	0.117±0.003	0.067±0.002	0.117±0.003	0.067±0.002
	12	0.248±0.018	0.118±0.016	0.411±0.029	0.312±0.034	0.232±0.008	0.100±0.009	0.346±0.008	0.223±0.011	0.124±0.001	0.075±0.001	0.124±0.004	0.075±0.002	0.124±0.004	0.075±0.002
	14	0.261±0.014	0.132±0.018	0.426±0.028	0.336±0.032	0.250±0.008	0.117±0.010	0.365±0.008	0.246±0.012	0.132±0.001	0.084±0.001	0.132±0.041	0.084±0.046	0.132±0.041	0.084±0.046
	16	0.270±0.014	0.140±0.011	0.440±0.026	0.356±0.030	0.269±0.009	0.139±0.012	0.382±0.007	0.268±0.014	0.139±0.000	0.092±0.000	0.139±0.003	0.092±0.002	0.139±0.003	0.092±0.002
	18	0.283±0.013	0.154±0.011	0.454±0.026	0.379±0.031	0.289±0.010	0.161±0.013	0.398±0.008	0.290±0.015	0.146±0.001	0.102±0.001	0.146±0.004	0.102±0.003	0.146±0.004	0.102±0.003
	20	0.297±0.013	0.169±0.011	0.469±0.028	0.404±0.036	0.309±0.009	0.182±0.012	0.413±0.009	0.310±0.017	0.153±0.001	0.111±0.001	0.153±0.004	0.111±0.003	0.153±0.004	0.111±0.003
	22	0.311±0.013	0.186±0.011	0.480±0.027	0.422±0.034	0.327±0.009	0.205±0.013	0.426±0.008	0.328±0.016	0.159±0.001	0.119±0.001	0.159±0.002	0.119±0.001	0.159±0.002	0.119±0.001
ETTm1	6	0.176±0.008	0.064±0.006	0.256±0.005	0.150±0.005	0.140±0.002	0.041±0.001	0.205±0.002	0.099±0.001	0.071±0.001	0.029±0.000	0.071±0.000	0.029±0.000	0.071±0.000	0.029±0.000
	8	0.186±0.010	0.071±0.008	0.288±0.007	0.191±0.008	0.142±0.002	0.042±0.001	0.226±0.002	0.120±0.001	0.076±0.001	0.034±0.001	0.076±0.001	0.034±0.000	0.076±0.001	0.034±0.000
	10	0.197±0.011	0.081±0.011	0.319±0.012	0.234±0.013	0.148±0.002	0.045±0.001	0.244±0.002	0.140±0.001	0.081±0.001	0.040±0.000	0.081±0.001	0.040±0.000	0.081±0.001	0.040±0.000
	12	0.212±0.012	0.096±0.014	0.343±0.013	0.273±0.015	0.157±0.002	0.052±0.001	0.260±0.002	0.158±0.001	0.087±0.000	0.045±0.000	0.087±0.002	0.045±0.001	0.087±0.002	0.045±0.001
	14	0.230±0.013	0.116±0.016	0.365±0.013	0.310±0.017	0.170±0.002	0.063±0.001	0.274±0.002	0.175±0.002	0.092±0.001	0.051±0.001	0.092±0.002	0.051±0.001	0.092±0.002	0.051±0.001
	16	0.247±0.013	0.139±0.019	0.385±0.014	0.345±0.019	0.183±0.002	0.076±0.002	0.286±0.003	0.191±0.002	0.098±0.000	0.058±0.000	0.098±0.001	0.058±0.000	0.098±0.001	0.058±0.000
	18	0.267±0.014	0.165±0.023	0.403±0.014	0.377±0.019	0.198±0.003	0.091±0.002	0.298±0.003	0.206±0.002	0.103±0.000	0.064±0.000	0.103±0.001	0.064±0.000	0.103±0.001	0.064±0.000
	20	0.284±0.015	0.190±0.024	0.418±0.015	0.405±0.022	0.212±0.003	0.106±0.003	0.309±0.004	0.220±0.004	0.109±0.002	0.071±0.002	0.109±0.002	0.071±0.001	0.109±0.002	0.071±0.001
	22	0.301±0.015	0.215±0.025	0.432±0.016	0.432±0.024	0.226±0.003	0.122±0.003	0.318±0.004	0.234±0.005	0.113±0.002	0.077±0.002	0.113±0.001	0.077±0.001	0.113±0.001	0.077±0.001
ETTm2	6	0.148±0.006	0.045±0.004	0.222±0.019	0.103±0.015	0.131±0.004	0.035±0.001	0.164±0.004	0.062±0.002	0.064±0.001	0.023±0.000	0.064±0.000	0.023±0.000	0.064±0.000	0.023±0.000
	8	0.155±0.007	0.049±0.005	0.239±0.022	0.118±0.019	0.135±0.004	0.037±0.001	0.174±0.003	0.069±0.002	0.068±0.000	0.026±0.000	0.068±0.002	0.026±0.001	0.068±0.002	0.026±0.001
	10	0.162±0.008	0.054±0.005	0.253±0.024	0.133±0.022	0.140±0.005	0.039±0.002	0.184±0.003	0.076±0.002	0.071±0.000	0.028±0.000	0.071±0.001	0.028±0.000	0.071±0.001	0.028±0.000
	12	0.171±0.009	0.060±0.006	0.265±0.026	0.144±0.024	0.147±0.006	0.043±0.003	0.193±0.003	0.082±0.002	0.075±0.000	0.031±0.000	0.075±0.001	0.031±0.000	0.075±0.001	0.031±0.000
	14	0.181±0.010	0.067±0.005	0.276±0.027	0.155±0.026	0.155±0.006	0.049±0.003	0.201±0.003	0.088±0.002	0.078±0.000	0.034±0.000	0.078±0.002	0.034±0.000	0.078±0.002	0.034±0.000
	16	0.190±0.011	0.074±0.006	0.285±0.027	0.164±0.027	0.164±0.007	0.055±0.004	0.208±0.003	0.094±0.002	0.082±0.000	0.036±0.000	0.082±0.002	0.036±0.001	0.082±0.002	0.036±0.001
	18	0.200±0.012	0.083±0.007	0.293±0.028	0.171±0.027	0.172±0.008	0.061±0.004	0.215±0.003	0.099±0.002	0.085±0.000	0.039±0.000	0.085±0.001	0.039±0.001	0.085±0.001	0.039±0.001
	20	0.213±0.018	0.092±0.010	0.301±0.028	0.179±0.029	0.179±0.008	0.066±0.005	0.222±0.002	0.105±0.001	0.088±0.000	0.041±0.001	0.088±0.001	0.041±0.001	0.088±0.001	0.041±0.001
	22	0.221±0.018	0.100±0.011	0.308±0.029	0.187±0.031	0.187±0.008	0.072±0.005	0.228±0.003	0.110±0.002	0.091±0.000	0.044±0.000	0.091±0.003	0.044±0.000	0.091±0.003	0.044±0.000
Exch.	6	0.109±0.018	0.022±0.008	0.146±0.025	0.039±0.013	0.100±0.007	0.018±0.002	0.116±0.007	0.026±0.002	0.051±0.001	0.012±0.001	0.051±0.002	0.012±0.000	0.051±0.002	0.012±0.000
	8	0.113±0.017	0.024±0.008	0.159±0.022	0.047±0.015	0.108±0.007	0.020±0.002	0.131±0.007	0.030±0.002	0.055±0.001	0.015±0.000	0.055±0.009	0.015±0.003	0.055±0.009	0.015±0.003
	10	0.118±0.017	0.026±0.008	0.171±0.020	0.054±0.015	0.117±0.007	0.024±0.002	0.145±0.009	0.040±0.004	0.059±0.001	0.017±0.001	0.059±0.003	0.017±0.001	0.059±0.003	0.017±0.001
	12	0.126±0.017	0.029±0.008	0.182±0.021	0.061±0.019	0.125±0.006	0.028±0.003	0.157±0.009	0.047±0.005	0.064±0.000	0.020±0.000	0.064±0.003	0.020±0.003	0.064±0.003	0.020±0.003
	14	0.134±0.016	0.033±0.007	0.193±0.023	0.069±0.022	0.137±0.007	0.035±0.004	0.169±0.008	0.054±0.004	0.069±0.001	0.024±0.000	0.069±0.024	0.024±0.000	0.069±0.024	0.024±0.000
	16	0.141±0.016	0.037±0.007	0.201±0.018	0.075±0.017	0.148±0.008	0.042±0.005	0.181±0.011	0.061±0.006	0.073±0.000	0.026±0.000	0.073±0.004	0.026±0.002	0.073±0.004	0.0

**Table 10: Short-term forecasting for prediction length from 6 to 22 timestamps with kernel size  $k = 25$ . Models of the second pipeline application.**

D	L	CoST				MaskAE				PatchTST				DLinear	
		TED4STL		Orig.		TED4STL		Orig.		PatchTST					
		MAE	MSE												
ETTH1	6	0.377±0.007	0.307±0.009	0.355±0.006	0.271±0.006	0.650±0.038	0.771±0.046	1.048±0.048	1.702±0.106	0.358±0.001	0.526±0.001	0.358±0.001	0.526±0.001	0.358±0.001	0.526±0.001
	8	0.378±0.007	0.306±0.007	0.375±0.007	0.303±0.007	0.670±0.056	0.796±0.095	1.031±0.025	1.658±0.074	0.358±0.000	0.526±0.000	0.358±0.003	0.526±0.002	0.354±0.005	0.521±0.004
	10	0.379±0.007	0.305±0.008	0.389±0.006	0.324±0.007	0.650±0.051	0.779±0.089	0.996±0.066	1.564±0.169	0.354±0.001	0.521±0.002	0.354±0.005	0.521±0.004	0.354±0.005	0.521±0.004
	12	0.383±0.006	0.308±0.008	0.399±0.006	0.340±0.007	0.685±0.037	0.847±0.074	0.994±0.008	1.580±0.024	0.346±0.001	0.506±0.002	0.346±0.003	0.506±0.002	0.346±0.003	0.506±0.002
	14	0.392±0.003	0.324±0.007	0.408±0.006	0.352±0.006	0.734±0.031	0.953±0.042	1.015±0.028	1.612±0.075	0.363±0.000	0.538±0.001	0.363±0.002	0.538±0.003	0.363±0.002	0.538±0.003
	16	0.404±0.002	0.347±0.006	0.413±0.006	0.361±0.007	0.709±0.070	0.919±0.133	0.980±0.038	1.543±0.112	0.361±0.001	0.543±0.001	0.361±0.001	0.543±0.002	0.361±0.001	0.543±0.002
	18	0.416±0.003	0.369±0.004	0.417±0.007	0.367±0.008	0.733±0.032	0.965±0.064	1.017±0.025	1.620±0.049	0.363±0.001	0.541±0.001	0.363±0.004	0.541±0.003	0.363±0.004	0.541±0.003
ETTH2	20	0.426±0.002	0.388±0.004	0.421±0.007	0.372±0.008	0.757±0.041	1.009±0.084	1.018±0.012	1.595±0.028	0.367±0.001	0.545±0.001	0.367±0.001	0.545±0.001	0.367±0.001	0.545±0.001
	22	0.434±0.003	0.403±0.003	0.423±0.007	0.376±0.009	0.774±0.041	1.043±0.080	0.977±0.054	1.508±0.135	0.371±0.000	0.555±0.000	0.371±0.003	0.555±0.002	0.371±0.003	0.555±0.002
ETTM1	6	0.243±0.011	0.107±0.006	0.327±0.031	0.206±0.036	0.973±0.104	1.451±0.304	1.293±0.037	2.767±0.163	0.488±0.000	0.944±0.000	0.488±0.003	0.944±0.002	0.488±0.003	0.944±0.002
	8	0.257±0.015	0.118±0.009	0.363±0.034	0.239±0.041	1.040±0.054	1.612±0.162	1.262±0.019	2.629±0.117	0.482±0.000	0.912±0.000	0.482±0.002	0.912±0.001	0.482±0.002	0.912±0.001
	10	0.270±0.016	0.129±0.012	0.387±0.037	0.271±0.047	0.997±0.062	1.515±0.187	1.283±0.026	2.684±0.133	0.481±0.000	0.913±0.000	0.481±0.003	0.913±0.002	0.481±0.003	0.913±0.002
	12	0.283±0.017	0.142±0.013	0.408±0.036	0.298±0.046	1.026±0.025	1.589±0.078	1.275±0.038	2.676±0.163	0.480±0.001	0.911±0.001	0.480±0.004	0.911±0.002	0.480±0.004	0.911±0.002
	14	0.300±0.018	0.161±0.015	0.428±0.039	0.327±0.050	1.047±0.048	1.654±0.167	1.275±0.031	2.678±0.138	0.488±0.001	0.937±0.001	0.488±0.041	0.937±0.046	0.488±0.041	0.937±0.046
	16	0.319±0.018	0.184±0.016	0.446±0.041	0.355±0.054	1.133±0.102	1.983±0.332	1.279±0.030	2.678±0.169	0.517±0.000	1.043±0.000	0.517±0.003	1.043±0.002	0.517±0.003	1.043±0.002
	18	0.336±0.018	0.205±0.016	0.463±0.042	0.382±0.058	1.067±0.039	1.714±0.127	1.285±0.010	2.707±0.049	0.489±0.001	0.931±0.001	0.489±0.004	0.931±0.003	0.489±0.004	0.931±0.003
ETTM2	20	0.354±0.017	0.227±0.017	0.479±0.043	0.408±0.061	1.202±0.109	2.202±0.418	1.276±0.034	2.687±0.157	0.533±0.001	1.105±0.001	0.533±0.004	1.105±0.003	0.533±0.004	1.105±0.003
	22	0.372±0.018	0.252±0.018	0.495±0.042	0.432±0.063	1.138±0.047	2.010±0.198	1.294±0.049	2.739±0.204	0.514±0.001	1.043±0.001	0.514±0.002	1.043±0.002	0.514±0.002	1.043±0.002
Exch.	6	0.171±0.003	0.060±0.003	0.210±0.002	0.100±0.001	0.248±0.018	0.132±0.013	1.176±0.014	2.252±0.068	0.291±0.001	0.493±0.000	0.291±0.000	0.493±0.000	0.291±0.000	0.493±0.000
	8	0.175±0.003	0.062±0.004	0.230±0.003	0.121±0.002	0.257±0.012	0.137±0.010	1.105±0.034	2.021±0.084	0.282±0.001	0.451±0.001	0.282±0.001	0.451±0.000	0.282±0.001	0.451±0.000
	10	0.180±0.003	0.066±0.004	0.248±0.003	0.140±0.003	0.261±0.012	0.143±0.018	1.117±0.009	2.052±0.055	0.280±0.001	0.454±0.000	0.280±0.001	0.454±0.000	0.280±0.001	0.454±0.000
	12	0.190±0.003	0.074±0.005	0.264±0.004	0.159±0.004	0.275±0.013	0.156±0.011	1.096±0.032	2.016±0.107	0.284±0.000	0.459±0.000	0.284±0.002	0.459±0.001	0.284±0.002	0.459±0.001
	14	0.202±0.003	0.085±0.005	0.278±0.004	0.176±0.004	0.295±0.012	0.182±0.012	1.096±0.028	1.977±0.063	0.287±0.001	0.448±0.001	0.287±0.002	0.448±0.001	0.287±0.002	0.448±0.001
	16	0.215±0.004	0.100±0.006	0.290±0.004	0.192±0.004	0.332±0.015	0.232±0.017	1.087±0.011	1.987±0.033	0.290±0.000	0.455±0.001	0.290±0.001	0.455±0.000	0.290±0.001	0.455±0.000
	18	0.229±0.004	0.115±0.007	0.302±0.004	0.207±0.005	0.346±0.028	0.250±0.030	1.084±0.026	1.968±0.095	0.297±0.000	0.469±0.000	0.297±0.001	0.469±0.001	0.297±0.001	0.469±0.001
WTH	20	0.242±0.004	0.130±0.007	0.312±0.004	0.221±0.005	0.373±0.019	0.294±0.030	1.076±0.018	1.940±0.046	0.298±0.002	0.462±0.003	0.298±0.002	0.462±0.001	0.298±0.002	0.462±0.001
	22	0.254±0.005	0.146±0.009	0.321±0.004	0.234±0.005	0.395±0.030	0.328±0.047	1.066±0.012	1.887±0.037	0.301±0.002	0.461±0.002	0.301±0.001	0.461±0.001	0.301±0.001	0.461±0.001
Electr.	6	0.140±0.023	0.035±0.010	0.174±0.017	0.053±0.012	1.154±0.065	2.363±0.275	1.128±0.028	1.945±0.103	0.478±0.001	0.940±0.001	0.478±0.002	0.940±0.000	0.478±0.002	0.940±0.000
	8	0.150±0.024	0.040±0.011	0.186±0.018	0.061±0.013	1.166±0.033	2.482±0.149	1.128±0.018	1.968±0.063	0.473±0.000	0.935±0.000	0.473±0.009	0.935±0.003	0.473±0.009	0.935±0.003
	10	0.160±0.023	0.045±0.011	0.198±0.019	0.070±0.014	1.181±0.023	2.481±0.130	1.133±0.023	2.009±0.029	0.476±0.001	0.933±0.001	0.476±0.003	0.933±0.001	0.476±0.003	0.933±0.001
	12	0.173±0.023	0.054±0.012	0.208±0.023	0.078±0.018	1.183±0.044	2.465±0.138	1.139±0.027	2.013±0.065	0.483±0.000	0.940±0.000	0.483±0.008	0.940±0.003	0.483±0.008	0.940±0.003
	14	0.181±0.022	0.060±0.012	0.219±0.023	0.086±0.019	1.181±0.017	2.484±0.100	1.132±0.003	2.038±0.075	0.471±0.001	0.943±0.000	0.471±0.002	0.943±0.001	0.471±0.002	0.943±0.001
	16	0.193±0.022	0.067±0.013	0.227±0.024	0.093±0.020	1.179±0.036	2.436±0.152	1.140±0.011	2.055±0.051	0.478±0.000	0.943±0.000	0.478±0.004	0.943±0.002	0.478±0.004	0.943±0.002
	18	0.206±0.023	0.082±0.017	0.234±0.009	0.111±0.007	0.487±0.060	0.383±0.079	1.193±0.038	2.627±0.164	0.357±0.000	0.652±0.000	0.357±0.001	0.652±0.001	0.357±0.001	0.652±0.001
Weath.	20	0.219±0.024	0.088±0.008	0.240±0.009	0.117±0.008	0.544±0.074	0.471±0.121	1.202±0.020	2.629±0.105	0.370±0.001	0.667±0.001	0.370±0.001	0.667±0.001	0.370±0.001	0.667±0.001
	22	0.227±0.024	0.094±0.017	0.254±0.026	0.116±0.023	0.173±0.032	2.386±0.118	1.154±0.007	2.100±0.053	0.478±0.001	0.936±0.000	0.478±0.002	0.936±0.001	0.478±0.002	0.936±0.001
Traff.	6	0.240±0.002	0.065±0.002	0.288±0.001	0.227±0.000	0.260±0.011	0.178±0.011	1.064±0.020	1.869±0.058	0.271±0.017	0.423±0.020	0.271±0.000	0.423±0.000	0.271±0.000	0.423±0.000
	8	0.241±0.003	0.065±0.003	0.260±0.001	0.240±0.000	0.263±0.007	0.177±0.008	1.078±0.031	1.909±0.098	0.276±0.017	0.438±0.020	0.276±0.000	0.438±0.000	0.276±0.000	0.438±0.000
	10	0.243±0.003	0.065±0.004	0.314±0.001	0.251±0.001	0.284±0.011	0.198±0.011	1.055±0.024	1.836±0.079	0.275±0.022	0.425±0.027	0.275±0.000	0.425±0.000	0.275±0.000	0.425±0.000
	12	0.248±0.004	0.068±0.004	0.323±0.001	0.260±0.001	0.289±0.008	0.203±0.009	1.042±0.049	1.791±0.155	0.275±0.005	0.432±0.006	0.278±0.000	0.432±0.001	0.278±0.000	0.432±0.001
	14	0.258±0.003	0.078±0.004	0.332±0.001	0.268±0.001	0.298±0.003	0.215±0.004	1.054±0.039	1.823±0.118	0.279±0.024	0.432±0.029	0.279±0.000	0.432±0.000	0.279±0.000	0.432±0.000
	16	0.268±0.003	0.090±0.003	0.339±0.001	0.275±0.001	0.313±0.006	0.231±0.006	1.018±0.030	1.712±0.087	0.274±0.024	0.407±0.031	0.274±0.000	0.407±0.000	0.274±	

**Table 11: Learning rate analysis: MSE for TS2Vec and SimTS models. Best results for each model, prediction horizon and dataset are bolded.**

D	L	TS2Vec				SimTS			
		lr = 0.01	lr = 0.001	lr = 0.0001	lr = 0.00001	lr = 0.01	lr = 0.001	lr = 0.0001	lr = 0.00001
ETTh1	24	0.852 ± 0.377	<b>0.377 ± 0.017</b>	0.393 ± 0.017	0.395 ± 0.012	0.270 ± 0.007	<b>0.270 ± 0.006</b>	<b>0.270 ± 0.006</b>	<b>0.270 ± 0.006</b>
	48	0.889 ± 0.292	<b>0.479 ± 0.022</b>	0.492 ± 0.021	0.496 ± 0.015	0.370 ± 0.005	0.369 ± 0.005	<b>0.368 ± 0.005</b>	<b>0.368 ± 0.005</b>
	168	0.953 ± 0.174	<b>0.686 ± 0.018</b>	0.702 ± 0.026	0.708 ± 0.012	0.619 ± 0.012	<b>0.617 ± 0.010</b>	<b>0.617 ± 0.010</b>	<b>0.617 ± 0.010</b>
	336	1.038 ± 0.132	<b>0.878 ± 0.020</b>	0.921 ± 0.029	0.933 ± 0.018	0.810 ± 0.009	0.814 ± 0.009	<b>0.814 ± 0.008</b>	<b>0.814 ± 0.008</b>
	720	1.118 ± 0.049	<b>1.066 ± 0.030</b>	1.100 ± 0.032	1.128 ± 0.052	0.978 ± 0.016	<b>0.978 ± 0.015</b>	0.979 ± 0.016	0.980 ± 0.016
ETTh2	24	0.695 ± 0.616	<b>0.202 ± 0.008</b>	0.217 ± 0.019	0.204 ± 0.016	0.226 ± 0.013	<b>0.227 ± 0.013</b>	<b>0.227 ± 0.013</b>	<b>0.227 ± 0.013</b>
	48	0.949 ± 0.675	0.414 ± 0.011	0.416 ± 0.025	<b>0.404 ± 0.025</b>	<b>0.493 ± 0.006</b>	0.494 ± 0.007	0.494 ± 0.007	0.493 ± 0.008
	168	2.364 ± 0.712	<b>1.679 ± 0.052</b>	1.795 ± 0.050	1.834 ± 0.049	<b>1.595 ± 0.052</b>	1.624 ± 0.027	1.622 ± 0.029	1.622 ± 0.029
	336	2.670 ± 0.547	<b>2.102 ± 0.071</b>	2.364 ± 0.300	2.536 ± 0.335	<b>1.870 ± 0.041</b>	1.921 ± 0.030	1.918 ± 0.030	1.918 ± 0.030
	720	2.882 ± 0.775	<b>2.358 ± 0.064</b>	2.494 ± 0.105	2.526 ± 0.094	<b>2.047 ± 0.018</b>	2.091 ± 0.023	2.089 ± 0.024	2.089 ± 0.024
ETTm1	24	0.369 ± 0.096	<b>0.237 ± 0.023</b>	0.250 ± 0.027	0.249 ± 0.022	0.138 ± 0.004	<b>0.137 ± 0.003</b>	<b>0.137 ± 0.003</b>	<b>0.137 ± 0.003</b>
	48	0.600 ± 0.072	<b>0.417 ± 0.031</b>	0.451 ± 0.036	0.452 ± 0.038	0.267 ± 0.003	<b>0.266 ± 0.003</b>	0.266 ± 0.004	0.266 ± 0.004
	96	0.700 ± 0.044	<b>0.495 ± 0.025</b>	0.531 ± 0.037	0.545 ± 0.032	0.346 ± 0.009	<b>0.346 ± 0.010</b>	<b>0.346 ± 0.010</b>	<b>0.346 ± 0.010</b>
	288	0.804 ± 0.045	<b>0.609 ± 0.017</b>	0.648 ± 0.037	0.666 ± 0.029	<b>0.455 ± 0.009</b>	0.456 ± 0.009	0.456 ± 0.008	0.456 ± 0.008
	672	0.898 ± 0.033	<b>0.736 ± 0.023</b>	0.772 ± 0.030	0.793 ± 0.024	<b>0.612 ± 0.007</b>	0.614 ± 0.007	0.615 ± 0.006	0.615 ± 0.006
ETTm2	24	0.470 ± 0.313	0.108 ± 0.011	<b>0.107 ± 0.007</b>	0.109 ± 0.009	<b>0.077 ± 0.003</b>	0.078 ± 0.004	0.078 ± 0.004	0.078 ± 0.004
	48	0.579 ± 0.311	<b>0.179 ± 0.018</b>	0.184 ± 0.016	0.182 ± 0.016	<b>0.141 ± 0.004</b>	0.141 ± 0.005	0.140 ± 0.005	0.140 ± 0.005
	96	0.690 ± 0.298	0.292 ± 0.021	0.293 ± 0.027	<b>0.290 ± 0.028</b>	0.251 ± 0.005	<b>0.249 ± 0.006</b>	<b>0.249 ± 0.006</b>	<b>0.249 ± 0.006</b>
	288	1.182 ± 0.520	0.687 ± 0.030	0.668 ± 0.028	<b>0.671 ± 0.037</b>	0.701 ± 0.011	<b>0.696 ± 0.007</b>	<b>0.696 ± 0.007</b>	<b>0.696 ± 0.007</b>
	672	2.598 ± 1.399	<b>1.897 ± 0.084</b>	1.989 ± 0.128	2.055 ± 0.153	<b>1.613 ± 0.022</b>	1.709 ± 0.046	1.708 ± 0.050	1.707 ± 0.050
Exch.	24	259.742 ± 574.449	0.058 ± 0.010	0.052 ± 0.008	<b>0.052 ± 0.007</b>	<b>0.074 ± 0.008</b>	<b>0.074 ± 0.008</b>	<b>0.074 ± 0.008</b>	<b>0.074 ± 0.008</b>
	48	272.426 ± 602.183	0.141 ± 0.019	0.126 ± 0.009	<b>0.125 ± 0.009</b>	0.185 ± 0.010	<b>0.183 ± 0.009</b>	<b>0.183 ± 0.009</b>	<b>0.183 ± 0.009</b>
	96	378.580 ± 838.522	0.380 ± 0.047	<b>0.333 ± 0.021</b>	0.337 ± 0.018	0.442 ± 0.021	<b>0.436 ± 0.020</b>	<b>0.436 ± 0.020</b>	<b>0.436 ± 0.020</b>
	288	309.833 ± 674.843	<b>1.198 ± 0.157</b>	1.286 ± 0.084	1.399 ± 0.145	1.313 ± 0.045	<b>1.343 ± 0.075</b>	<b>1.343 ± 0.075</b>	<b>1.343 ± 0.075</b>
	672	337.969 ± 696.435	2.238 ± 0.285	<b>1.902 ± 0.146</b>	1.932 ± 0.124	1.913 ± 0.129	<b>1.943 ± 0.133</b>	<b>1.943 ± 0.133</b>	<b>1.943 ± 0.133</b>
WTH	24	0.282 ± 0.030	<b>0.242 ± 0.001</b>	0.249 ± 0.001	0.249 ± 0.002	<b>0.230 ± 0.001</b>	<b>0.230 ± 0.001</b>	<b>0.230 ± 0.001</b>	<b>0.230 ± 0.001</b>
	48	0.352 ± 0.024	<b>0.320 ± 0.003</b>	0.326 ± 0.002	0.326 ± 0.001	<b>0.309 ± 0.001</b>	<b>0.309 ± 0.001</b>	<b>0.309 ± 0.001</b>	<b>0.309 ± 0.001</b>
	168	0.483 ± 0.020	<b>0.462 ± 0.006</b>	0.463 ± 0.005	0.465 ± 0.005	<b>0.449 ± 0.001</b>	0.449 ± 0.002	0.449 ± 0.002	0.449 ± 0.002
	336	0.526 ± 0.017	<b>0.502 ± 0.005</b>	0.503 ± 0.005	0.503 ± 0.004	<b>0.490 ± 0.002</b>	0.491 ± 0.003	0.491 ± 0.003	0.491 ± 0.003
	720	0.560 ± 0.027	0.541 ± 0.005	0.540 ± 0.004	<b>0.538 ± 0.002</b>	<b>0.529 ± 0.003</b>	0.530 ± 0.003	0.530 ± 0.003	0.530 ± 0.003
Electr.	24	0.281 ± 0.052	<b>0.200 ± 0.003</b>	0.203 ± 0.002	0.203 ± 0.003	<b>0.104 ± 0.001</b>	<b>0.104 ± 0.001</b>	<b>0.104 ± 0.001</b>	<b>0.104 ± 0.001</b>
	48	0.321 ± 0.056	0.235 ± 0.003	0.236 ± 0.002	<b>0.234 ± 0.004</b>	<b>0.136 ± 0.001</b>	<b>0.136 ± 0.001</b>	<b>0.136 ± 0.001</b>	<b>0.136 ± 0.001</b>
	168	0.372 ± 0.059	0.279 ± 0.003	<b>0.278 ± 0.002</b>	0.278 ± 0.003	<b>0.172 ± 0.000</b>	0.172 ± 0.001	<b>0.172 ± 0.000</b>	<b>0.172 ± 0.000</b>
	336	0.392 ± 0.059	0.300 ± 0.003	<b>0.299 ± 0.003</b>	0.299 ± 0.004	<b>0.195 ± 0.000</b>	<b>0.195 ± 0.000</b>	<b>0.195 ± 0.000</b>	<b>0.195 ± 0.000</b>
	720	0.417 ± 0.058	0.331 ± 0.003	0.330 ± 0.002	<b>0.329 ± 0.004</b>	<b>0.232 ± 0.000</b>	<b>0.232 ± 0.000</b>	<b>0.232 ± 0.000</b>	<b>0.232 ± 0.000</b>
Weath.	24	0.369 ± 0.125	0.218 ± 0.080	<b>0.178 ± 0.055</b>	0.186 ± 0.073	<b>0.153 ± 0.021</b>	0.157 ± 0.019	0.157 ± 0.019	0.157 ± 0.019
	48	0.775 ± 0.209	<b>0.631 ± 0.197</b>	0.646 ± 0.218	0.668 ± 0.277	<b>0.421 ± 0.040</b>	0.438 ± 0.037	0.437 ± 0.037	0.437 ± 0.037
	96	1.653 ± 0.262	<b>1.337 ± 0.257</b>	1.654 ± 0.192	1.623 ± 0.174	<b>0.888 ± 0.069</b>	0.922 ± 0.068	0.922 ± 0.065	0.922 ± 0.065
	288	2.282 ± 0.348	<b>1.817 ± 0.150</b>	2.331 ± 0.111	2.427 ± 0.116	<b>1.748 ± 0.087</b>	1.839 ± 0.076	1.841 ± 0.075	1.845 ± 0.080
	672	3.059 ± 0.484	<b>2.813 ± 0.182</b>	3.484 ± 0.141	3.540 ± 0.120	<b>2.315 ± 0.070</b>	2.334 ± 0.093	2.333 ± 0.095	2.333 ± 0.096
Traf.	24	0.790 ± 0.029	<b>0.887 ± 0.029</b>	0.914 ± 0.034	0.941 ± 0.032	<b>0.728 ± 0.002</b>	0.730 ± 0.002	0.730 ± 0.002	0.730 ± 0.002
	48	0.832 ± 0.030	<b>0.923 ± 0.016</b>	0.955 ± 0.027	0.977 ± 0.028	<b>0.767 ± 0.004</b>	0.770 ± 0.004	0.770 ± 0.004	0.770 ± 0.004
	96	0.878 ± 0.023	<b>0.969 ± 0.023</b>	1.003 ± 0.024	1.028 ± 0.029	<b>0.796 ± 0.005</b>	0.799 ± 0.005	0.799 ± 0.005	0.799 ± 0.005
	288	0.895 ± 0.023	<b>0.986 ± 0.026</b>	1.023 ± 0.030	1.053 ± 0.036	<b>0.805 ± 0.005</b>	0.808 ± 0.005	0.808 ± 0.005	0.808 ± 0.005
	672	0.910 ± 0.027	<b>1.001 ± 0.027</b>	1.047 ± 0.037	1.072 ± 0.034	<b>0.818 ± 0.005</b>	0.821 ± 0.004	0.821 ± 0.004	0.821 ± 0.004
Iii	24	4.643 ± 1.245	4.393 ± 1.575	4.036 ± 0.885	<b>4.019 ± 0.702</b>	<b>1.954 ± 0.024</b>	1.957 ± 0.028	1.956 ± 0.029	1.956 ± 0.029
	36	5.214 ± 1.400	<b>3.502 ± 0.448</b>	3.506 ± 0.545	3.703 ± 0.757	2.434 ± 0.081	2.413 ± 0.038	<b>2.412 ± 0.039</b>	<b>2.412 ± 0.039</b>
	48	5.311 ± 1.346	3.613 ± 0.358	3.482 ± 0.250	<b>3.313 ± 0.241</b>	2.928 ± 0.027	2.911 ± 0.065	<b>2.910 ± 0.065</b>	<b>2.910 ± 0.065</b>
	60	5.246 ± 1.049	3.710 ± 0.283	3.529 ± 0.224	<b>3.362 ± 0.180</b>	3.317 ± 0.009	<b>3.331 ± 0.017</b>	<b>3.331 ± 0.017</b>	3.331 ± 0.017

**Table 12: Learning rate analysis: MSE for CoST and MaskAE models. Best results for each model, prediction horizon and dataset are bolded.**

D	L	CoST				MaskAE			
		lr = 0.01	lr = 0.001	lr = 0.0001	lr = 0.00001	lr = 0.01	lr = 0.001	lr = 0.0001	lr = 0.00001
ETTh1	24	0.395 ± 0.000	0.414 ± 0.000	0.423 ± 0.000	0.426 ± 0.000	0.591 ± 0.000	0.975 ± 0.000	1.166 ± 0.000	1.459 ± 0.000
	48	0.472 ± 0.000	0.483 ± 0.000	0.491 ± 0.000	0.494 ± 0.000	0.835 ± 0.000	1.148 ± 0.000	1.163 ± 0.000	1.512 ± 0.000
	168	0.666 ± 0.000	0.674 ± 0.000	0.685 ± 0.000	0.694 ± 0.000	1.153 ± 0.000	1.150 ± 0.000	1.163 ± 0.000	1.492 ± 0.000
	336	0.827 ± 0.000	0.857 ± 0.000	0.871 ± 0.000	0.883 ± 0.000	1.206 ± 0.000	1.175 ± 0.000	1.178 ± 0.000	1.480 ± 0.000
	720	1.024 ± 0.000	1.041 ± 0.000	1.057 ± 0.000	1.072 ± 0.000	1.240 ± 0.000	1.171 ± 0.000	1.185 ± 0.000	1.541 ± 0.000
	24	0.305 ± 0.000	0.277 ± 0.000	0.267 ± 0.000	0.266 ± 0.000	1.388 ± 0.000	1.722 ± 0.000	2.839 ± 0.000	3.493 ± 0.000
ETTh2	48	0.618 ± 0.000	0.542 ± 0.000	0.512 ± 0.000	0.509 ± 0.000	1.800 ± 0.000	1.931 ± 0.000	3.074 ± 0.000	3.569 ± 0.000
	168	1.771 ± 0.000	1.635 ± 0.000	1.641 ± 0.000	1.678 ± 0.000	2.916 ± 0.000	3.069 ± 0.000	3.129 ± 0.000	3.651 ± 0.000
	336	1.959 ± 0.000	1.925 ± 0.000	1.919 ± 0.000	1.971 ± 0.000	3.143 ± 0.000	3.034 ± 0.000	3.174 ± 0.000	3.584 ± 0.000
	720	2.118 ± 0.000	2.095 ± 0.000	2.127 ± 0.000	2.136 ± 0.000	2.764 ± 0.000	2.863 ± 0.000	3.320 ± 0.000	3.659 ± 0.000
	24	0.158 ± 0.000	0.161 ± 0.000	0.162 ± 0.000	0.160 ± 0.000	0.234 ± 0.000	0.342 ± 0.000	0.903 ± 0.000	1.122 ± 0.000
	48	0.280 ± 0.000	0.285 ± 0.000	0.285 ± 0.000	0.287 ± 0.000	0.508 ± 0.000	0.635 ± 0.000	1.004 ± 0.000	1.143 ± 0.000
ETTm1	96	0.356 ± 0.000	0.363 ± 0.000	0.364 ± 0.000	0.363 ± 0.000	0.596 ± 0.000	0.804 ± 0.000	1.044 ± 0.000	1.132 ± 0.000
	288	0.464 ± 0.000	0.471 ± 0.000	0.474 ± 0.000	0.474 ± 0.000	0.873 ± 0.000	0.975 ± 0.000	1.156 ± 0.000	1.139 ± 0.000
	672	0.616 ± 0.000	0.627 ± 0.000	0.629 ± 0.000	0.632 ± 0.000	0.915 ± 0.000	1.116 ± 0.000	1.161 ± 0.000	1.145 ± 0.000
	24	0.096 ± 0.000	0.100 ± 0.000	0.100 ± 0.000	0.100 ± 0.000	0.328 ± 0.000	0.487 ± 0.000	1.353 ± 0.000	2.762 ± 0.000
	48	0.159 ± 0.000	0.161 ± 0.000	0.163 ± 0.000	0.161 ± 0.000	0.742 ± 0.000	0.910 ± 0.000	1.513 ± 0.000	2.955 ± 0.000
	96	0.277 ± 0.000	0.275 ± 0.000	0.272 ± 0.000	0.270 ± 0.000	0.955 ± 0.000	1.267 ± 0.000	1.616 ± 0.000	3.010 ± 0.000
ETTm2	288	0.750 ± 0.000	0.732 ± 0.000	0.739 ± 0.000	0.721 ± 0.000	1.516 ± 0.000	1.308 ± 0.000	1.613 ± 0.000	3.166 ± 0.000
	672	2.099 ± 0.000	1.969 ± 0.000	2.002 ± 0.000	1.730 ± 0.000	3.186 ± 0.000	2.568 ± 0.000	2.917 ± 0.000	3.203 ± 0.000
	24	0.121 ± 0.000	0.104 ± 0.000	0.098 ± 0.000	0.094 ± 0.000	2.107 ± 0.000	2.366 ± 0.000	3.759 ± 0.000	4.812 ± 0.000
	48	0.247 ± 0.000	0.216 ± 0.000	0.210 ± 0.000	0.201 ± 0.000	2.056 ± 0.000	2.581 ± 0.000	4.005 ± 0.000	4.839 ± 0.000
	96	0.550 ± 0.000	0.482 ± 0.000	0.455 ± 0.000	0.445 ± 0.000	2.249 ± 0.000	2.532 ± 0.000	4.102 ± 0.000	4.812 ± 0.000
	288	1.338 ± 0.000	1.257 ± 0.000	1.253 ± 0.000	1.308 ± 0.000	2.542 ± 0.000	2.752 ± 0.000	4.055 ± 0.000	4.635 ± 0.000
Exch.	672	2.030 ± 0.000	1.849 ± 0.000	1.831 ± 0.000	1.807 ± 0.000	2.998 ± 0.000	3.594 ± 0.000	3.991 ± 0.000	4.460 ± 0.000
	24	0.229 ± 0.000	0.231 ± 0.000	0.233 ± 0.000	0.234 ± 0.000	0.262 ± 0.000	0.280 ± 0.000	0.582 ± 0.000	0.975 ± 0.000
	48	0.314 ± 0.000	0.315 ± 0.000	0.315 ± 0.000	0.316 ± 0.000	0.362 ± 0.000	0.384 ± 0.000	0.599 ± 0.000	1.017 ± 0.000
	96	0.454 ± 0.000	0.452 ± 0.000	0.452 ± 0.000	0.451 ± 0.000	0.583 ± 0.000	0.597 ± 0.000	0.617 ± 0.000	1.057 ± 0.000
	336	0.493 ± 0.000	0.490 ± 0.000	0.489 ± 0.000	0.489 ± 0.000	0.585 ± 0.000	0.588 ± 0.000	0.626 ± 0.000	1.076 ± 0.000
	720	0.534 ± 0.000	0.530 ± 0.000	0.529 ± 0.000	0.529 ± 0.000	0.568 ± 0.000	0.563 ± 0.000	0.632 ± 0.000	1.084 ± 0.000
Electr.	24	0.233 ± 0.000	0.271 ± 0.000	0.287 ± 0.000	0.291 ± 0.000	0.757 ± 0.000	0.978 ± 0.000	1.061 ± 0.000	1.122 ± 0.000
	48	0.255 ± 0.000	0.293 ± 0.000	0.310 ± 0.000	0.317 ± 0.000	0.900 ± 0.000	0.982 ± 0.000	1.062 ± 0.000	1.120 ± 0.000
	168	0.295 ± 0.000	0.332 ± 0.000	0.350 ± 0.000	0.352 ± 0.000	0.917 ± 0.000	0.982 ± 0.000	1.061 ± 0.000	1.128 ± 0.000
	336	0.319 ± 0.000	0.354 ± 0.000	0.371 ± 0.000	0.376 ± 0.000	0.847 ± 0.000	0.976 ± 0.000	1.053 ± 0.000	1.119 ± 0.000
	720	0.350 ± 0.000	0.383 ± 0.000	0.403 ± 0.000	0.405 ± 0.000	0.892 ± 0.000	0.973 ± 0.000	1.045 ± 0.000	1.107 ± 0.000
	24	0.143 ± 0.000	0.152 ± 0.000	0.156 ± 0.000	0.153 ± 0.000	0.279 ± 0.000	0.542 ± 0.000	1.087 ± 0.000	0.924 ± 0.000
Weath.	48	0.356 ± 0.000	0.359 ± 0.000	0.374 ± 0.000	0.379 ± 0.000	0.913 ± 0.000	1.060 ± 0.000	1.190 ± 0.000	0.855 ± 0.000
	96	0.727 ± 0.000	0.736 ± 0.000	0.775 ± 0.000	0.793 ± 0.000	1.453 ± 0.000	1.663 ± 0.000	1.318 ± 0.000	0.827 ± 0.000
	288	1.508 ± 0.000	1.331 ± 0.000	1.296 ± 0.000	1.377 ± 0.000	1.750 ± 0.000	1.624 ± 0.000	1.586 ± 0.000	0.762 ± 0.000
	672	2.500 ± 0.000	2.069 ± 0.000	1.890 ± 0.000	1.825 ± 0.000	1.862 ± 0.000	1.581 ± 0.000	1.823 ± 0.000	0.773 ± 0.000
	24	0.953 ± 0.000	1.045 ± 0.000	0.983 ± 0.000	1.052 ± 0.000	1.309 ± 0.000	1.258 ± 0.000	1.541 ± 0.000	1.597 ± 0.000
	48	0.975 ± 0.000	1.055 ± 0.000	1.000 ± 0.000	1.067 ± 0.000	1.373 ± 0.000	1.353 ± 0.000	1.542 ± 0.000	1.581 ± 0.000
Traf.	96	1.003 ± 0.000	1.085 ± 0.000	1.031 ± 0.000	1.091 ± 0.000	1.361 ± 0.000	1.387 ± 0.000	1.551 ± 0.000	1.607 ± 0.000
	288	1.022 ± 0.000	1.101 ± 0.000	1.057 ± 0.000	1.111 ± 0.000	1.496 ± 0.000	1.402 ± 0.000	1.571 ± 0.000	1.629 ± 0.000
	672	1.048 ± 0.000	1.139 ± 0.000	1.079 ± 0.000	1.139 ± 0.000	1.465 ± 0.000	1.463 ± 0.000	1.588 ± 0.000	1.645 ± 0.000
	24	2.490 ± 0.000	2.347 ± 0.000	2.224 ± 0.000	2.228 ± 0.000	7.388 ± 0.000	8.269 ± 0.000	9.280 ± 0.000	10.611 ± 0.000
	36	3.023 ± 0.000	2.853 ± 0.000	2.662 ± 0.000	2.647 ± 0.000	8.710 ± 0.000	8.936 ± 0.000	10.307 ± 0.000	11.552 ± 0.000
	48	3.359 ± 0.000	3.181 ± 0.000	3.068 ± 0.000	2.972 ± 0.000	8.171 ± 0.000	8.699 ± 0.000	10.167 ± 0.000	11.447 ± 0.000
Ili	60	3.723 ± 0.000	3.547 ± 0.000	3.391 ± 0.000	3.327 ± 0.000	8.077 ± 0.000	8.586 ± 0.000	10.630 ± 0.000	11.654 ± 0.000

**Table 13: Ablation for the 1st pipeline application with kernel size of 25 timestamps - MSE metric**

D	L	TS2Vec				SimTS			
		TED4STL	Trend	Error	Orig.	TED4STL	Trend	Error	Orig.
ETTh1	24	0.377±0.017	0.503±0.010	1.059±0.015	0.590±0.042	0.270±0.006	0.413±0.005	0.954±0.004	0.377±0.006
	48	0.479±0.022	0.562±0.009	1.071±0.018	0.635±0.041	0.369±0.005	0.488±0.004	0.972±0.004	0.430±0.007
	168	0.686±0.018	0.705±0.014	1.083±0.020	0.768±0.039	0.617±0.010	0.698±0.005	1.012±0.005	0.644±0.005
	336	0.878±0.020	0.912±0.043	1.078±0.020	0.923±0.039	0.814±0.009	0.878±0.009	1.019±0.004	0.831±0.009
	720	1.066±0.030	1.050±0.027	1.017±0.029	1.053±0.024	0.978±0.015	1.081±0.026	0.948±0.004	0.985±0.020
ETTh2	24	0.202±0.008	0.241±0.027	3.540±0.029	0.437±0.037	0.227±0.013	0.244±0.021	3.498±0.021	0.347±0.017
	48	0.414±0.011	0.473±0.044	3.541±0.030	0.623±0.058	0.494±0.007	0.505±0.015	3.501±0.018	0.579±0.016
	168	1.679±0.052	1.835±0.095	3.564±0.035	1.800±0.104	1.624±0.027	1.627±0.033	3.516±0.012	1.656±0.028
	336	2.102±0.071	2.248±0.116	3.512±0.034	2.161±0.094	1.921±0.030	1.928±0.032	3.499±0.012	1.940±0.029
	720	2.358±0.064	2.738±0.130	3.546±0.017	2.593±0.092	2.091±0.023	2.098±0.024	3.555±0.017	2.113±0.024
ETTm1	24	0.237±0.023	0.331±0.008	1.119±0.004	0.456±0.023	0.137±0.003	0.148±0.004	1.057±0.010	0.245±0.005
	48	0.417±0.031	0.510±0.019	1.125±0.003	0.598±0.030	0.266±0.003	0.271±0.007	1.070±0.003	0.327±0.007
	96	0.495±0.025	0.580±0.027	1.131±0.002	0.634±0.037	0.346±0.010	0.349±0.011	1.065±0.004	0.375±0.008
	288	0.609±0.017	0.664±0.022	1.127±0.002	0.700±0.032	0.456±0.009	0.457±0.011	1.067±0.003	0.467±0.008
	720	0.736±0.023	0.760±0.023	1.117±0.003	0.789±0.025	0.614±0.007	0.620±0.010	1.078±0.009	0.623±0.009
ETTm2	24	0.108±0.011	0.111±0.002	3.456±0.015	0.198±0.036	0.078±0.004	0.082±0.002	3.468±0.029	0.115±0.002
	48	0.179±0.018	0.178±0.004	3.457±0.013	0.267±0.038	0.141±0.005	0.143±0.002	3.470±0.028	0.170±0.003
	96	0.292±0.021	0.288±0.015	3.457±0.016	0.372±0.042	0.249±0.006	0.251±0.004	3.470±0.027	0.273±0.004
	288	0.687±0.030	0.693±0.031	3.459±0.021	0.746±0.035	0.696±0.007	0.705±0.015	3.463±0.025	0.714±0.011
	720	1.897±0.084	1.865±0.093	3.468±0.020	1.790±0.087	1.709±0.046	1.709±0.048	3.469±0.022	1.715±0.045
Exch.	24	0.058±0.010	0.089±0.011	5.100±0.003	0.095±0.004	0.074±0.008	0.075±0.005	5.090±0.000	0.092±0.006
	48	0.141±0.019	0.167±0.017	5.095±0.004	0.173±0.009	0.183±0.009	0.180±0.010	5.088±0.000	0.200±0.011
	96	0.380±0.047	0.419±0.041	5.070±0.004	0.425±0.030	0.436±0.020	0.434±0.022	5.064±0.001	0.451±0.023
	288	1.198±0.157	1.429±0.238	5.040±0.009	1.478±0.234	1.343±0.075	1.303±0.047	5.045±0.002	1.306±0.048
	720	2.238±0.285	2.575±0.471	5.180±0.012	2.288±0.197	1.943±0.133	1.926±0.100	5.173±0.000	1.920±0.100
WTH	24	0.242±0.001	0.261±0.002	0.593±0.026	0.307±0.002	0.230±0.001	0.221±0.002	0.730±0.016	0.294±0.001
	48	0.320±0.003	0.337±0.003	0.601±0.024	0.373±0.003	0.309±0.001	0.306±0.001	0.737±0.015	0.356±0.001
	168	0.462±0.006	0.475±0.004	0.635±0.021	0.494±0.005	0.449±0.002	0.449±0.001	0.754±0.013	0.464±0.001
	336	0.502±0.005	0.514±0.004	0.641±0.022	0.528±0.006	0.491±0.003	0.489±0.002	0.755±0.013	0.499±0.002
	720	0.541±0.005	0.553±0.003	0.636±0.023	0.561±0.006	0.530±0.003	0.528±0.003	0.754±0.012	0.535±0.003
Electr.	24	0.200±0.003	0.385±0.002	0.448±0.004	0.285±0.007	0.104±0.001	0.279±0.005	0.360±0.004	0.138±0.001
	48	0.235±0.003	0.414±0.002	0.457±0.004	0.308±0.007	0.136±0.001	0.299±0.005	0.368±0.004	0.155±0.000
	168	0.279±0.003	0.451±0.002	0.466±0.004	0.334±0.007	0.172±0.001	0.339±0.001	0.369±0.003	0.175±0.000
	336	0.300±0.003	0.469±0.002	0.467±0.003	0.351±0.007	0.195±0.000	0.359±0.001	0.372±0.002	0.195±0.000
	720	0.331±0.003	0.494±0.002	0.469±0.003	0.377±0.006	0.232±0.000	0.388±0.001	0.378±0.002	0.232±0.001
Weath.	24	0.218±0.080	0.249±0.082	5.050±0.229	0.292±0.074	0.157±0.019	0.150±0.017	4.013±0.002	0.259±0.033
	48	0.631±0.197	0.606±0.139	5.053±0.189	0.748±0.189	0.438±0.037	0.431±0.029	4.010±0.002	0.542±0.044
	96	1.337±0.257	1.390±0.394	5.105±0.136	1.538±0.274	0.922±0.068	0.884±0.053	3.988±0.003	0.955±0.050
	288	1.817±0.150	1.804±0.369	5.055±0.120	1.925±0.303	1.839±0.076	1.268±0.054	3.971±0.003	1.278±0.055
	720	2.813±0.182	2.630±0.527	5.189±0.108	2.720±0.312	2.334±0.093	1.708±0.070	3.998±0.003	1.710±0.071
Traf.	24	0.887±0.029	1.038±0.039	0.960±0.071	0.973±0.023	0.730±0.002	1.127±0.117	0.755±0.084	0.755±0.006
	48	0.923±0.016	1.051±0.045	0.995±0.070	1.005±0.027	0.770±0.004	1.138±0.115	0.784±0.092	0.789±0.005
	96	0.969±0.023	1.067±0.040	1.037±0.064	1.038±0.021	0.799±0.005	1.160±0.109	0.804±0.093	0.810±0.007
	288	0.986±0.026	1.079±0.037	1.048±0.059	1.075±0.016	0.808±0.005	1.180±0.107	0.811±0.084	0.814±0.005
	720	1.001±0.027	1.098±0.042	1.061±0.059	1.128±0.066	0.821±0.004	1.203±0.124	0.824±0.090	0.826±0.005
Ili	24	4.393±1.575	3.751±1.054	5.047±0.054	4.367±1.780	1.957±0.028	2.104±0.036	5.115±0.024	2.699±0.045
	36	3.502±0.448	3.579±0.470	5.185±0.041	3.857±0.254	2.413±0.038	2.457±0.045	5.231±0.014	2.971±0.043
	48	3.613±0.358	4.026±0.275	5.424±0.042	4.126±0.250	2.911±0.065	2.774±0.052	5.425±0.015	3.240±0.033
	60	3.710±0.283	4.061±0.279	5.595±0.050	4.350±0.225	3.331±0.017	3.126±0.035	5.620±0.014	3.621±0.030

**Table 14: Ablation for the 1st pipeline application with kernel size of 25 timestamps - MAE metric**

D	L	TS2Vec				SimTS			
		TED4STL	Trend	Error	Orig.	TED4STL	Trend	Error	Orig.
ETTh1	24	0.418±0.009	0.486±0.009	0.811±0.005	0.531±0.021	0.350±0.005	0.436±0.005	0.796±0.003	0.421±0.005
	48	0.478±0.010	0.523±0.008	0.816±0.003	0.562±0.022	0.416±0.004	0.484±0.004	0.801±0.003	0.456±0.006
	168	0.599±0.009	0.614±0.011	0.817±0.004	0.642±0.019	0.565±0.004	0.610±0.002	0.808±0.003	0.583±0.003
	336	0.703±0.008	0.723±0.019	0.811±0.005	0.724±0.019	0.676±0.005	0.710±0.004	0.803±0.002	0.686±0.004
	720	0.800±0.010	0.794±0.012	0.784±0.010	0.794±0.012	0.773±0.006	0.817±0.010	0.763±0.002	0.777±0.007
ETTh2	24	0.324±0.008	0.361±0.026	1.450±0.010	0.489±0.027	0.344±0.009	0.358±0.016	1.440±0.004	0.439±0.008
	48	0.472±0.007	0.512±0.028	1.449±0.009	0.602±0.033	0.522±0.006	0.533±0.011	1.441±0.004	0.582±0.007
	168	1.002±0.018	1.066±0.031	1.451±0.010	1.051±0.032	0.995±0.018	0.998±0.019	1.445±0.003	1.007±0.018
	336	1.160±0.028	1.212±0.029	1.440±0.010	1.178±0.026	1.099±0.017	1.104±0.019	1.441±0.005	1.107±0.018
	720	1.277±0.035	1.404±0.033	1.454±0.005	1.344±0.036	1.164±0.016	1.173±0.015	1.459±0.006	1.174±0.013
ETTm1	24	0.315±0.013	0.376±0.006	0.830±0.002	0.446±0.016	0.239±0.004	0.251±0.004	0.817±0.005	0.326±0.004
	48	0.427±0.018	0.476±0.010	0.832±0.002	0.524±0.017	0.335±0.003	0.341±0.005	0.821±0.003	0.383±0.005
	96	0.480±0.015	0.525±0.015	0.832±0.002	0.553±0.020	0.394±0.007	0.398±0.008	0.818±0.003	0.417±0.006
	288	0.553±0.010	0.579±0.010	0.828±0.001	0.599±0.016	0.474±0.006	0.476±0.008	0.816±0.003	0.483±0.006
	672	0.628±0.013	0.640±0.011	0.820±0.002	0.655±0.010	0.570±0.005	0.574±0.006	0.816±0.003	0.576±0.006
ETTm2	24	0.231±0.017	0.237±0.005	1.433±0.003	0.317±0.034	0.194±0.008	0.198±0.003	1.426±0.006	0.234±0.003
	48	0.300±0.022	0.304±0.007	1.433±0.003	0.376±0.030	0.266±0.007	0.270±0.003	1.427±0.005	0.296±0.003
	96	0.386±0.020	0.389±0.016	1.433±0.004	0.447±0.032	0.362±0.007	0.364±0.005	1.427±0.006	0.383±0.003
	288	0.628±0.013	0.630±0.022	1.432±0.005	0.660±0.024	0.633±0.002	0.637±0.005	1.426±0.005	0.645±0.004
	672	1.052±0.025	1.053±0.029	1.434±0.005	1.030±0.026	1.016±0.022	1.018±0.021	1.428±0.006	1.020±0.020
Exch.	24	0.178±0.019	0.226±0.018	1.834±0.000	0.229±0.005	0.196±0.012	0.197±0.009	1.834±0.000	0.223±0.010
	48	0.274±0.020	0.305±0.013	1.834±0.001	0.311±0.004	0.312±0.010	0.310±0.011	1.834±0.000	0.329±0.011
	96	0.463±0.038	0.482±0.030	1.831±0.000	0.486±0.023	0.493±0.012	0.490±0.012	1.828±0.000	0.502±0.012
	288	0.850±0.070	0.901±0.068	1.820±0.001	0.918±0.076	0.920±0.020	0.910±0.015	1.819±0.000	0.912±0.015
	672	1.144±0.084	1.218±0.085	1.856±0.002	1.166±0.061	1.110±0.034	1.108±0.019	1.855±0.000	1.106±0.020
WTH	24	0.307±0.001	0.328±0.001	0.579±0.013	0.363±0.001	0.301±0.001	0.293±0.002	0.661±0.007	0.356±0.001
	48	0.376±0.002	0.392±0.002	0.585±0.012	0.418±0.001	0.370±0.001	0.367±0.001	0.664±0.007	0.407±0.001
	168	0.484±0.003	0.497±0.002	0.603±0.011	0.507±0.002	0.479±0.001	0.479±0.001	0.672±0.006	0.491±0.001
	336	0.515±0.002	0.527±0.003	0.605±0.012	0.532±0.002	0.511±0.002	0.510±0.002	0.671±0.006	0.517±0.002
	720	0.543±0.002	0.554±0.003	0.601±0.013	0.555±0.003	0.538±0.002	0.538±0.002	0.671±0.006	0.543±0.002
Electr.	24	0.315±0.003	0.470±0.002	0.484±0.002	0.374±0.006	0.212±0.001	0.392±0.002	0.424±0.003	0.242±0.001
	48	0.341±0.003	0.485±0.002	0.489±0.002	0.390±0.006	0.242±0.001	0.406±0.004	0.428±0.003	0.258±0.000
	168	0.373±0.003	0.504±0.002	0.495±0.002	0.409±0.005	0.274±0.001	0.431±0.001	0.430±0.002	0.275±0.000
	336	0.389±0.003	0.514±0.002	0.497±0.002	0.422±0.005	0.297±0.001	0.445±0.001	0.433±0.002	0.296±0.000
	720	0.411±0.003	0.527±0.002	0.500±0.002	0.440±0.004	0.329±0.000	0.463±0.001	0.439±0.001	0.328±0.001
Weath.	24	0.286±0.053	0.331±0.058	1.817±0.049	0.331±0.035	0.249±0.018	0.237±0.022	1.617±0.018	0.324±0.027
	48	0.514±0.091	0.509±0.058	1.806±0.035	0.550±0.064	0.435±0.022	0.425±0.019	1.615±0.020	0.497±0.025
	96	0.788±0.082	0.809±0.118	1.810±0.023	0.849±0.067	0.671±0.025	0.656±0.021	1.610±0.020	0.697±0.020
	288	0.985±0.039	0.998±0.114	1.797±0.020	1.013±0.081	1.012±0.023	0.850±0.021	1.607±0.017	0.857±0.022
	672	1.290±0.039	1.269±0.141	1.820±0.018	1.291±0.087	1.205±0.025	1.021±0.022	1.615±0.019	1.024±0.023
Traf.	24	0.536±0.032	0.585±0.014	0.559±0.030	0.567±0.009	0.433±0.006	0.655±0.052	0.450±0.001	0.435±0.006
	48	0.533±0.013	0.580±0.019	0.570±0.030	0.579±0.010	0.451±0.007	0.649±0.053	0.462±0.001	0.456±0.007
	96	0.551±0.015	0.579±0.020	0.585±0.028	0.580±0.014	0.461±0.006	0.651±0.053	0.469±0.004	0.472±0.006
	288	0.556±0.016	0.583±0.022	0.588±0.028	0.600±0.012	0.467±0.003	0.655±0.053	0.466±0.004	0.468±0.006
	672	0.561±0.015	0.588±0.024	0.592±0.029	0.618±0.024	0.470±0.003	0.666±0.066	0.469±0.004	0.472±0.002
Ili	24	1.370±0.286	1.262±0.215	1.600±0.012	1.373±0.378	0.895±0.013	0.937±0.009	1.621±0.007	1.051±0.007
	36	1.243±0.109	1.229±0.110	1.609±0.007	1.279±0.063	0.977±0.011	0.988±0.009	1.625±0.005	1.082±0.007
	48	1.244±0.083	1.313±0.055	1.639±0.008	1.330±0.047	1.066±0.011	1.048±0.010	1.653±0.004	1.129±0.005
	60	1.260±0.063	1.313±0.048	1.664±0.007	1.366±0.038	1.148±0.005	1.120±0.006	1.685±0.007	1.210±0.004

**Table 15: Ablation for the 2nd pipeline application with kernel size of 25 timestamps - MsE results**

D	L	CoST				MaskAE			
		TED4STL	Trend	Error	Orig.	TED4STL	Trend	Error	Orig.
ETTh1	24	0.369±0.003	0.423±0.007	0.412±0.007	0.380±0.009	0.975±0.134	0.913±0.196	1.264±0.008	1.565±0.069
	48	0.429±0.004	0.488±0.012	0.487±0.006	0.434±0.008	1.148±0.016	1.264±0.044	1.248±0.021	1.410±0.141
	168	0.640±0.011	0.670±0.022	0.677±0.012	0.630±0.010	1.150±0.006	1.288±0.025	1.260±0.020	1.309±0.036
	336	0.826±0.021	0.836±0.043	0.837±0.015	0.789±0.005	1.175±0.014	1.320±0.030	1.278±0.015	1.344±0.021
	720	0.996±0.047	1.004±0.077	1.010±0.052	0.898±0.021	1.171±0.012	1.369±0.015	1.268±0.006	1.350±0.053
ETTh2	24	0.343±0.019	0.311±0.052	0.299±0.041	0.456±0.067	1.722±0.419	1.836±0.340	3.255±0.132	2.801±0.114
	48	0.598±0.036	0.603±0.074	0.563±0.051	0.695±0.064	1.931±0.137	2.044±0.225	3.306±0.040	2.789±0.158
	168	1.663±0.143	1.715±0.118	1.662±0.059	1.608±0.076	3.069±0.355	2.776±0.246	3.329±0.150	2.954±0.165
	336	1.913±0.192	1.964±0.162	1.913±0.107	1.819±0.083	3.034±0.139	2.602±0.177	3.326±0.042	2.716±0.072
	720	2.108±0.136	2.132±0.164	2.108±0.110	2.019±0.075	2.863±0.179	2.872±0.138	3.260±0.062	3.193±0.152
ETTm1	24	0.215±0.009	0.158±0.003	0.155±0.006	0.245±0.005	0.342±0.055	0.257±0.017	1.258±0.019	1.893±0.108
	48	0.316±0.008	0.282±0.003	0.278±0.005	0.329±0.004	0.635±0.073	0.551±0.046	1.245±0.005	1.835±0.146
	96	0.375±0.008	0.358±0.006	0.356±0.005	0.377±0.002	0.804±0.038	0.743±0.064	1.263±0.007	1.715±0.065
	288	0.475±0.006	0.468±0.011	0.466±0.006	0.473±0.009	0.975±0.018	0.983±0.046	1.266±0.005	1.797±0.128
	672	0.626±0.007	0.623±0.009	0.621±0.009	0.624±0.009	1.116±0.066	1.239±0.108	1.272±0.006	1.701±0.253
ETTm2	24	0.114±0.009	0.095±0.010	0.094±0.012	0.128±0.009	0.487±0.123	0.240±0.085	3.268±0.062	2.569±0.232
	48	0.176±0.010	0.157±0.013	0.159±0.013	0.191±0.014	0.910±0.234	0.734±0.138	3.193±0.094	2.580±0.175
	96	0.288±0.021	0.269±0.010	0.275±0.013	0.307±0.021	1.267±0.089	1.175±0.200	3.272±0.069	2.557±0.051
	288	0.746±0.061	0.740±0.018	0.740±0.022	0.765±0.025	1.308±0.106	1.553±0.151	3.239±0.112	2.539±0.057
	672	1.959±0.695	1.709±0.136	1.708±0.051	1.641±0.064	2.568±0.106	2.823±0.105	3.204±0.181	3.160±0.154
Exch.	24	0.117±0.020	0.264±0.018	0.111±0.018	0.125±0.024	2.366±0.106	2.271±0.105	3.900±0.309	2.069±0.043
	48	0.232±0.035	0.352±0.030	0.227±0.042	0.233±0.039	2.581±0.090	2.440±0.111	4.044±0.239	2.150±0.044
	96	0.489±0.052	0.406±0.043	0.475±0.078	0.484±0.069	2.532±0.078	2.437±0.057	3.990±0.320	2.204±0.045
	288	1.260±0.132	0.485±0.089	1.278±0.066	1.236±0.029	2.752±0.131	2.476±0.117	4.211±0.087	2.221±0.058
	672	1.846±0.226	0.579±0.142	1.813±0.146	1.857±0.214	3.594±0.419	3.382±0.279	4.038±0.073	2.403±0.059
WTH	24	0.272±0.002	0.446±0.001	0.228±0.002	0.299±0.001	0.280±0.007	0.263±0.003	0.577±0.012	1.698±0.016
	48	0.343±0.002	0.490±0.001	0.314±0.001	0.360±0.001	0.384±0.013	0.372±0.005	0.582±0.010	1.578±0.053
	168	0.460±0.001	0.603±0.001	0.451±0.002	0.464±0.001	0.597±0.011	0.655±0.046	0.566±0.009	1.422±0.053
	336	0.495±0.002	0.694±0.002	0.490±0.002	0.497±0.002	0.588±0.002	0.632±0.016	0.564±0.006	1.532±0.054
	720	0.532±0.004	0.786±0.005	0.532±0.007	0.534±0.003	0.563±0.003	0.596±0.010	0.550±0.002	1.462±0.049
Electr.	24	0.149±0.027	0.419±0.017	0.272±0.036	0.135±0.001	0.978±0.009	0.990±0.006	1.018±0.025	1.150±0.010
	48	0.170±0.020	0.590±0.011	0.295±0.038	0.152±0.001	0.982±0.006	0.995±0.012	1.008±0.009	1.165±0.019
	168	0.199±0.023	1.039±0.010	0.332±0.036	0.175±0.001	0.982±0.004	0.995±0.005	1.017±0.030	1.129±0.005
	336	0.220±0.024	1.127±0.010	0.352±0.036	0.195±0.001	0.976±0.009	0.990±0.009	1.007±0.029	1.129±0.008
	720	0.254±0.023	1.181±0.008	0.384±0.033	0.232±0.001	0.973±0.007	0.991±0.005	1.006±0.022	1.135±0.021
Weath.	24	0.194±0.032	0.160±0.016	0.155±0.019	0.254±0.025	0.542±0.086	0.236±0.038	1.812±0.321	1.904±0.143
	48	0.422±0.077	0.384±0.066	0.387±0.074	0.476±0.041	1.060±0.266	1.055±0.304	1.653±0.189	2.076±0.195
	96	0.788±0.099	0.734±0.121	0.784±0.100	0.770±0.080	1.663±0.146	1.369±0.162	1.620±0.260	1.966±0.154
	288	1.353±0.173	1.197±0.306	1.557±0.187	1.050±0.082	1.624±0.138	1.078±0.068	1.271±0.039	1.540±0.200
	672	2.091±0.355	1.741±0.444	2.080±0.282	1.486±0.087	1.581±0.258	1.245±0.102	1.245±0.037	1.596±0.315
Traf.	24	0.789±0.080	0.962±0.035	0.915±0.023	0.722±0.004	1.258±0.177	1.095±0.039	1.507±0.004	1.816±0.139
	48	0.816±0.085	0.987±0.038	0.949±0.021	0.744±0.002	1.353±0.177	1.059±0.010	1.511±0.005	1.852±0.078
	96	0.834±0.088	1.019±0.039	0.984±0.023	0.754±0.003	1.387±0.143	1.115±0.093	1.513±0.007	1.763±0.160
	288	0.844±0.076	1.047±0.044	1.002±0.022	0.763±0.001	1.402±0.175	1.353±0.225	1.541±0.007	1.704±0.079
	672	0.859±0.080	1.085±0.055	1.027±0.016	0.776±0.002	1.463±0.171	1.486±0.086	1.566±0.004	1.747±0.093
Ili	24	2.803±0.129	2.187±0.162	2.225±0.078	2.873±0.086	8.269±0.740	9.423±0.038	7.395±0.533	8.583±0.254
	36	3.125±0.123	2.686±0.186	2.769±0.079	3.165±0.057	8.936±0.510	9.390±0.445	8.079±0.505	8.846±0.474
	48	3.419±0.096	3.077±0.089	3.095±0.064	3.449±0.065	8.699±0.592	9.839±0.690	8.477±0.655	8.772±0.335
	60	3.829±0.092	3.425±0.086	3.502±0.058	3.849±0.072	8.586±0.252	9.838±0.603	8.807±0.564	9.223±0.116

**Table 16: Ablation for the 2nd pipeline application with kernel size of 25 timestamps - MAE results**

D	L	CoST				MaskAE			
		TED4STL	Trend	Error	Orig.	TED4STL	Trend	Error	Orig.
ETTh1	24	0.419±0.004	0.446±0.004	0.440±0.004	0.426±0.008	0.745±0.070	0.708±0.086	0.867±0.007	0.997±0.035
	48	0.459±0.005	0.490±0.007	0.488±0.006	0.464±0.007	0.838±0.009	0.885±0.029	0.860±0.008	0.936±0.049
	168	0.584±0.006	0.603±0.011	0.606±0.008	0.579±0.007	0.832±0.008	0.916±0.014	0.865±0.008	0.905±0.009
	336	0.682±0.011	0.694±0.019	0.697±0.004	0.672±0.005	0.850±0.012	0.934±0.015	0.873±0.007	0.922±0.008
	720	0.776±0.016	0.786±0.034	0.791±0.017	0.748±0.006	0.848±0.013	0.969±0.003	0.861±0.003	0.930±0.020
ETTh2	24	0.437±0.018	0.419±0.040	0.413±0.032	0.509±0.043	1.049±0.125	1.124±0.093	1.371±0.025	1.302±0.026
	48	0.589±0.023	0.590±0.040	0.573±0.031	0.640±0.038	1.122±0.038	1.183±0.071	1.380±0.009	1.308±0.032
	168	1.003±0.060	1.039±0.042	1.008±0.010	0.992±0.015	1.383±0.075	1.334±0.049	1.382±0.033	1.350±0.035
	336	1.077±0.070	1.127±0.055	1.098±0.021	1.061±0.016	1.386±0.037	1.310±0.069	1.391±0.012	1.305±0.014
	720	1.141±0.049	1.181±0.056	1.153±0.025	1.097±0.012	1.303±0.056	1.347±0.078	1.377±0.009	1.421±0.035
ETTm1	24	0.304±0.005	0.264±0.002	0.262±0.005	0.329±0.004	0.395±0.048	0.348±0.011	0.859±0.005	1.070±0.029
	48	0.375±0.004	0.352±0.003	0.349±0.004	0.387±0.003	0.552±0.038	0.517±0.035	0.856±0.005	1.051±0.052
	96	0.418±0.005	0.406±0.004	0.405±0.002	0.421±0.002	0.639±0.018	0.622±0.026	0.861±0.003	1.019±0.020
	288	0.489±0.005	0.485±0.008	0.484±0.004	0.489±0.006	0.735±0.014	0.755±0.026	0.861±0.003	1.049±0.044
	672	0.579±0.004	0.579±0.005	0.578±0.006	0.578±0.006	0.810±0.046	0.873±0.040	0.862±0.003	1.034±0.081
ETTm2	24	0.235±0.010	0.221±0.012	0.221±0.014	0.253±0.010	0.551±0.081	0.374±0.071	1.378±0.010	1.181±0.056
	48	0.299±0.010	0.287±0.013	0.288±0.013	0.315±0.013	0.766±0.114	0.677±0.061	1.357±0.023	1.215±0.029
	96	0.390±0.010	0.380±0.010	0.385±0.012	0.406±0.015	0.910±0.031	0.882±0.088	1.374±0.014	1.228±0.017
	288	0.654±0.019	0.653±0.006	0.656±0.012	0.669±0.012	0.925±0.041	1.065±0.064	1.367±0.026	1.262±0.016
	672	1.067±0.170	1.029±0.047	1.019±0.012	0.991±0.014	1.279±0.026	1.367±0.034	1.362±0.041	1.414±0.032
Exch.	24	0.256±0.026	0.239±0.022	0.248±0.001	0.264±0.028	1.178±0.019	1.154±0.020	1.561±0.064	1.145±0.007
	48	0.362±0.034	0.344±0.027	0.361±0.001	0.364±0.037	1.222±0.026	1.181±0.016	1.588±0.048	1.161±0.014
	96	0.529±0.035	0.525±0.032	0.527±0.001	0.531±0.053	1.248±0.018	1.200±0.011	1.581±0.066	1.182±0.016
	288	0.889±0.064	0.912±0.025	0.893±0.002	0.870±0.022	1.299±0.023	1.220±0.028	1.628±0.021	1.179±0.008
	672	1.075±0.069	1.081±0.045	1.054±0.005	1.059±0.054	1.470±0.096	1.413±0.067	1.590±0.014	1.213±0.026
WTH	24	0.337±0.002	0.305±0.001	0.302±0.032	0.362±0.001	0.358±0.008	0.335±0.003	0.563±0.011	1.015±0.005
	48	0.397±0.002	0.376±0.001	0.375±0.031	0.412±0.001	0.438±0.010	0.426±0.005	0.570±0.003	0.983±0.017
	96	0.488±0.001	0.482±0.001	0.481±0.029	0.492±0.001	0.581±0.007	0.612±0.019	0.557±0.005	0.942±0.021
	288	0.515±0.001	0.512±0.001	0.512±0.027	0.517±0.001	0.574±0.002	0.605±0.011	0.555±0.003	0.980±0.019
	720	0.540±0.003	0.540±0.004	0.540±0.024	0.543±0.002	0.564±0.002	0.586±0.007	0.553±0.002	0.954±0.023
Electr.	24	0.265±0.022	0.411±0.010	0.387±0.016	0.240±0.002	0.801±0.003	0.808±0.002	0.817±0.007	0.876±0.004
	48	0.283±0.017	0.424±0.008	0.402±0.042	0.256±0.001	0.801±0.002	0.809±0.004	0.815±0.003	0.882±0.007
	168	0.307±0.018	0.445±0.007	0.425±0.046	0.275±0.001	0.801±0.001	0.811±0.004	0.820±0.010	0.867±0.002
	336	0.326±0.018	0.457±0.007	0.438±0.051	0.296±0.001	0.799±0.002	0.808±0.004	0.815±0.011	0.867±0.003
	720	0.354±0.017	0.476±0.006	0.459±0.071	0.329±0.001	0.801±0.003	0.809±0.004	0.816±0.009	0.872±0.009
Weath.	24	0.282±0.028	0.258±0.013	0.256±0.020	0.334±0.022	0.549±0.049	0.315±0.037	1.070±0.081	1.016±0.041
	48	0.437±0.047	0.417±0.034	0.420±0.042	0.479±0.024	0.782±0.106	0.736±0.121	1.039±0.063	1.085±0.060
	96	0.631±0.044	0.607±0.047	0.627±0.059	0.634±0.036	0.994±0.043	0.885±0.051	1.016±0.087	1.086±0.035
	288	0.871±0.063	0.808±0.111	0.933±0.032	0.778±0.036	1.023±0.044	0.788±0.037	0.898±0.016	0.980±0.062
	672	1.130±0.105	1.023±0.145	1.133±0.032	0.959±0.031	1.007±0.089	0.886±0.034	0.892±0.014	1.002±0.100
Traf.	24	0.474±0.045	0.593±0.018	0.568±0.018	0.423±0.005	0.693±0.094	0.587±0.022	0.815±0.003	0.923±0.051
	48	0.485±0.047	0.597±0.015	0.578±0.013	0.437±0.004	0.742±0.092	0.565±0.009	0.815±0.002	0.936±0.029
	96	0.489±0.052	0.603±0.015	0.587±0.007	0.438±0.005	0.759±0.070	0.597±0.052	0.815±0.002	0.901±0.060
	288	0.488±0.042	0.610±0.019	0.590±0.010	0.434±0.004	0.759±0.091	0.715±0.117	0.817±0.002	0.875±0.030
	672	0.492±0.048	0.635±0.033	0.599±0.012	0.436±0.006	0.783±0.087	0.778±0.043	0.820±0.000	0.888±0.035
Ili	24	1.057±0.019	0.978±0.027	0.969±0.022	1.078±0.015	2.069±0.112	2.197±0.094	1.942±0.082	2.112±0.043
	36	1.107±0.024	1.050±0.036	1.064±0.019	1.123±0.011	2.140±0.074	2.200±0.063	2.018±0.080	2.134±0.069
	48	1.164±0.021	1.116±0.017	1.123±0.013	1.179±0.011	2.123±0.089	2.308±0.091	2.083±0.085	2.126±0.047
	60	1.245±0.019	1.186±0.016	1.205±0.015	1.262±0.010	2.111±0.041	2.288±0.087	2.132±0.075	2.181±0.015

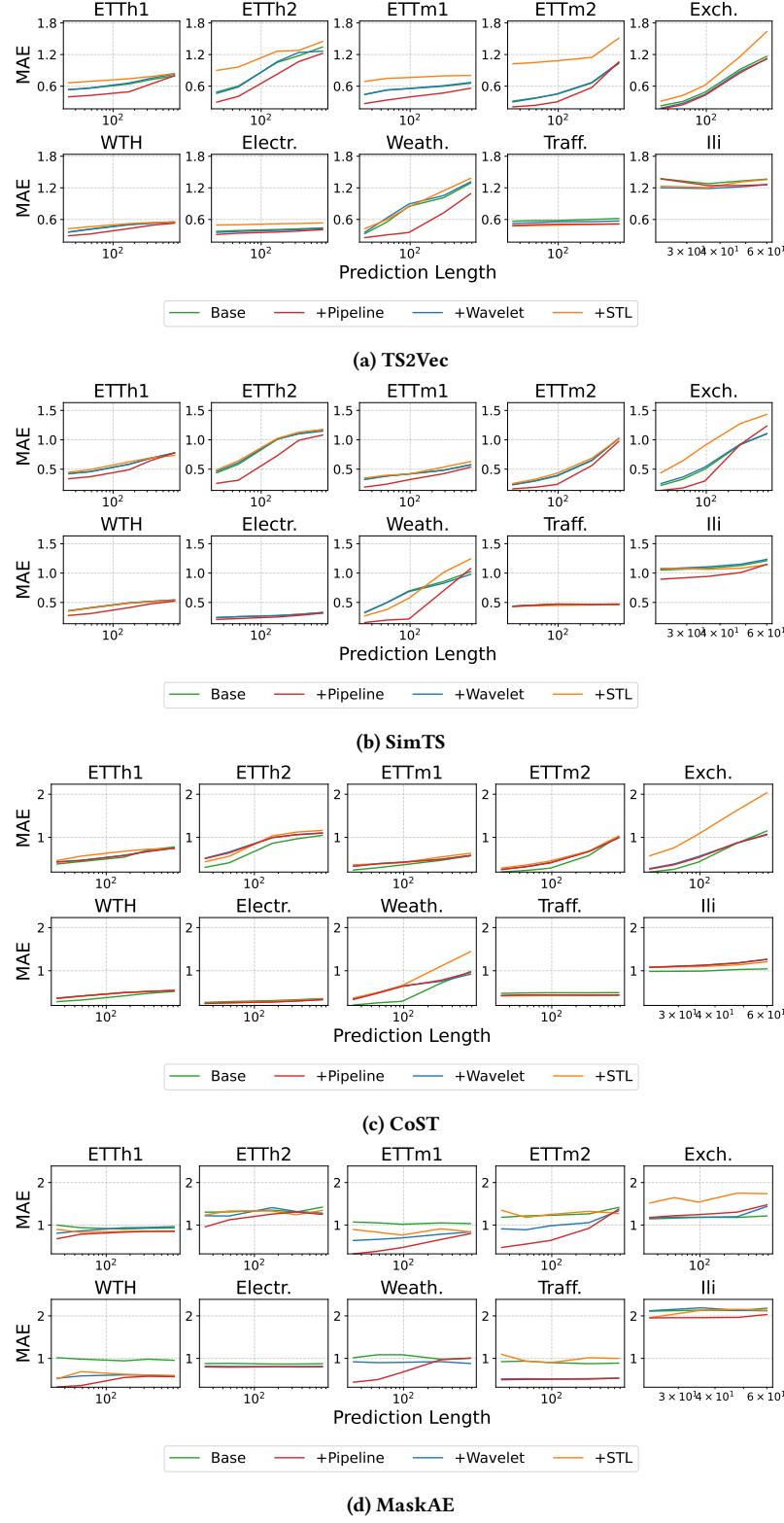


Figure 1: MAE for different types of decomposition.