

## Self-organized Non-linear Models to Predict Global Temperatures 36 Months Ahead

This is a set of models which has been developed from observed temperature data (Jan. 1890 - Dec. 2009) and been used to predict 9 regions of the globe for both land air (LAT) and sea surface temperatures (SST) 36 months ahead. For an Excel version with all models implemented and functional, please download file:

[http://www.climateprediction.eu/cc/download/models/selforganized\\_models\\_dec\\_09.zip](http://www.climateprediction.eu/cc/download/models/selforganized_models_dec_09.zip)

Note: This is free, original, copyrighted work. For questions and comments please contact:

[info@climateprediction.eu](mailto:info@climateprediction.eu) (predictions and general climate problems)

[info@knowledgeminer.com](mailto:info@knowledgeminer.com) (models and modeling).

### 1. Land Air Temperatures

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#### MODEL FOR REGION N90-N70\_LAT

$$X4(t) = 1.23816z11 + 1.3464z82 + 0.503238$$

$$z11 = -0.102042X5(t-517) - 0.0113559$$

$$z82 = 0.823348z11 + 0.99517z72$$

$$z11 = 0.154711X13(t-333) - 0.0430961$$

$$z72 = 1.04575z62 + 0.521687z51z62 - 0.588555z51z51$$

$$z51 = 0.264966z11 + 0.98355z42 - 0.943955z11z11$$

$$z11 = 0.267784X13(t-442) - 0.0459765$$

$$z42 = 0.924285z32 + 0.142962z11z11$$

$$z11 = 0.823628X14(t-52) + 0.711432X13(t-442)X14(t-52) - 0.168586$$

$$z32 = 0.851655z11 + 0.980471z22 - 5.39979z11z11$$

$$z11 = 0.132156X13(t-253) - 0.0358659$$

$$z22 = 0.684582z11 + 0.551164z12$$

$$z11 = 0.975223X2(t-93) + 0.371884X2(t-72) + 3.23118X2(t-93)X2(t-72) - 0.182676$$

$$z12 = 0.217223X13(t-624) + 1.02384X14(t-52) + 0.760665X13(t-624)X14(t-52) - 0.148637$$

$$z62 = 0.939344z52 + 0.117421z11z11$$

$$z11 = 0.823628X14(t-52) + 0.711432X13(t-442)X14(t-52) - 0.168586$$

$$z52 = 0.427808z11 + 0.956359z42$$

$$z11 = 0.278789X13(t-727) + 0.0741129$$

$$z42 = 0.849752z11 + 0.981175z32 - 5.08685z11z11$$

$$z11 = 0.132156X13(t-253) - 0.0358659$$

$$z32 = 0.546638z11 + 0.955022z22$$

$$z11 = 0.2844X13(t-673) + 0.0404377$$

$$z22 = 0.666231z11 + 0.55997z12$$

$$z11 = 0.975223X2(t-93) + 0.371884X2(t-72) + 3.23118X2(t-93)X2(t-72) - 0.182676$$

$$z12 = 0.221065X13(t-624) + 0.684799X14(t-52) + 0.618268X13(t-624)X14(t-52) + 0.638849X14(t-52)X14$$

$$(t-52) - 0.168375$$

TARGET VARIABLE:

X4(t) : N90-70\_LAT (E)

RELEVANT INPUT VARIABLES: 10

X2(t-72) : anomalies\_nh\_land\_sea (C)

X2(t-93) : anomalies\_nh\_land\_sea (C)

X5(t-517) : N70-50\_LAT (F)

X13(t-253) : N90-70\_sst (N)

X13(t-333) : N90-70\_sst (N)

X13(t-442) : N90-70\_sst (N)  
X13(t-624) : N90-70\_sst (N)  
X13(t-673) : N90-70\_sst (N)  
X13(t-727) : N90-70\_sst (N)  
X14(t-52) : N70-50\_sst (O)

MODEL ACCURACY: 0,38

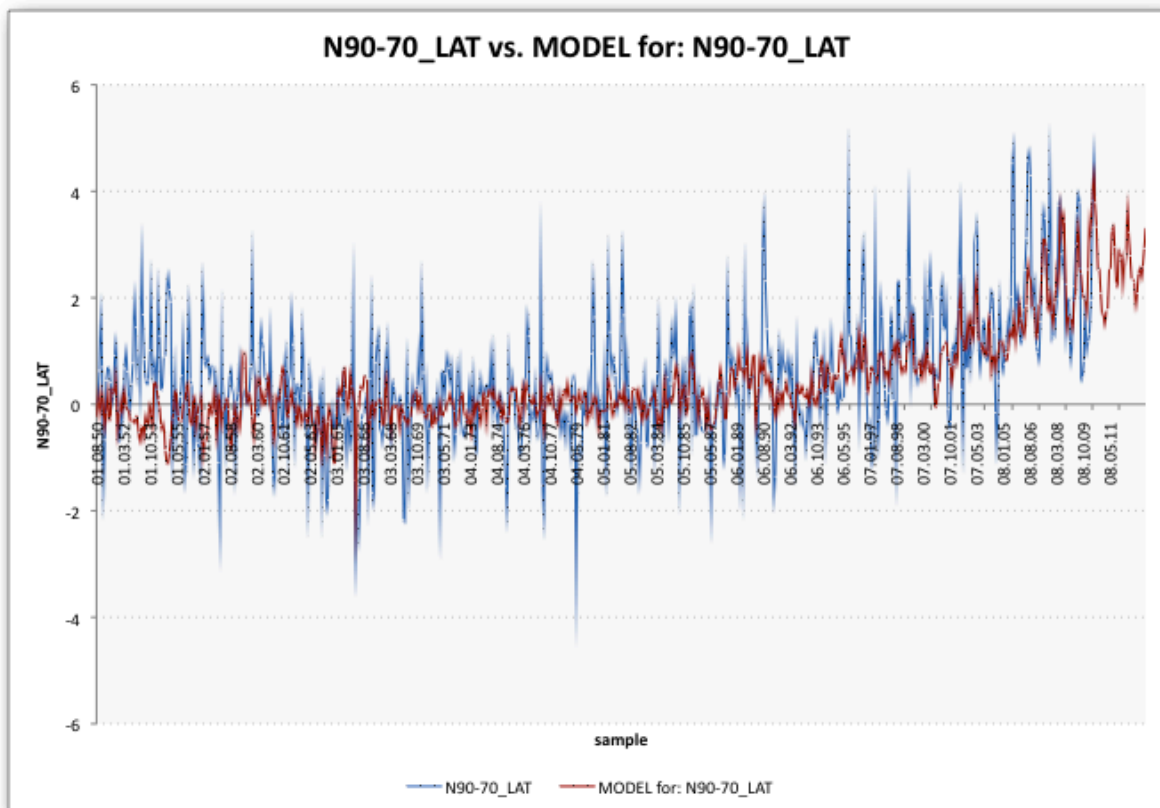
CHOSEN PARAMETERS:

Number of samples: 1440  
Starting at row: 6  
Number of potential inputs: 4025  
Noise immunity: VERY GOOD  
Model type: non-linear dynamic input-output model  
Max. time lag: 840  
Forecast horizon: 36  
Number of models to survive: 30  
Network layers used: 9

MODEL EVALUATION: UNCERTAIN

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 16%.

The model was generated by self-organizing high-dimensional modeling.



## MODEL FOR REGION N70-N50\_LAT

$$X5(t) = 0.861069z_{21} + 0.431849z_{22} + 0.336483$$

$$z_{21} = 0.905217z_{11} + 0.543747z_{12}$$

$$z_{11} = 0.199866X4(t-840) + 0.988875X15(t-666) + 0.0228882X4(t-840)X4(t-840) + 0.195876$$

$$z_{12} = 0.265325X6(t-736) - 0.66315X6(t-682)X6(t-736) + 0.0996703$$

$$z_{22} = 0.663735z_{12} + 2.14948z_{11}z_{12}$$

$$z_{11} = 0.538111X14(t-55) - 0.085652$$

$$z_{12} = 0.484549X14(t-55) + 0.177426X13(t-610) + 0.825165X14(t-55)X13(t-610) - 0.0634384$$

TARGET VARIABLE:

X5(t) : N70-50\_LAT (F)

RELEVANT INPUT VARIABLES: 6

X4(t-840) : N90-70\_LAT (E)

X6(t-682) : N50-30\_LAT (G)

X6(t-736) : N50-30\_LAT (G)

X13(t-610) : N90-70\_sst (N)

X14(t-55) : N70-50\_sst (O)

X15(t-666) : N50-30\_sst (P)

MODEL ACCURACY: 0,29

CHOSEN PARAMETERS:

Number of samples: 1440

Starting at row: 6

Number of potential inputs: 4830

Noise immunity: VERY GOOD

Model type: non-linear dynamic input-output model

Max. time lag: 840

Forecast horizon: 36

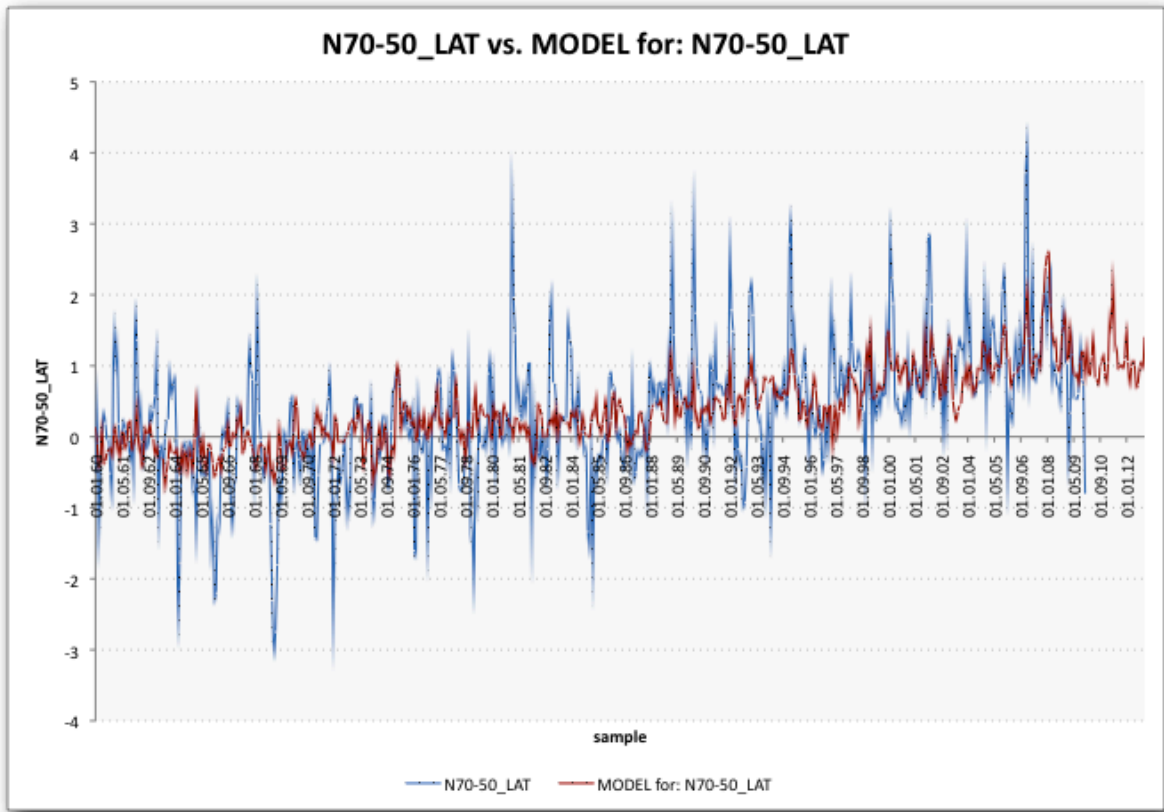
Number of models to survive: 30

Network layers used: 3

MODEL EVALUATION: UNCERTAIN

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 10%.

The model was generated by self-organizing high-dimensional modeling.




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**MODEL FOR REGION N50-N30\_LAT**

$$X6(t) = 0.36506z21 + 0.31393z22 + 0.255623$$

$$z21 = 0.698434z11 + 0.633879z12$$

$$z11 = 0.627725X14(t-760) + 1.58053X15(t-737) + 0.950707X15(t-737)X15(t-737) + 0.315986$$

$$z12 = 0.67192X7(t-43) + 1.52994X7(t-61)X7(t-43) - 0.234342$$

$$z22 = 0.634688z11 + 0.619723z12$$

$$z11 = 1.02701X7(t-43) + 0.873714X16(t-759) + 1.37079X7(t-43)X16(t-759) + 0.0151058$$

$$z12 = 0.627725X14(t-760) + 1.58053X15(t-737) + 0.950707X15(t-737)X15(t-737) + 0.315986$$

TARGET VARIABLE:

X6(t) : N50-30\_LAT (G)

RELEVANT INPUT VARIABLES: 5

X7(t-43) : N30-10\_LAT (H)

X7(t-61) : N30-10\_LAT (H)

X14(t-760) : N70-50\_sst (O)

X15(t-737) : N50-30\_sst (P)

X16(t-759) : N30-10\_sst (Q)

MODEL ACCURACY: 0,37

CHOSEN PARAMETERS:

Number of samples: 1440

Starting at row: 6

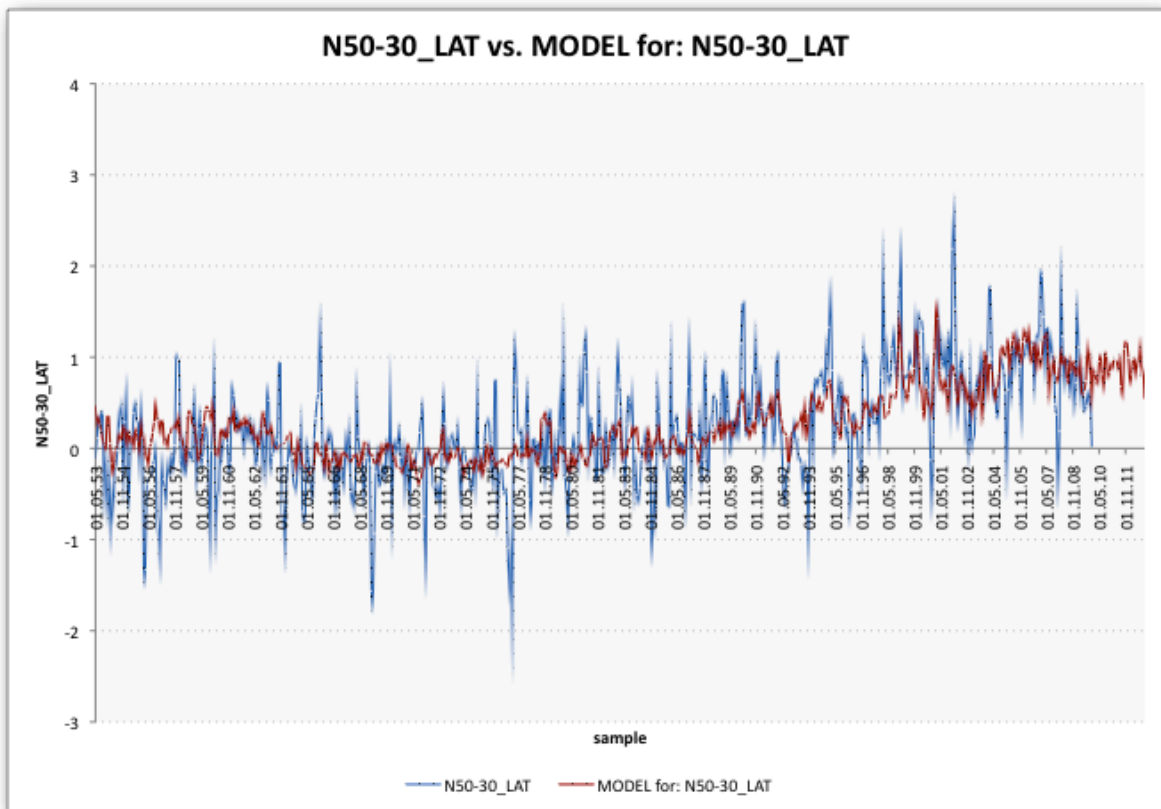
Number of potential inputs: 4830

Noise immunity: VERY GOOD  
 Model type: non-linear dynamic input-output model  
 Max. time lag: 840  
 Forecast horizon: 36  
 Number of models to survive: 30  
 Network layers used: 3

**MODEL EVALUATION: UNCERTAIN**

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 15%.

The model was generated by self-organizing high-dimensional modeling.



**MODEL FOR REGION N30-N10\_LAT**

$$\begin{aligned}
 X7(t) &= 0.109535z11 + 0.404677z82 + 0.222982 \\
 z11 &= 1.05174X7(t-174) - 0.0194042 \\
 z82 &= 1.00845z72 + 0.302101z11z72 \\
 z11 &= 1.18262X8(t-649) + 0.069987 \\
 z72 &= 0.291158z11 + 0.970381z62 \\
 z11 &= 1.1082X8(t-725) + 0.0959792 \\
 z62 &= -0.323267z11 + 1.18877z52 \\
 z11 &= 0.986509X7(t-92) + 0.59889X15(t-87) + 1.24472X7(t-92)X15(t-87) - 0.156065 \\
 z52 &= 0.311183z21 + 0.780995z42 \\
 z21 &= 0.770497z11 + 0.757826z12 - 0.212446z11z12 \\
 z11 &= 1.03694X7(t-92) + 1.83606X7(t-92)X8(t-725) + 0.644466X7(t-92)X7(t-92) - 1.65794X8(t-725)X8(t-725) - 0.101332
 \end{aligned}$$

$$\begin{aligned}z_{12} &= 0.969739X_7(t-133) + 0.977452X_8(t-684) + 0.736517X_7(t-133)X_7(t-133) - 0.0671654 \\z_{42} &= 0.511886z_{11} + 0.923545z_{32} + 0.320213z_{11}z_{32} \\z_{11} &= 1.37568X_8(t-695) + 0.11149 \\z_{32} &= 0.595505z_{11} + 0.829101z_{22} - 0.24z_{11}z_{22} \\z_{11} &= 1.08186X_{15}(t-87) + 1.15919X_8(t-690) + 3.67352X_{15}(t-87)X_8(t-690) + 2.31153X_{15}(t-87)X_{15}(t-87) - \\ &0.0705933 \\z_{22} &= 0.71183z_{11} + 0.611026z_{12} \\z_{11} &= 0.573992X_7(t-61) + 0.683971X_7(t-92) + 1.44347X_7(t-61)X_7(t-92) - 0.249409 \\z_{12} &= 1.0881X_7(t-128) + 1.07849X_8(t-649) + 0.718524X_7(t-128)X_7(t-128) - 0.0962556\end{aligned}$$

TARGET VARIABLE:

X7(t) : N30-10\_LAT (H)

RELEVANT INPUT VARIABLES: 11

X7(t-61) : N30-10\_LAT (H)  
X7(t-92) : N30-10\_LAT (H)  
X7(t-128) : N30-10\_LAT (H)  
X7(t-133) : N30-10\_LAT (H)  
X7(t-174) : N30-10\_LAT (H)  
X8(t-649) : N10-S10\_LAT (I)  
X8(t-684) : N10-S10\_LAT (I)  
X8(t-690) : N10-S10\_LAT (I)  
X8(t-695) : N10-S10\_LAT (I)  
X8(t-725) : N10-S10\_LAT (I)  
X15(t-87) : N50-30\_sst (P)

MODEL ACCURACY: 0,56

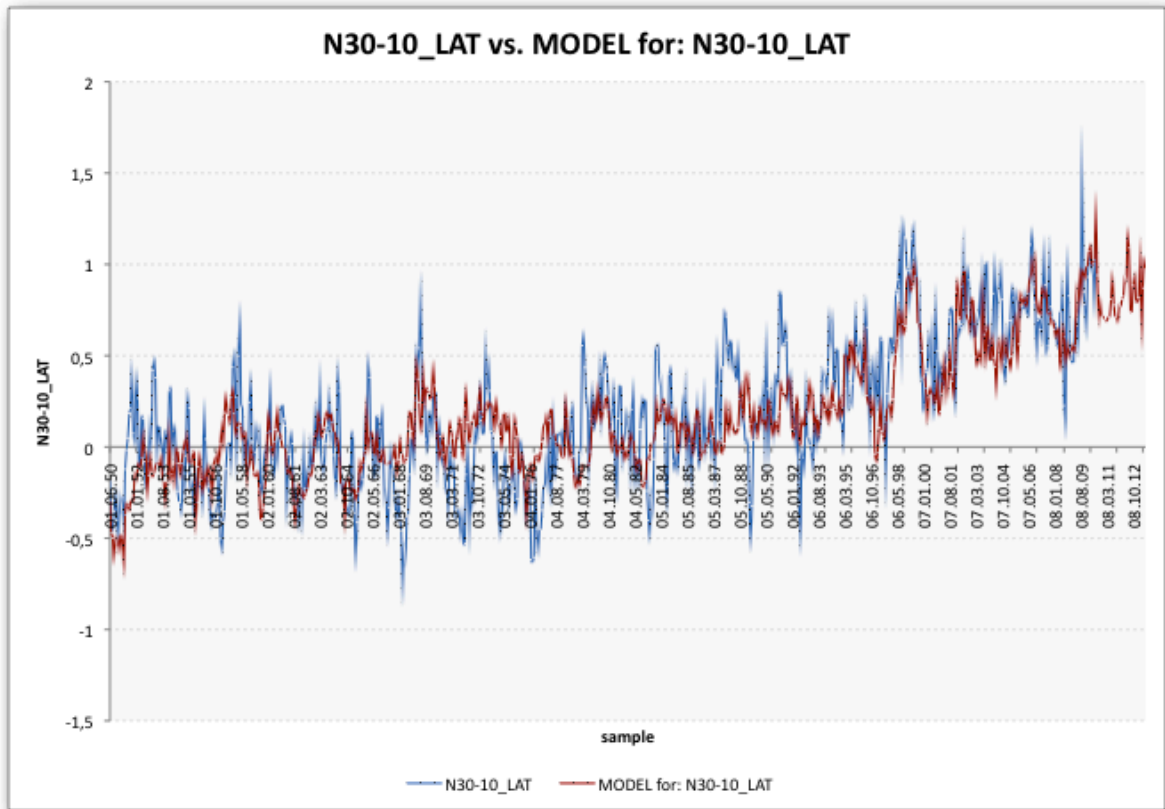
CHOSEN PARAMETERS:

Number of samples: 1440  
Starting at row: 6  
Number of potential inputs: 4830  
Noise immunity: VERY GOOD  
Model type: non-linear dynamic input-output model  
Max. time lag: 840  
Forecast horizon: 36  
Number of models to survive: 30  
Network layers used: 9

MODEL EVALUATION: VALID

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 28%.

The model was generated by self-organizing high-dimensional modeling.



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**MODEL FOR REGION N10-S10\_LAT**

$$X8(t) = 0.174924z31 + 0.164768z32 + 0.160398$$

$$z31 = 0.405612z11 + 0.776364z22$$

$$z11 = 0.920514X16(t-696) + 2.52191X16(t-789) + 1.9257X16(t-696)X16(t-789) - 2.04868X16(t-696)X16(t-696) + 0.995425X16(t-789)X16(t-789) + 0.807857$$

$$z22 = 0.812796z11 + 0.646579z12$$

$$z11 = 2.12108X17(t-176) + 1.30678X16(t-811) + 2.22538X17(t-176)X16(t-811) + 1.59199X17(t-176)X17(t-176) + 0.273151$$

$$z12 = 0.632908X16(t-691) - 3.61105X16(t-644)X16(t-691) + 0.43344$$

$$z32 = 0.356371z11 + 0.806493z22$$

$$z11 = 1.84325X16(t-691) + 2.01594X16(t-789) + 1.69188X16(t-691)X16(t-789) + 0.788455$$

$$z22 = 0.840571z11 + 0.684576z12$$

$$z11 = 2.12108X17(t-176) + 1.30678X16(t-811) + 2.22538X17(t-176)X16(t-811) + 1.59199X17(t-176)X17(t-176) + 0.273151$$

$$z12 = -4.62118X16(t-696)X16(t-644) + 0.366699$$

TARGET VARIABLE:

X8(t) : N10-S10\_LAT (I)

RELEVANT INPUT VARIABLES: 6

X16(t-644) : N30-10\_sst (Q)

X16(t-691) : N30-10\_sst (Q)

X16(t-696) : N30-10\_sst (Q)

X16(t-789) : N30-10\_sst (Q)

X16(t-811) : N30-10\_sst (Q)

X17(t-176) : N10-S10\_sst (R)

MODEL ACCURACY: 0,6

CHOSEN PARAMETERS:

Number of samples: 1440

Starting at row: 6

Number of potential inputs: 4830

Noise immunity: VERY GOOD

Model type: non-linear dynamic input-output model

Max. time lag: 840

Forecast horizon: 36

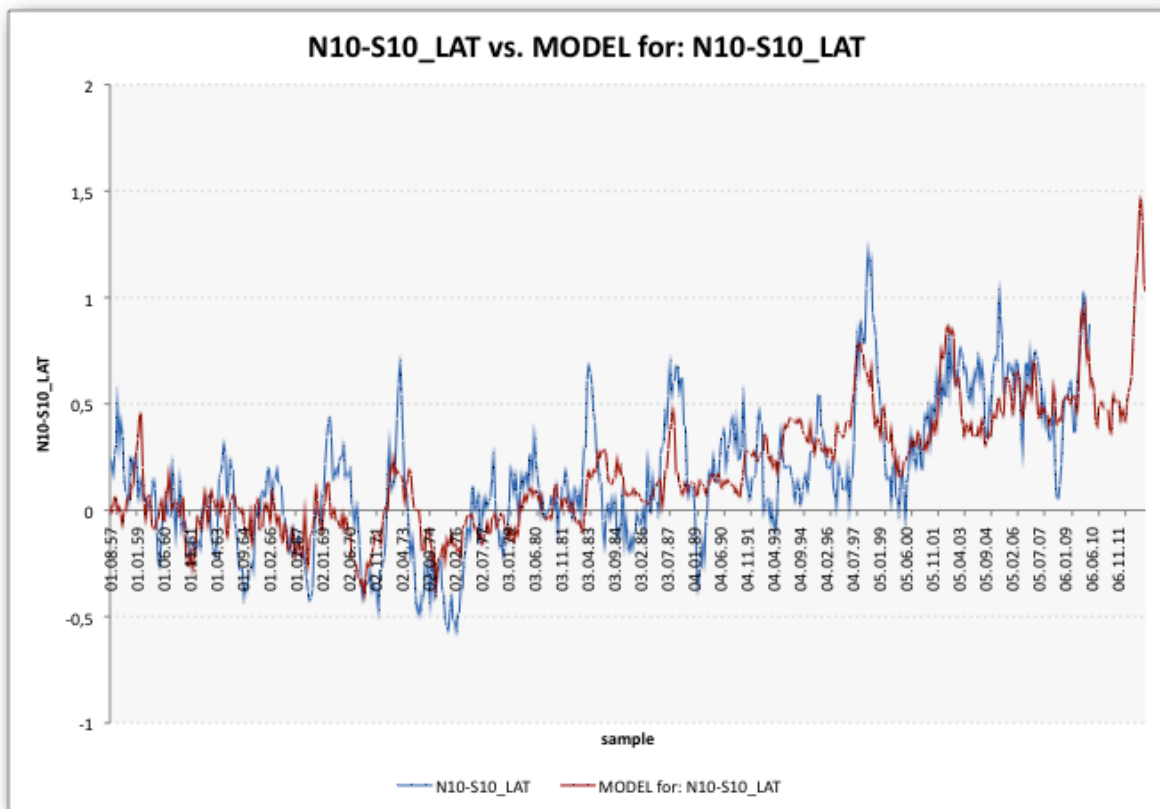
Number of models to survive: 30

Network layers used: 4

MODEL EVALUATION: VALID

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 31%.

The model was generated by self-organizing high-dimensional modeling.




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### MODEL FOR REGION S10-S30\_LAT

$$X9(t) = 0.167767z11 + 0.262605z22 + 0.139949$$

$$z11 = 1.00308X19(t-125) - 2.12872X19(t-125)X19(t-486) - 0.778801X19(t-486)X19(t-486) + 0.361519$$

$$z22 = 0.730449z11 + 0.665699z12$$

$$z11 = 0.674209X19(t-779) - 3.48369X18(t-128)X19(t-779) + 0.543637$$



$$z_{12} = 1.81325X_{17}(t-47) + 0.848001X_{19}(t-652) + 1.29608X_{17}(t-47)X_{19}(t-652) + 0.295772$$

TARGET VARIABLE:

X9(t) : S10-30\_LAT (J)

RELEVANT INPUT VARIABLES: 6

X17(t-47) : N10-S10\_sst (R)

X18(t-128) : S10-30\_sst (S)

X19(t-125) : S30-50\_sst (T)

X19(t-486) : S30-50\_sst (T)

X19(t-652) : S30-50\_sst (T)

X19(t-779) : S30-50\_sst (T)

MODEL ACCURACY: 0,45

CHOSEN PARAMETERS:

Number of samples: 1440

Starting at row: 6

Number of potential inputs: 4830

Noise immunity: VERY GOOD

Model type: non-linear dynamic input-output model

Max. time lag: 840

Forecast horizon: 36

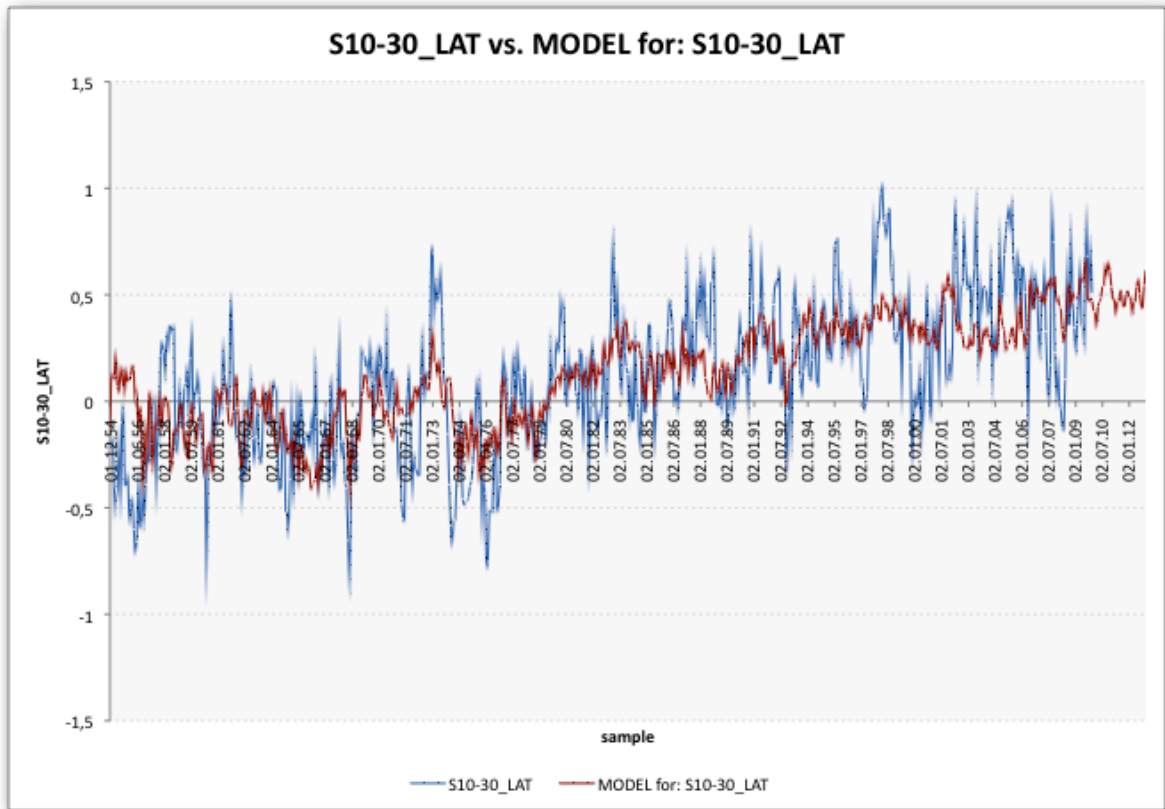
Number of models to survive: 30

Network layers used: 3

MODEL EVALUATION: VALID

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 20%.

The model was generated by self-organizing high-dimensional modeling.



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**MODEL FOR REGION S30-S50\_LAT**

$$\begin{aligned}
 X_{10}(t) &= 0.172185z_{11} + 0.325905z_{22} + 0.0771353 \\
 z_{11} &= 0.190981X_{11}(t-197) - 1.10998X_{19}(t-475)X_{19}(t-475) + 0.263282 \\
 z_{22} &= 0.777252z_{11} + 0.525428z_{12} \\
 z_{11} &= 1.05608X_{18}(t-124) + 1.01863X_{19}(t-80) + 0.0896152 \\
 z_{12} &= -1.63403X_{19}(t-776)X_{19}(t-793) + 0.515592
 \end{aligned}$$

TARGET VARIABLE:

X<sub>10</sub>(t) : S30-50\_LAT (K)

RELEVANT INPUT VARIABLES: 6

- X<sub>11</sub>(t-197) : S50-70\_LAT (L)
- X<sub>18</sub>(t-124) : S10-30\_sst (S)
- X<sub>19</sub>(t-80) : S30-50\_sst (T)
- X<sub>19</sub>(t-475) : S30-50\_sst (T)
- X<sub>19</sub>(t-776) : S30-50\_sst (T)
- X<sub>19</sub>(t-793) : S30-50\_sst (T)

MODEL ACCURACY: 0,24

CHOSEN PARAMETERS:

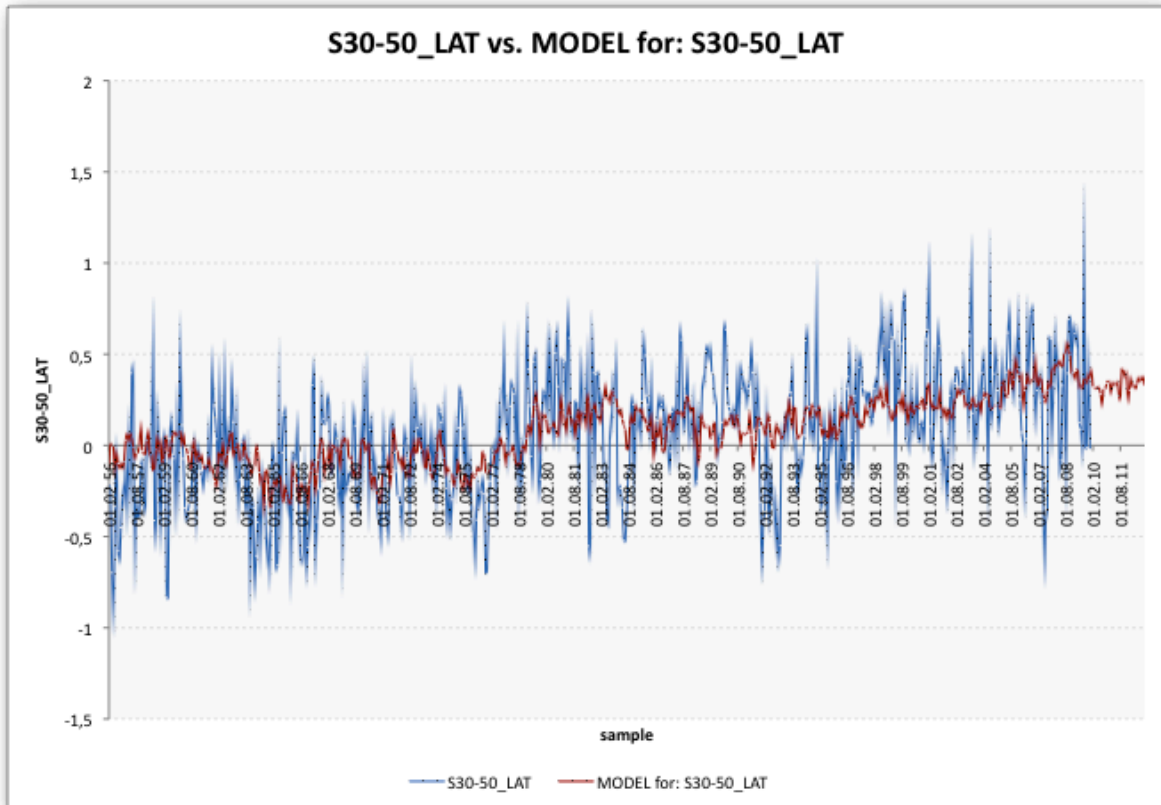
- Number of samples: 1440
- Starting at row: 6
- Number of potential inputs: 4830
- Noise immunity: VERY GOOD

Model type: non-linear dynamic input-output model  
 Max. time lag: 840  
 Forecast horizon: 36  
 Number of models to survive: 30  
 Network layers used: 3

**MODEL EVALUATION: UNCERTAIN**

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 7%.

The model was generated by self-organizing high-dimensional modeling.



**MODEL FOR REGION S50-S70\_LAT**

$$\begin{aligned}
 X11(t) &= 0.417189z11 + 0.594519z22 + 0.0843051 \\
 z11 &= -1.8034X19(t-343)X19(t-772) + 0.277911 \\
 z22 &= 1.03759z12 + 1.88321z11z12 \\
 z11 &= -0.00376281X21(t-239) - 0.162142 \\
 z12 &= 1.06799X19(t-137) - 0.70618X19(t-772)X19(t-772) + 0.363427
 \end{aligned}$$

**TARGET VARIABLE:**

X11(t) : S50-70\_LAT (L)

**RELEVANT INPUT VARIABLES: 4**

X19(t-137) : S30-50\_sst (T)  
 X19(t-343) : S30-50\_sst (T)

X19(t-772) : S30-50\_sst (T)  
X21(t-239) : S70-90\_sst (V)

MODEL ACCURACY: 0,17

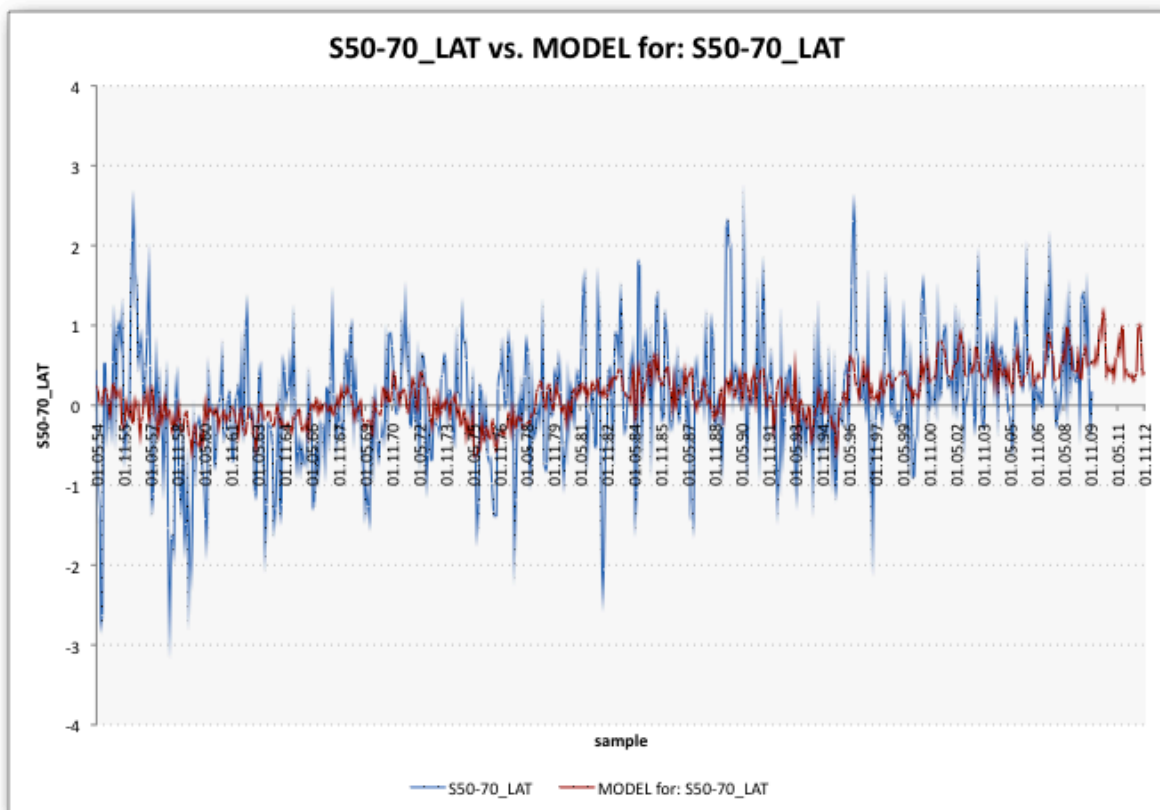
CHOSEN PARAMETERS:

Number of samples: 1440  
Starting at row: 6  
Number of potential inputs: 4830  
Noise immunity: VERY GOOD  
Model type: non-linear dynamic input-output model  
Max. time lag: 840  
Forecast horizon: 36  
Number of models to survive: 30  
Network layers used: 3

MODEL EVALUATION: UNCERTAIN

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 3%.

The model was generated by self-organizing high-dimensional modeling.



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**MODEL FOR REGION S70-S90\_LAT**

$$X12(t) = 1.55438z11 + 1.57818z42 - 0.0434656$$
$$z11 = -0.0681526X11(t-788)X12(t-83) + 0.00298016$$
$$z42 = 0.844385z31 + 0.690787z32$$

$$\begin{aligned}z_{31} &= 0.952515z_{21} + 0.935358z_{22} \\z_{21} &= 0.982277z_{11} + 0.977787z_{12} \\z_{11} &= -0.0705814X_{12}(t-327)X_{12}(t-301) + 0.00046748 \\z_{12} &= 0.00322009X_{20}(t-792)X_{21}(t-63) - 0.0913491 \\z_{22} &= -57.5736z_{11}z_{12} \\z_{11} &= 0.437474X_{11}(t-788)X_3(t-420) + 0.00230357 \\z_{12} &= 6.0985e-05X_{21}(t-529)X_{21}(t-274) - 0.0205919 \\z_{32} &= 0.885278z_{22} + 2.40753z_{11}z_{11} \\z_{11} &= 0.00322009X_{20}(t-792)X_{21}(t-63) - 0.0913491 \\z_{22} &= 18.1124z_{11}z_{12} \\z_{11} &= 0.0436461X_{12}(t-83)X_{12}(t-98) - 0.00831673 \\z_{12} &= -0.325262X_{12}(t-536)X_3(t-788) - 0.0131228\end{aligned}$$

TARGET VARIABLE:

X12(t) : S70-90\_LAT (M)

RELEVANT INPUT VARIABLES: 12

X3(t-420) : anomalies\_sh\_land\_sea (D)  
X3(t-788) : anomalies\_sh\_land\_sea (D)  
X11(t-788) : S50-70\_LAT (L)  
X12(t-83) : S70-90\_LAT (M)  
X12(t-98) : S70-90\_LAT (M)  
X12(t-301) : S70-90\_LAT (M)  
X12(t-327) : S70-90\_LAT (M)  
X12(t-536) : S70-90\_LAT (M)  
X20(t-792) : S50-70\_sst (U)  
X21(t-63) : S70-90\_sst (V)  
X21(t-274) : S70-90\_sst (V)  
X21(t-529) : S70-90\_sst (V)

MODEL ACCURACY: 0,16

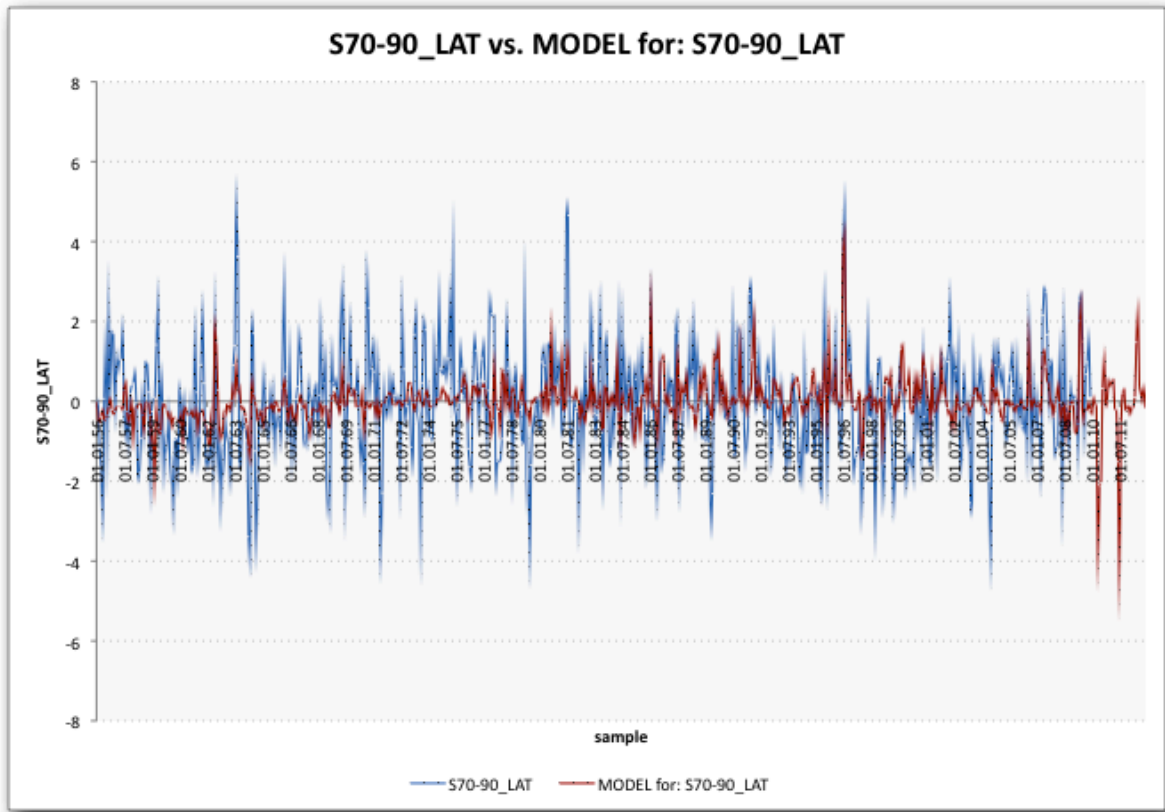
CHOSEN PARAMETERS:

Number of samples: 1440  
Starting at row: 6  
Number of potential inputs: 4025  
Noise immunity: VERY GOOD  
Model type: non-linear dynamic input-output model  
Max. time lag: 840  
Forecast horizon: 36  
Number of models to survive: 30  
Network layers used: 5

MODEL EVALUATION: UNCERTAIN

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 2%.

The model was generated by self-organizing high-dimensional modeling.




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## 2. Sea Surface Temperatures

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### MODEL FOR REGION N90-N70\_SST

$$\begin{aligned}
 X13(t) &= 0.233759z21 + 0.499172z32 + 0.495597 \\
 z21 &= 0.982486z12 - 2.82064z11z11 \\
 z11 &= 0.0880676X4(t-592) - 0.0179938 \\
 z12 &= 0.807665X2(t-41) + 1.38221X2(t-41)X2(t-41) - 0.211832 \\
 z32 &= 0.813061z11 + 0.978463z22 \\
 z11 &= 0.192111X5(t-726) + 0.0406887 \\
 z22 &= 0.940525z11 + 0.899451z12 \\
 z11 &= 2.5488X2(t-36)X14(t-47) - 0.159505 \\
 z12 &= -0.111515X4(t-588)X4(t-592) + 0.0980014
 \end{aligned}$$

TARGET VARIABLE:

X13(t) : N90-70\_sst (N)

RELEVANT INPUT VARIABLES: 6

X2(t-36) : anomalies\_nh\_land\_sea (C)  
 X2(t-41) : anomalies\_nh\_land\_sea (C)  
 X4(t-588) : N90-70\_LAT (E)  
 X4(t-592) : N90-70\_LAT (E)  
 X5(t-726) : N70-50\_LAT (F)  
 X14(t-47) : N70-50\_sst (O)

MODEL ACCURACY: 0,26

CHOSEN PARAMETERS:

Number of samples: 1440

Starting at row: 6

Number of potential inputs: 4830

Noise immunity: VERY GOOD

Model type: non-linear dynamic input-output model

Max. time lag: 840

Forecast horizon: 36

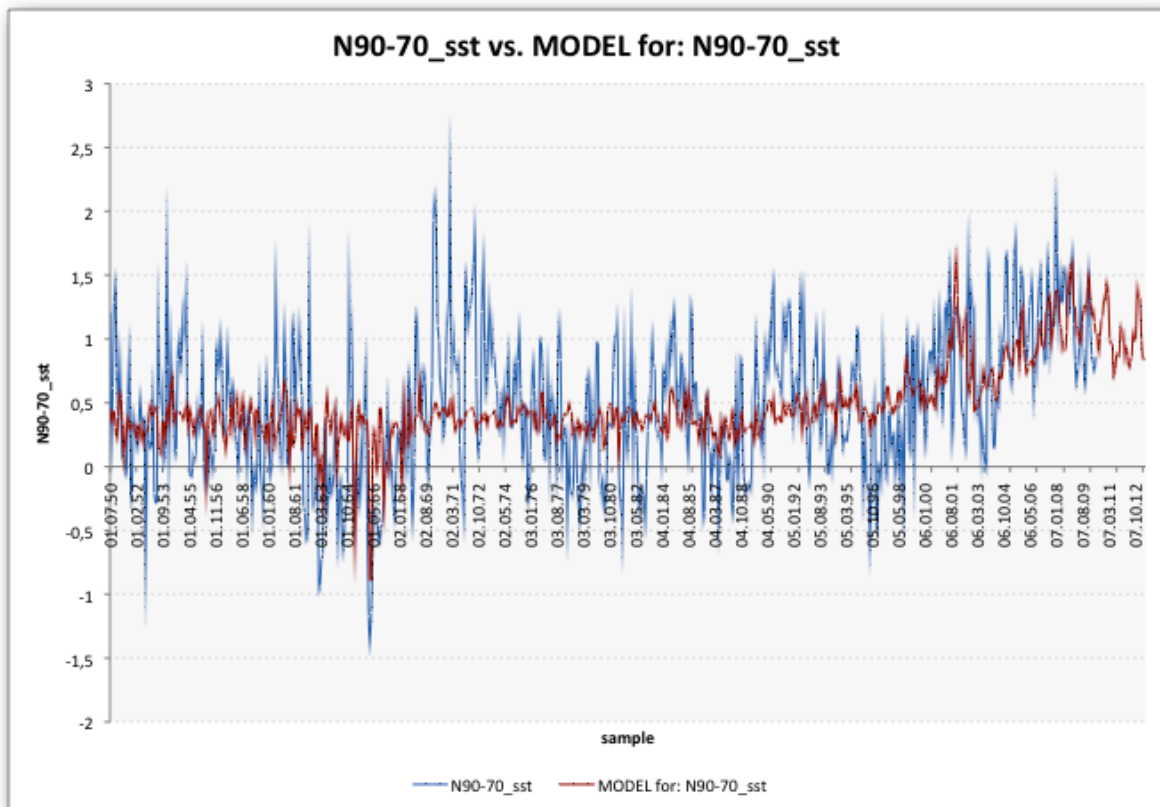
Number of models to survive: 30

Network layers used: 4

MODEL EVALUATION: UNCERTAIN

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 8%.

The model was generated by self-organizing high-dimensional modeling.



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### MODEL FOR REGION N70-N50\_SST

$$X14(t) = -0.110329z21 + 0.437647z52 + 0.197148$$

$$z21 = 0.731628z11 + 0.607381z12$$

$$z11 = 1.41596X15(t-72) + 0.726922X15(t-59) + 2.56828X15(t-59)X15(t-59) - 0.250834$$

$$z12 = 0.184226X13(t-768) + 1.23061X15(t-37) + 2.2779X15(t-37)X15(t-37) - 0.176869$$

$$z52 = -0.414473z11 + 1.35641z42$$

$$z11 = 1.22088X15(t-72) + 1.09226X15(t-37) + 3.02011X15(t-72)X15(t-37) - 0.182536$$

$$z42 = 0.631093z31 + 0.40278z32$$

$$z31 = 0.605126z11 + 0.971221z22$$

$$z11 = 0.292155X13(t-768) + 0.0989696$$

$$z22 = 0.745883z11 + 0.482248z12$$

$$z11 = 1.26577X15(t-72) + 0.816104X15(t-37) + 2.31553X15(t-72)X15(t-37) + 1.3146X15(t-37)X15(t-37) - 0.248899$$

$$z12 = 0.188795X13(t-721) + 1.32579X15(t-59) + 2.7106X15(t-59)X15(t-59) - 0.192$$

$$z32 = 0.502369z11 + 0.975044z22 + 0.791034z11z11$$

$$z11 = 0.252821X13(t-711) + 0.0602721$$

$$z22 = 0.788346z11 + 0.498955z12 - 0.124751z11z12$$

$$z11 = 1.26577X15(t-72) + 0.816104X15(t-37) + 2.31553X15(t-72)X15(t-37) + 1.3146X15(t-37)X15(t-37) - 0.248899$$

$$z12 = 1.01488X15(t-61) + 0.609738X15(t-50) + 3.42723X15(t-61)X15(t-50) - 0.2101$$

TARGET VARIABLE:

X14(t) : N70-50\_sst (O)

RELEVANT INPUT VARIABLES: 8

X13(t-711) : N90-70\_sst (N)

X13(t-721) : N90-70\_sst (N)

X13(t-768) : N90-70\_sst (N)

X15(t-37) : N50-30\_sst (P)

X15(t-50) : N50-30\_sst (P)

X15(t-59) : N50-30\_sst (P)

X15(t-61) : N50-30\_sst (P)

X15(t-72) : N50-30\_sst (P)

MODEL ACCURACY: 0,55

CHOSEN PARAMETERS:

Number of samples: 1440

Starting at row: 6

Number of potential inputs: 4830

Noise immunity: VERY GOOD

Model type: non-linear dynamic input-output model

Max. time lag: 840

Forecast horizon: 36

Number of models to survive: 30

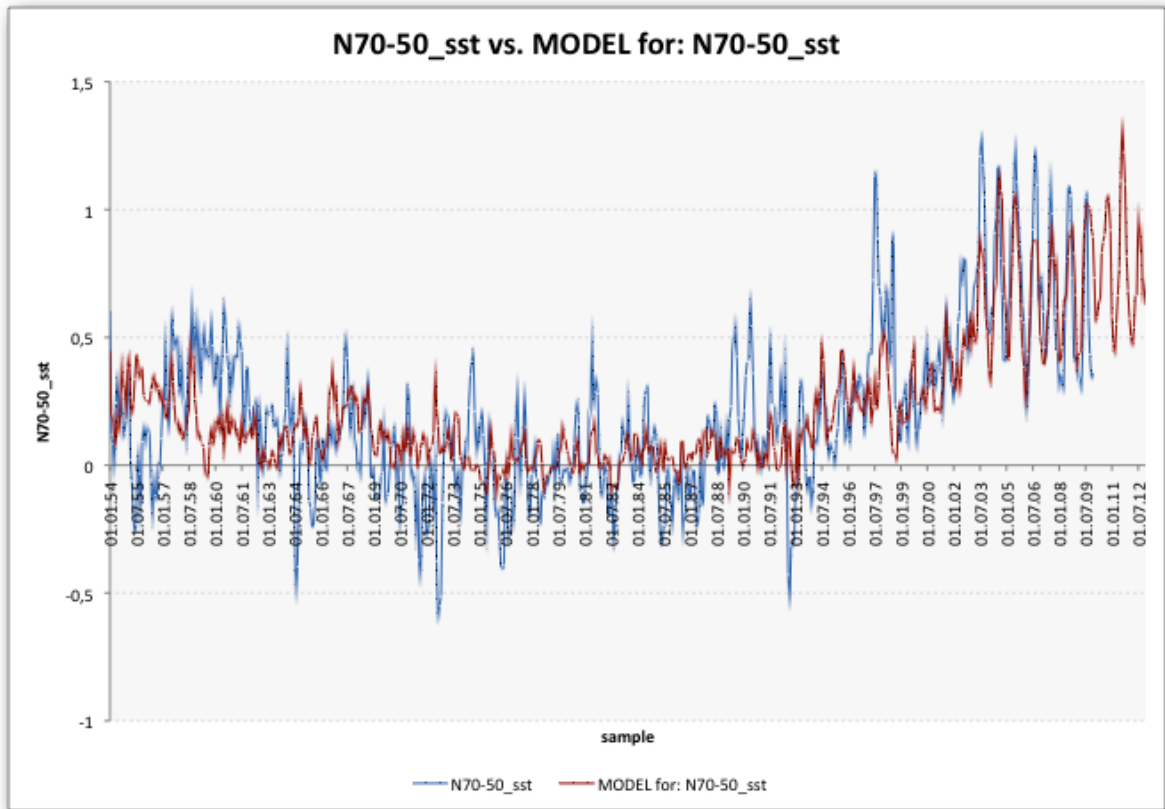
Network layers used: 6

MODEL EVALUATION: VALID

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 27%.

The model was generated by self-organizing high-dimensional modeling.






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**MODEL FOR REGION N50-N30\_SST**

$$\begin{aligned}
 X15(t) &= -0.0654878z11 + 0.342083z32 + 0.0794725 \\
 z11 &= 1.81389X16(t-769) + 0.908846X14(t-757) + 0.65481X14(t-757)X14(t-757) + 0.381884 \\
 z32 &= 0.290742z11 + 0.792926z22 \\
 z11 &= 2.385X16(t-770) + 1.29865X15(t-793) + 1.64844X16(t-770)X15(t-793) + 0.751736 \\
 z22 &= 0.678136z11 + 0.561095z12 \\
 z11 &= 2.02818X16(t-769) + 1.03154X14(t-743) + 1.3476X16(t-769)X14(t-743) + 0.470017 \\
 z12 &= 1.17948X14(t-48) + 1.16883X14(t-757) + 0.729332X14(t-757)X14(t-757) - 0.218119
 \end{aligned}$$

TARGET VARIABLE:

X15(t) : N50-30\_sst (P)

RELEVANT INPUT VARIABLES: 6

X14(t-48) : N70-50\_sst (O)  
 X14(t-743) : N70-50\_sst (O)  
 X14(t-757) : N70-50\_sst (O)  
 X15(t-793) : N50-30\_sst (P)  
 X16(t-769) : N30-10\_sst (Q)  
 X16(t-770) : N30-10\_sst (Q)

MODEL ACCURACY: 0,6

CHOSEN PARAMETERS:

Number of samples: 1440

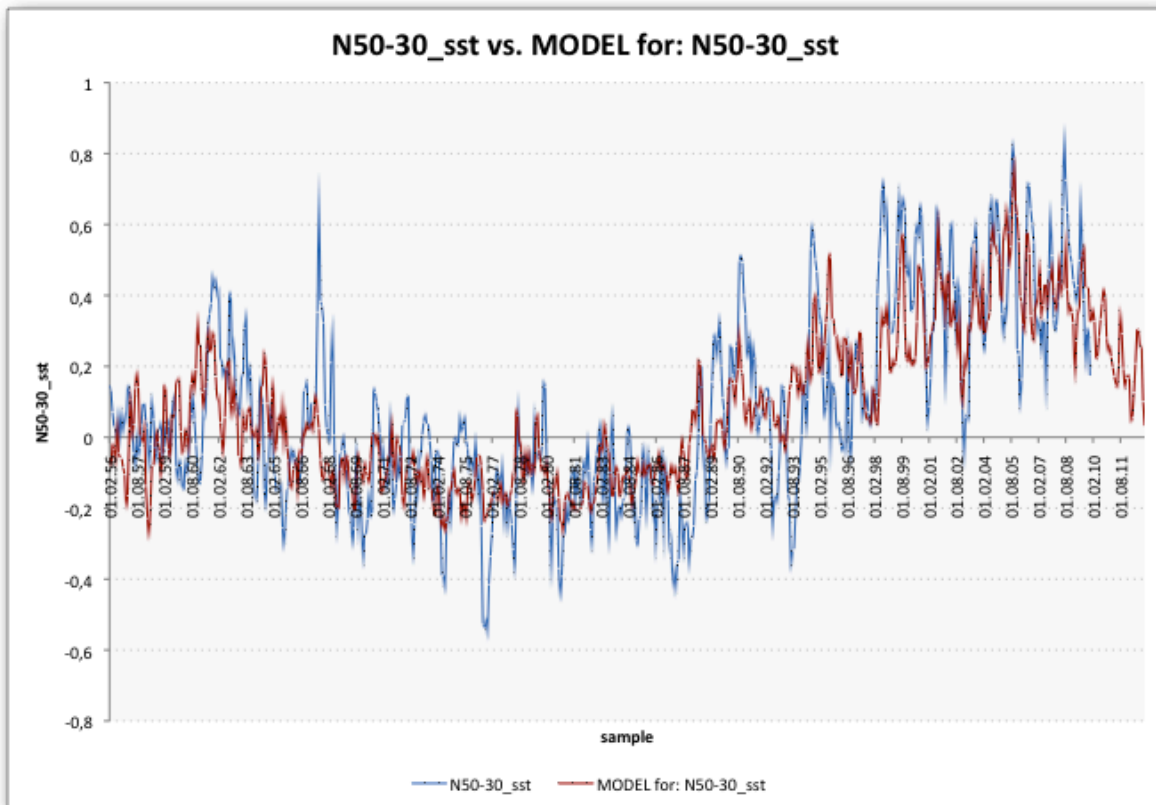
Starting at row: 6

Number of potential inputs: 4830  
Noise immunity: VERY GOOD  
Model type: non-linear dynamic input-output model  
Max. time lag: 840  
Forecast horizon: 36  
Number of models to survive: 30  
Network layers used: 4

**MODEL EVALUATION: VALID**

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 31%.

The model was generated by self-organizing high-dimensional modeling.



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**MODEL FOR REGION N30-N10\_SST**

$$\begin{aligned} X16(t) &= 0.205992z52 - 0.0517404z31z52 + 0.0423242z52z52 + 0.0741697 \\ z31 &= 0.310243z11 + 0.958128z22 - 0.223881z11z22 \\ z11 &= 1.14184X15(t-60) + 0.694205X15(t-86) + 2.06217X15(t-86)X15(t-86) - 0.188826 \\ z22 &= 1.19034z11 + 0.898921z12 - 1.17615z11z12 \\ z11 &= 1.0281X15(t-60) + 0.77631X15(t-86) + 2.53046X15(t-60)X15(t-86) - 0.123598 \\ z12 &= -3.99674X16(t-614)X16(t-661) + 0.293506 \\ z52 &= 0.813521z41 + 0.235114z42 \\ z41 &= 0.674019z31 + 0.344049z32 \\ z31 &= 0.661581z21 + 0.498798z22 \\ z21 &= 0.883974z11 + 0.761005z12 \\ z11 &= 1.14302X15(t-86) + 1.96982X16(t-736) + 0.415016 \end{aligned}$$

$$\begin{aligned}z_{12} &= -4.14783X_{16}(t-614)X_{16}(t-644) + 0.294325 \\z_{22} &= 1.17668z_{11} + 1.2522z_{12} - 0.290356z_{11}z_{11} + 0.348257z_{12}z_{12} \\z_{11} &= 1.14184X_{15}(t-60) + 0.694205X_{15}(t-86) + 2.06217X_{15}(t-86)X_{15}(t-86) - 0.188826 \\z_{12} &= -3.99674X_{16}(t-614)X_{16}(t-661) + 0.293506 \\z_{32} &= 0.597049z_{11} + 0.878509z_{22} - 0.314705z_{11}z_{22} \\z_{11} &= 1.0281X_{15}(t-60) + 0.77631X_{15}(t-86) + 2.53046X_{15}(t-60)X_{15}(t-86) - 0.123598 \\z_{22} &= 0.874178z_{11} + 0.70508z_{12} \\z_{11} &= 0.75875X_{15}(t-86) + 1.9263X_{16}(t-736) + 2.01563X_{15}(t-86)X_{15}(t-86) + 0.296849 \\z_{12} &= -4.14783X_{16}(t-614)X_{16}(t-644) + 0.294325 \\z_{42} &= 1.17889z_{32} - 0.350349z_{11}z_{11} + 0.186372z_{32}z_{32} \\z_{11} &= 1.14184X_{15}(t-60) + 0.694205X_{15}(t-86) + 2.06217X_{15}(t-86)X_{15}(t-86) - 0.188826 \\z_{32} &= 1.0718z_{22} - 0.532474z_{11}z_{22} + 0.685988z_{11}z_{11} \\z_{11} &= 1.52997X_{15}(t-86) - 0.041078 \\z_{22} &= 1.19034z_{11} + 0.898921z_{12} - 1.17615z_{11}z_{12} \\z_{11} &= 1.0281X_{15}(t-60) + 0.77631X_{15}(t-86) + 2.53046X_{15}(t-60)X_{15}(t-86) - 0.123598 \\z_{12} &= -3.99674X_{16}(t-614)X_{16}(t-661) + 0.293506\end{aligned}$$

TARGET VARIABLE:

X16(t) : N30-10\_sst (Q)

RELEVANT INPUT VARIABLES: 6

X15(t-60) : N50-30\_sst (P)  
X15(t-86) : N50-30\_sst (P)  
X16(t-614) : N30-10\_sst (Q)  
X16(t-644) : N30-10\_sst (Q)  
X16(t-661) : N30-10\_sst (Q)  
X16(t-736) : N30-10\_sst (Q)

MODEL ACCURACY: 0,59

CHOSEN PARAMETERS:

Number of samples: 1440

Starting at row: 6

Number of potential inputs: 4830

Noise immunity: VERY GOOD

Model type: non-linear dynamic input-output model

Max. time lag: 840

Forecast horizon: 36

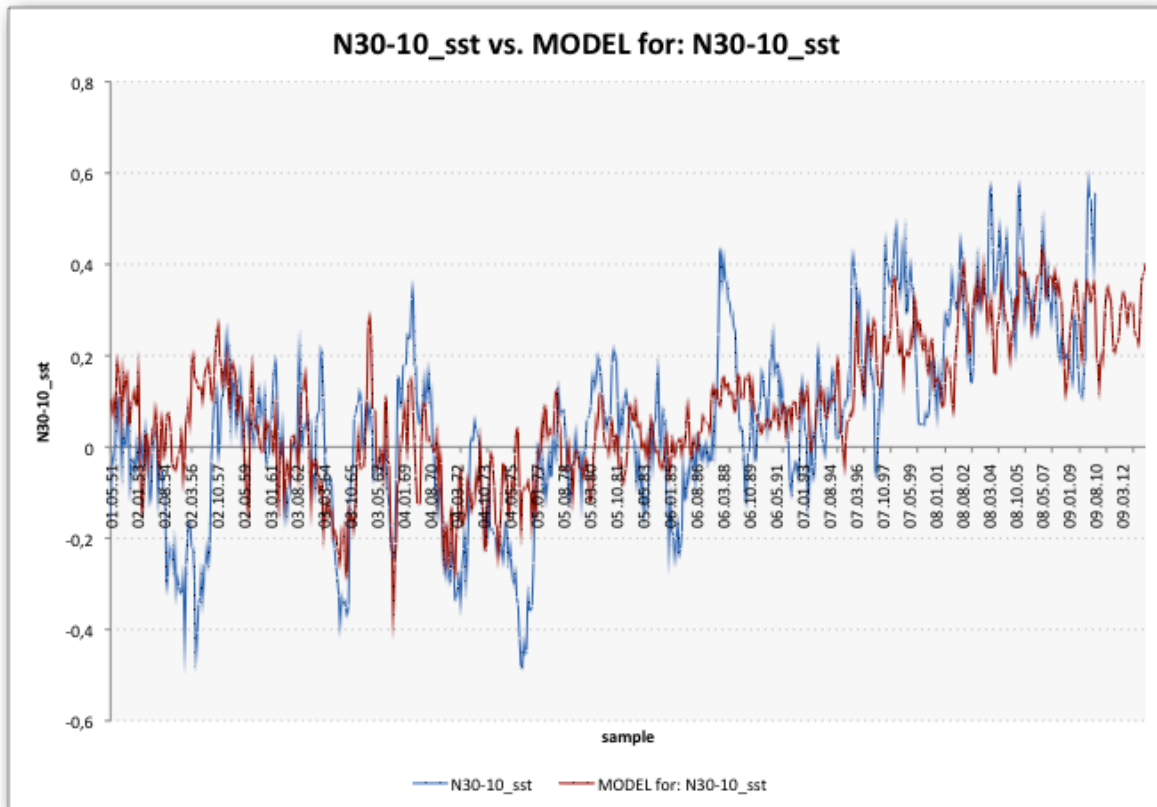
Number of models to survive: 30

Network layers used: 6

MODEL EVALUATION: VALID

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 30%.

The model was generated by self-organizing high-dimensional modeling.




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**MODEL FOR REGION N10-S10\_SST**

$$\begin{aligned}
 X17(t) &= -0.163032z91 + 0.484582z142 + 0.0946006 \\
 z91 &= -0.293518z11 + 1.14299z82 + 0.0857425z11z82 \\
 z11 &= 1.51804X17(t-179) + 1.30249X16(t-690) + 1.68212X17(t-179)X16(t-690) + 0.343742 \\
 z82 &= -0.198502z11 + 1.02439z72 - 0.200896z11z72 \\
 z11 &= 1.32329X16(t-652) + 0.281069 \\
 z72 &= -0.155941z11 + 1.06557z62 - 0.0972887z11z11 \\
 z11 &= 0.946305X16(t-731) + 0.565001X16(t-643) - 2.25169X16(t-731)X16(t-643) + 0.479649 \\
 z62 &= 1.07635z52 - 0.237555z11z11 + 0.137429z52z52 \\
 z11 &= 1.60739X17(t-179) + 2.37933X17(t-179)X17(t-179) - 1.98873X16(t-652)X16(t-652) + 0.125197 \\
 z52 &= 0.982107z42 + 0.454946z11z42 - 0.197637z42z42 \\
 z11 &= 1.14834X17(t-179) - 2.78486X17(t-179)X16(t-502) + 0.175966 \\
 z42 &= -0.414357z11 + 1.28971z32 \\
 z11 &= 1.60739X17(t-179) + 2.37933X17(t-179)X17(t-179) - 1.98873X16(t-652)X16(t-652) + 0.125197 \\
 z32 &= 0.594482z21 + 0.507264z22 \\
 z21 &= 0.78597z11 + 0.753401z12 \\
 z11 &= 1.13463X17(t-179) - 3.20537X17(t-179)X17(t-506) + 2.33773X17(t-179)X17(t-179) - 0.0695927 \\
 z12 &= -5.87893X16(t-690)X16(t-643) + 1.0974X16(t-643)X16(t-643) + 0.348153 \\
 z22 &= 0.781652z11 + 0.617367z12 \\
 z11 &= 1.55927X17(t-179) + 0.898456X16(t-614) + 2.42007X17(t-179)X17(t-179) - 1.06576X16(t-614)X16(t-614) + 0.182795 \\
 z12 &= 1.46161X16(t-731) - 3.84217X16(t-731)X16(t-502) + 0.425517 \\
 z142 &= 0.251115z101 + 0.758978z132 \\
 z101 &= -0.323954z11 + 1.12007z92 - 0.129912z11z11 \\
 z11 &= 0.668067X16(t-690) - 3.17883X16(t-690)X16(t-652) + 0.415638 \\
 z92 &= 0.977736z82 - 0.337572z11z82 + 0.333673z11z11
 \end{aligned}$$

$$\begin{aligned}
 z11 &= 1.46803X16(t-643) + 0.311396 \\
 z82 &= -0.21857z11 + 1.10214z72 + 0.0862864z11z11 \\
 z11 &= 1.61334X17(t-179) + 1.12169X16(t-643) + 2.45341X17(t-179)X17(t-179) + 0.131799 \\
 z72 &= -0.155941z11 + 1.06557z62 - 0.0972887z11z11 \\
 z11 &= 0.946305X16(t-731) + 0.565001X16(t-643) - 2.25169X16(t-731)X16(t-643) + 0.479649 \\
 z62 &= 1.07635z52 - 0.237555z11z11 + 0.137429z52z52 \\
 z11 &= 1.60739X17(t-179) + 2.37933X17(t-179)X17(t-179) - 1.98873X16(t-652)X16(t-652) + 0.125197 \\
 z52 &= 0.982107z42 + 0.454946z11z42 - 0.197637z42z42 \\
 z11 &= 1.14834X17(t-179) - 2.78486X17(t-179)X16(t-502) + 0.175966 \\
 z42 &= -0.414357z11 + 1.28971z32 \\
 z11 &= 1.60739X17(t-179) + 2.37933X17(t-179)X17(t-179) - 1.98873X16(t-652)X16(t-652) + 0.125197 \\
 z32 &= 0.594482z21 + 0.507264z22 \\
 z21 &= 0.78597z11 + 0.753401z12 \\
 z11 &= 1.13463X17(t-179) - 3.20537X17(t-179)X17(t-506) + 2.33773X17(t-179)X17(t-179) - 0.0695927 \\
 z12 &= -5.87893X16(t-690)X16(t-643) + 1.0974X16(t-643)X16(t-643) + 0.348153 \\
 z22 &= 0.781652z11 + 0.617367z12 \\
 z11 &= 1.55927X17(t-179) + 0.898456X16(t-614) + 2.42007X17(t-179)X17(t-179) - 1.06576X16(t-614) \\
 X16(t-614) &+ 0.182795 \\
 z12 &= 1.46161X16(t-731) - 3.84217X16(t-731)X16(t-502) + 0.425517 \\
 z132 &= -0.655067z71 + 1.68359z122 + 0.342884z71z122 - 0.370965z122z122 \\
 z71 &= 0.974351z62 - 0.656388z11z62 + 0.444169z11z11 + 0.123087z62z62 \\
 z11 &= -4.90008X16(t-690)X16(t-643) + 0.393177 \\
 z62 &= 1.07635z52 - 0.237555z11z11 + 0.137429z52z52 \\
 z11 &= 1.60739X17(t-179) + 2.37933X17(t-179)X17(t-179) - 1.98873X16(t-652)X16(t-652) + 0.125197 \\
 z52 &= 0.982107z42 + 0.454946z11z42 - 0.197637z42z42 \\
 z11 &= 1.14834X17(t-179) - 2.78486X17(t-179)X16(t-502) + 0.175966 \\
 z42 &= -0.414357z11 + 1.28971z32 \\
 z11 &= 1.60739X17(t-179) + 2.37933X17(t-179)X17(t-179) - 1.98873X16(t-652)X16(t-652) + 0.125197 \\
 z32 &= 0.594482z21 + 0.507264z22 \\
 z21 &= 0.78597z11 + 0.753401z12 \\
 z11 &= 1.13463X17(t-179) - 3.20537X17(t-179)X17(t-506) + 2.33773X17(t-179)X17(t-179) - 0.0695927 \\
 z12 &= -5.87893X16(t-690)X16(t-643) + 1.0974X16(t-643)X16(t-643) + 0.348153 \\
 z22 &= 0.781652z11 + 0.617367z12 \\
 z11 &= 1.55927X17(t-179) + 0.898456X16(t-614) + 2.42007X17(t-179)X17(t-179) - 1.06576X16(t-614)X16 \\
 (t-614) &+ 0.182795 \\
 z12 &= 1.46161X16(t-731) - 3.84217X16(t-731)X16(t-502) + 0.425517 \\
 z122 &= 1.01313z112 + 0.0992997z11z11 \\
 z11 &= 1.57522X16(t-731) - 2.69957X16(t-614)X16(t-614) + 0.64586 \\
 z112 &= 0.9821z102 - 0.370734z91z102 + 0.393096z91z91 \\
 z91 &= -0.241451z21 + 1.16569z82 - 0.113723z21z82 + 0.170709z21z21 \\
 z21 &= 0.760071z11 + 0.703067z12 + 0.313237z12z12 \\
 z11 &= -4.90008X16(t-690)X16(t-643) + 0.393177 \\
 z12 &= 0.854986X17(t-179) - 3.06441X17(t-179)X17(t-506) + 0.143052 \\
 z82 &= -0.221796z11 + 1.03125z72 - 0.173734z11z72 \\
 z11 &= 1.32329X16(t-652) + 0.281069 \\
 z72 &= -0.128147z11 + 1.05921z62 - 0.0941234z11z62 \\
 z11 &= 1.49996X16(t-731) - 1.95748X16(t-652)X16(t-652) + 0.56045 \\
 z62 &= 1.07635z52 - 0.237555z11z11 + 0.137429z52z52 \\
 z11 &= 1.60739X17(t-179) + 2.37933X17(t-179)X17(t-179) - 1.98873X16(t-652)X16(t-652) + 0.125197 \\
 z52 &= 0.982107z42 + 0.454946z11z42 - 0.197637z42z42 \\
 z11 &= 1.14834X17(t-179) - 2.78486X17(t-179)X16(t-502) + 0.175966 \\
 z42 &= -0.414357z11 + 1.28971z32 \\
 z11 &= 1.60739X17(t-179) + 2.37933X17(t-179)X17(t-179) - 1.98873X16(t-652)X16(t-652) + 0.125197 \\
 z32 &= 0.594482z21 + 0.507264z22 \\
 z21 &= 0.78597z11 + 0.753401z12
 \end{aligned}$$

0.0695927

$$z_{11} = 1.13463X_{17}(t-179) - 3.20537X_{17}(t-179)X_{17}(t-506) + 2.33773X_{17}(t-179)X_{17}(t-179) -$$

$$z_{12} = -5.87893X_{16}(t-690)X_{16}(t-643) + 1.0974X_{16}(t-643)X_{16}(t-643) + 0.348153$$

$$z_{22} = 0.781652z_{11} + 0.617367z_{12}$$

$$z_{11} = 1.55927X_{17}(t-179) + 0.898456X_{16}(t-614) + 2.42007X_{17}(t-179)X_{17}(t-179) - 1.06576X_{16}(t-614)X_{16}(t-614) + 0.182795$$

$$z_{12} = 1.46161X_{16}(t-731) - 3.84217X_{16}(t-731)X_{16}(t-502) + 0.425517$$

$$z_{102} = -0.266429z_{21} + 1.20822z_{92}$$

$$z_{21} = 0.760071z_{11} + 0.703067z_{12} + 0.313237z_{12}z_{12}$$

$$z_{11} = -4.90008X_{16}(t-690)X_{16}(t-643) + 0.393177$$

$$z_{12} = 0.854986X_{17}(t-179) - 3.06441X_{17}(t-179)X_{17}(t-506) + 0.143052$$

$$z_{92} = 0.541677z_{81} + 0.471752z_{82}$$

$$z_{81} = -0.258842z_{11} + 1.1446z_{72}$$

$$z_{11} = 1.51804X_{17}(t-179) + 1.30249X_{16}(t-690) + 1.68212X_{17}(t-179)X_{16}(t-690) + 0.343742$$

$$z_{72} = 0.974351z_{62} - 0.656388z_{11}z_{62} + 0.444169z_{11}z_{11} + 0.123087z_{62}z_{62}$$

$$z_{11} = -4.90008X_{16}(t-690)X_{16}(t-643) + 0.393177$$

$$z_{62} = 1.07635z_{52} - 0.237555z_{11}z_{11} + 0.137429z_{52}z_{52}$$

$$z_{11} = 1.60739X_{17}(t-179) + 2.37933X_{17}(t-179)X_{17}(t-179) - 1.98873X_{16}(t-652)X_{16}(t-652) + 0.125197$$

$$z_{52} = 0.982107z_{42} + 0.454946z_{11}z_{42} - 0.197637z_{42}z_{42}$$

$$z_{11} = 1.14834X_{17}(t-179) - 2.78486X_{17}(t-179)X_{16}(t-502) + 0.175966$$

$$z_{42} = -0.414357z_{11} + 1.28971z_{32}$$

0.125197

$$z_{11} = 1.60739X_{17}(t-179) + 2.37933X_{17}(t-179)X_{17}(t-179) - 1.98873X_{16}(t-652)X_{16}(t-652) +$$

$$z_{32} = 0.594482z_{21} + 0.507264z_{22}$$

$$z_{21} = 0.78597z_{11} + 0.753401z_{12}$$

$$z_{11} = 1.13463X_{17}(t-179) - 3.20537X_{17}(t-179)X_{17}(t-506) + 2.33773X_{17}(t-179)X_{17}(t-179) -$$

0.0695927

$$z_{12} = -5.87893X_{16}(t-690)X_{16}(t-643) + 1.0974X_{16}(t-643)X_{16}(t-643) + 0.348153$$

$$z_{22} = 0.781652z_{11} + 0.617367z_{12}$$

$$z_{11} = 1.55927X_{17}(t-179) + 0.898456X_{16}(t-614) + 2.42007X_{17}(t-179)X_{17}(t-179) - 1.06576X_{16}(t-614)X_{16}(t-614) + 0.182795$$

$$z_{12} = 1.46161X_{16}(t-731) - 3.84217X_{16}(t-731)X_{16}(t-502) + 0.425517$$

$$z_{82} = -0.154934z_{11} + 0.984053z_{72} - 0.374755z_{11}z_{72} + 0.0720454z_{72}z_{72}$$

$$z_{11} = 1.32329X_{16}(t-652) + 0.281069$$

$$z_{72} = -0.128147z_{11} + 1.05921z_{62} - 0.0941234z_{11}z_{62}$$

$$z_{11} = 1.49996X_{16}(t-731) - 1.95748X_{16}(t-652)X_{16}(t-652) + 0.56045$$

$$z_{62} = 1.07635z_{52} - 0.237555z_{11}z_{11} + 0.137429z_{52}z_{52}$$

$$z_{11} = 1.60739X_{17}(t-179) + 2.37933X_{17}(t-179)X_{17}(t-179) - 1.98873X_{16}(t-652)X_{16}(t-652) + 0.125197$$

$$z_{52} = 0.982107z_{42} + 0.454946z_{11}z_{42} - 0.197637z_{42}z_{42}$$

$$z_{11} = 1.14834X_{17}(t-179) - 2.78486X_{17}(t-179)X_{16}(t-502) + 0.175966$$

$$z_{42} = -0.414357z_{11} + 1.28971z_{32}$$

0.125197

$$z_{11} = 1.60739X_{17}(t-179) + 2.37933X_{17}(t-179)X_{17}(t-179) - 1.98873X_{16}(t-652)X_{16}(t-652) +$$

$$z_{32} = 0.594482z_{21} + 0.507264z_{22}$$

$$z_{21} = 0.78597z_{11} + 0.753401z_{12}$$

$$z_{11} = 1.13463X_{17}(t-179) - 3.20537X_{17}(t-179)X_{17}(t-506) + 2.33773X_{17}(t-179)X_{17}(t-179) -$$

0.0695927

$$z_{12} = -5.87893X_{16}(t-690)X_{16}(t-643) + 1.0974X_{16}(t-643)X_{16}(t-643) + 0.348153$$

$$z_{22} = 0.781652z_{11} + 0.617367z_{12}$$

$$z_{11} = 1.55927X_{17}(t-179) + 0.898456X_{16}(t-614) + 2.42007X_{17}(t-179)X_{17}(t-179) - 1.06576X_{16}(t-614)X_{16}(t-614) + 0.182795$$

$$z_{12} = 1.46161X_{16}(t-731) - 3.84217X_{16}(t-731)X_{16}(t-502) + 0.425517$$

TARGET VARIABLE:  
X17(t) : N10-S10\_sst (R)

RELEVANT INPUT VARIABLES: 8

X16(t-502) : N30-10\_sst (Q)  
X16(t-614) : N30-10\_sst (Q)  
X16(t-643) : N30-10\_sst (Q)  
X16(t-652) : N30-10\_sst (Q)  
X16(t-690) : N30-10\_sst (Q)  
X16(t-731) : N30-10\_sst (Q)  
X17(t-179) : N10-S10\_sst (R)  
X17(t-506) : N10-S10\_sst (R)

MODEL ACCURACY: 0,68

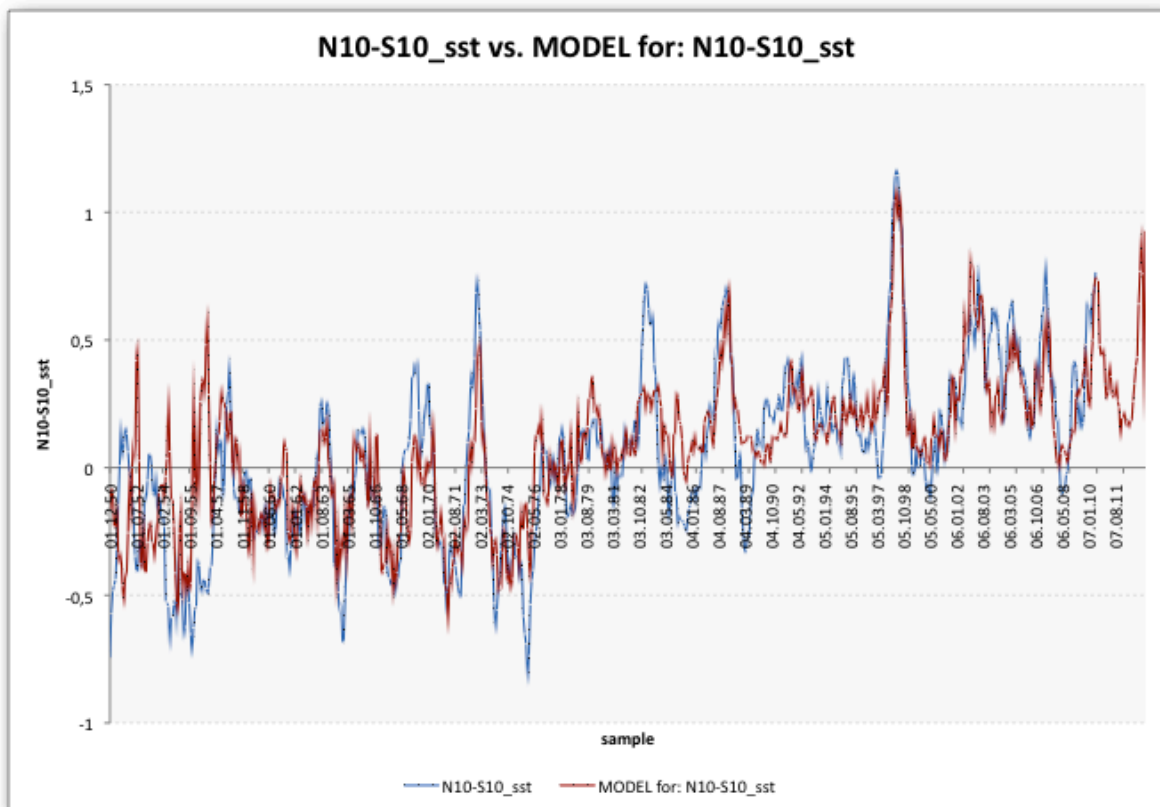
CHOSEN PARAMETERS:

Number of samples: 1440  
Starting at row: 6  
Number of potential inputs: 4830  
Noise immunity: VERY GOOD  
Model type: non-linear dynamic input-output model  
Max. time lag: 840  
Forecast horizon: 36  
Number of models to survive: 30  
Network layers used: 15

MODEL EVALUATION: VALID

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 38%.

The model was generated by self-organizing high-dimensional modeling.



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**MODEL FOR REGION S10-S30\_SST**

$$X18(t) = 0.0657693z11 + 0.205877z22 + 0.0761151$$

$$z11 = 2.2566X19(t-37) + 0.00971115$$

$$z22 = 0.634826z11 + 0.581111z12$$

$$z11 = 2.43471X18(t-182) + 2.06664X18(t-159) + 6.65772X18(t-182)X18(t-159) - 2.05125X18(t-159)X18(t-159) + 0.344163$$

$$z12 = 1.37191X17(t-183) + 1.89708X18(t-119) + 1.23965X17(t-183)X17(t-183) + 0.0848807$$

TARGET VARIABLE:

X18(t) : S10-30\_sst (S)

RELEVANT INPUT VARIABLES: 5

X17(t-183) : N10-S10\_sst (R)

X18(t-119) : S10-30\_sst (S)

X18(t-159) : S10-30\_sst (S)

X18(t-182) : S10-30\_sst (S)

X19(t-37) : S30-50\_sst (T)

MODEL ACCURACY: 0,61

CHOSEN PARAMETERS:

Number of samples: 1440

Starting at row: 6

Number of potential inputs: 4830

Noise immunity: VERY GOOD

Model type: non-linear dynamic input-output model

Max. time lag: 840

Forecast horizon: 36

Number of models to survive: 30

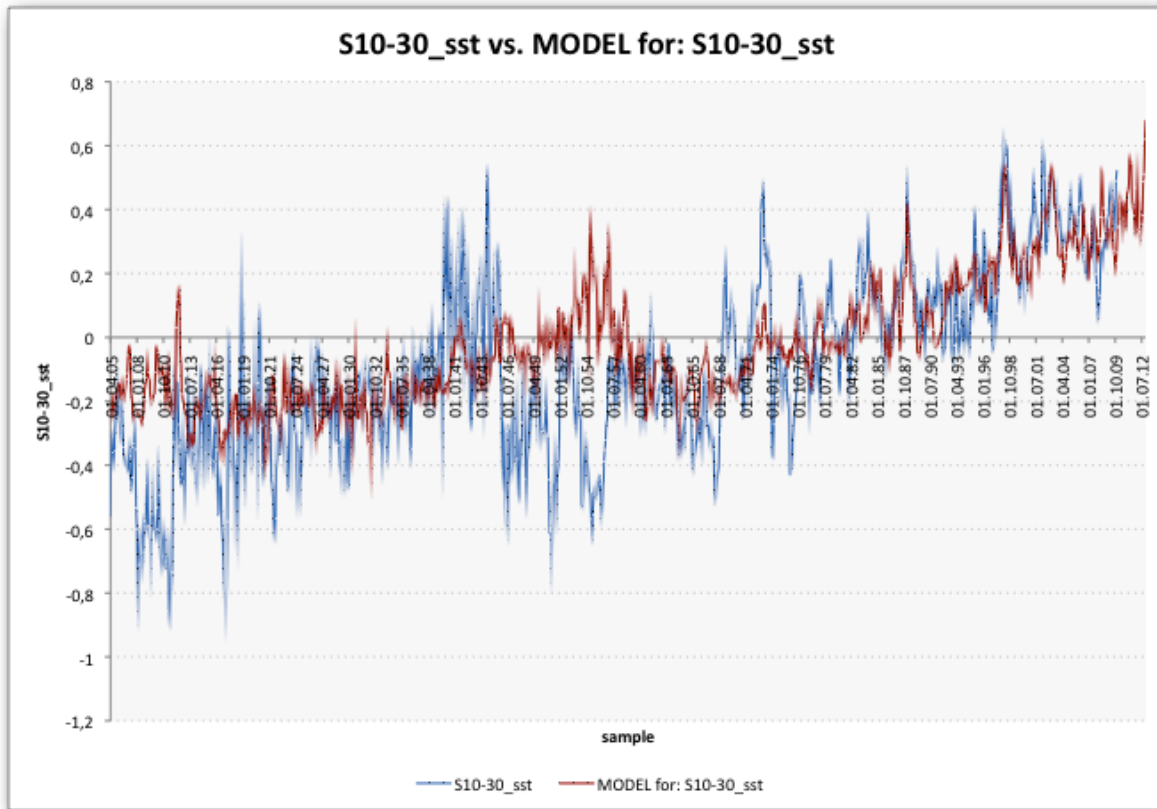
Network layers used: 3

MODEL EVALUATION: VALID

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 32%.

The model was generated by self-organizing high-dimensional modeling.






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**MODEL FOR REGION S30-S50\_SST**

$$X_{19}(t) = 0.0572498z_{41} + 0.19437z_{52} + 0.0252644$$

$$z_{41} = 0.983872z_{32} - 0.316175z_{21}z_{32} + 0.244614z_{32}z_{32}$$

$$z_{21} = 0.743739z_{11} + 0.598242z_{12} - 0.459728z_{11}z_{12} + 0.279119z_{11}z_{11}$$

$$z_{11} = 1.48461X_{18}(t-36) - 1.86649X_{19}(t-413)X_{18}(t-36) - 1.12953X_{19}(t-413)X_{19}(t-413) + 0.145483$$

$$z_{12} = 1.06494X_{18}(t-679) - 4.55986X_{18}(t-667)X_{18}(t-679) + 1.3923X_{18}(t-679)X_{18}(t-679) + 0.533112$$

$$z_{32} = 0.598961z_{21} + 0.518851z_{22}$$

$$z_{21} = 0.704335z_{11} + 0.588034z_{12}$$

$$z_{11} = 1.47676X_{18}(t-105) + 1.7012X_{18}(t-36) - 2.11517X_{18}(t-105)X_{18}(t-105) + 0.0735085$$

$$z_{12} = -4.11473X_{18}(t-679)X_{19}(t-431) + 0.44662$$

$$z_{22} = 0.723017z_{11} + 0.627524z_{12} - 0.521473z_{11}z_{12} + 0.276733z_{11}z_{11}$$

$$z_{11} = 1.10806X_{19}(t-661) + 1.21729X_{18}(t-36) - 1.57946X_{19}(t-661)X_{18}(t-36) + 0.45394$$

$$z_{12} = 0.797821X_{18}(t-667) + 1.17088X_{18}(t-729) - 2.96603X_{18}(t-667)X_{18}(t-729) + 1.0217X_{18}(t-729)X_{18}(t-729) +$$

0.623747

$$z_{52} = 0.238715z_{11} + 0.871485z_{42}$$

$$z_{11} = -0.963093X_{19}(t-413) - 4.6458X_{18}(t-667)X_{19}(t-413) - 0.891809X_{19}(t-413)X_{19}(t-413) + 0.291484$$

$$z_{42} = 0.257625z_{11} + 0.86586z_{32}$$

$$z_{11} = 0.600452X_{18}(t-729) + 0.763037X_{19}(t-661) - 2.21482X_{18}(t-729)X_{19}(t-661) + 0.812443$$

$$z_{32} = 0.494847z_{11} + 0.763311z_{22}$$

$$z_{11} = -4.11473X_{18}(t-679)X_{19}(t-431) + 0.44662$$

$$z_{22} = 0.740415z_{11} + 0.534671z_{12} - 0.364559z_{11}z_{12} + 0.206363z_{11}z_{11}$$

$$z_{11} = 1.47676X_{18}(t-105) + 1.7012X_{18}(t-36) - 2.11517X_{18}(t-105)X_{18}(t-105) + 0.0735085$$

$$z_{12} = 0.797821X_{18}(t-667) + 1.17088X_{18}(t-729) - 2.96603X_{18}(t-667)X_{18}(t-729) + 1.0217X_{18}(t-729)X_{18}(t-729) +$$

0.623747

TARGET VARIABLE:

X19(t) : S30-50\_sst (T)

RELEVANT INPUT VARIABLES: 8

X18(t-36) : S10-30\_sst (S)

X18(t-105) : S10-30\_sst (S)

X18(t-667) : S10-30\_sst (S)

X18(t-679) : S10-30\_sst (S)

X18(t-729) : S10-30\_sst (S)

X19(t-413) : S30-50\_sst (T)

X19(t-431) : S30-50\_sst (T)

X19(t-661) : S30-50\_sst (T)

MODEL ACCURACY: 0,62

CHOSEN PARAMETERS:

Number of samples: 1440

Starting at row: 6

Number of potential inputs: 4830

Noise immunity: VERY GOOD

Model type: non-linear dynamic input-output model

Max. time lag: 840

Forecast horizon: 36

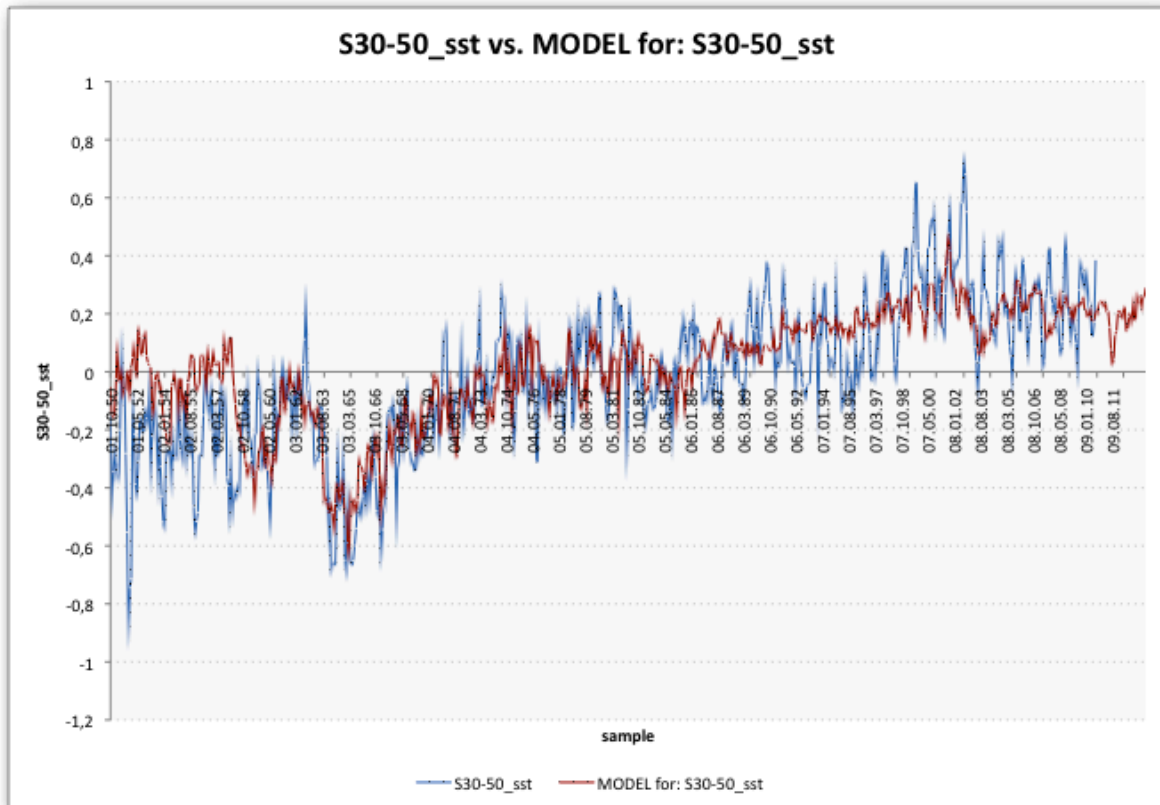
Number of models to survive: 30

Network layers used: 6

MODEL EVALUATION: VALID

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 33%.

The model was generated by self-organizing high-dimensional modeling.



## MODEL FOR REGION S50-S70\_SST

$$X20(t) = 0.283128z11 + 0.418383z32 + 0.473235z11z11 - 0.0148381$$

$$z11 = -1.03182X19(t-439)X10(t-801) + 0.159696$$

$$z32 = 0.815475z21 + 0.700013z22$$

$$z21 = 0.898044z11z11 - 2.5946z12z12$$

$$z11 = 0.112021X11(t-552)X12(t-368) - 0.0152122$$

$$z12 = -0.795872X10(t-214)X19(t-424) + 0.0445457$$

$$z22 = -5.00301z11z12$$

$$z11 = -1.03182X19(t-439)X10(t-801) + 0.159696$$

$$z12 = -0.76917X19(t-439)X19(t-424) + 0.117075$$

### TARGET VARIABLE:

X20(t) : S50-70\_sst (U)

### RELEVANT INPUT VARIABLES: 6

X10(t-214) : S30-50\_LAT (K)

X10(t-801) : S30-50\_LAT (K)

X11(t-552) : S50-70\_LAT (L)

X12(t-368) : S70-90\_LAT (M)

X19(t-424) : S30-50\_sst (T)

X19(t-439) : S30-50\_sst (T)

MODEL ACCURACY: 0,15

### CHOSEN PARAMETERS:

Number of samples: 1440

Starting at row: 6

Number of potential inputs: 4830

Noise immunity: VERY GOOD

Model type: non-linear dynamic input-output model

Max. time lag: 840

Forecast horizon: 36

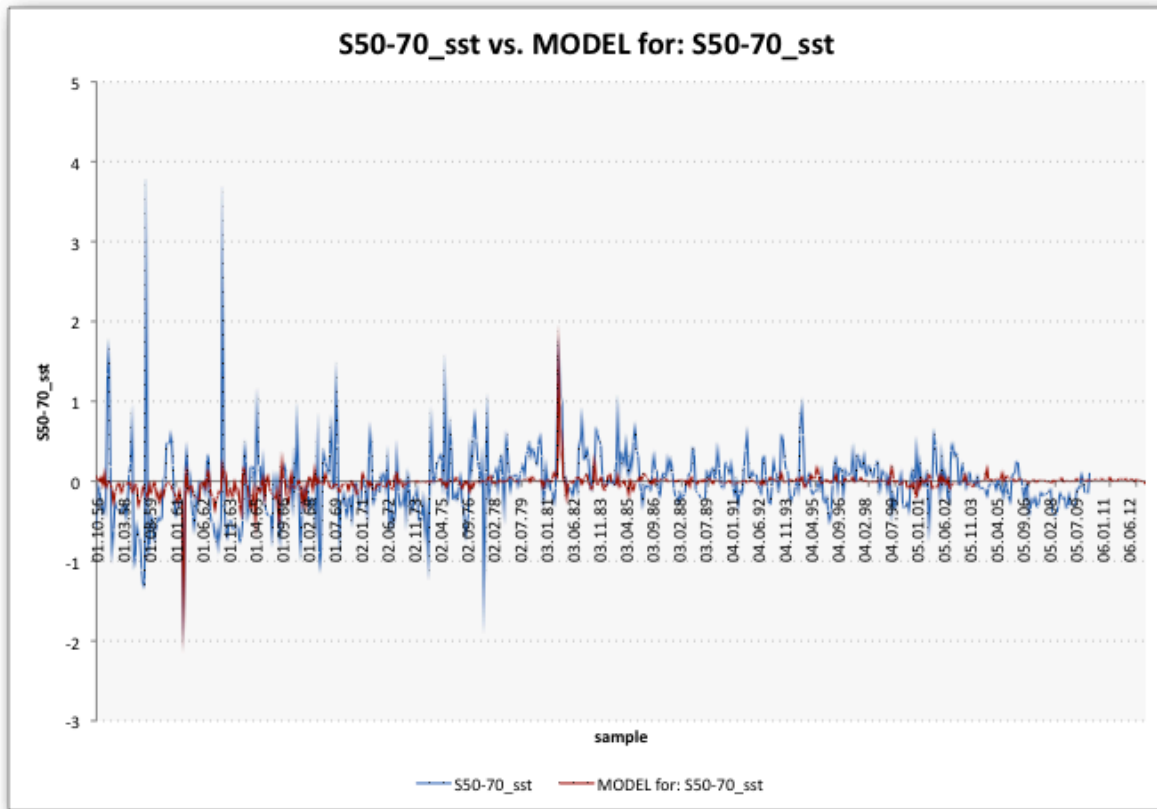
Number of models to survive: 30

Network layers used: 4

### MODEL EVALUATION: UNCERTAIN

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 2%.

The model was generated by self-organizing high-dimensional modeling.




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**MODEL FOR REGION S70-S90\_SST**

$$X21(t) = -0.696811z41 + 1.65702z62 + 0.15251$$

$$z41 = 1.15019z32 - 0.19283z11z11$$

$$z11 = 0.993488X21(t-569) + 1.47806X21(t-569)X21(t-557) + 1.83206X21(t-569)X21(t-569) + 1.17408X21(t-557)X21(t-557) - 0.397208$$

$$z32 = 0.274753z11 + 0.773533z22 + 0.17126z11z11$$

$$z11 = 2.88032X21(t-554)X3(t-371) + 1.64839X21(t-554)X21(t-554) + 2.67408X3(t-371)X3(t-371) - 0.615497$$

$$z22 = 0.505462z11 + 0.663727z12 + 0.535456z11z12 - 0.224507z12z12$$

$$z11 = -4.39707X3(t-354) - 1.04024X3(t-457) - 12.5224X3(t-354)X3(t-457) + 2.46968X3(t-354)X3(t-354) - 0.656539$$

$$z12 = 1.19956X21(t-568) + 1.28055X3(t-372) + 4.32998X21(t-568)X3(t-372) + 2.61026X21(t-568)X21(t-568) + 2.72136X3(t-372)X3(t-372) - 0.26236$$

$$z62 = 0.550522z51 + 0.47254z52$$

$$z51 = 0.930451z42 - 0.561744z31z42 + 0.572201z42z42$$

$$z31 = 0.568376z21 + 0.54116z22$$

$$z21 = 0.505462z11 + 0.663727z12 + 0.535456z11z12 - 0.224507z12z12$$

$$z11 = -4.39707X3(t-354) - 1.04024X3(t-457) - 12.5224X3(t-354)X3(t-457) + 2.46968X3(t-354)X3(t-354) - 0.656539$$

$$z12 = 1.19956X21(t-568) + 1.28055X3(t-372) + 4.32998X21(t-568)X3(t-372) + 2.61026X21(t-568)X21(t-568) + 2.72136X3(t-372)X3(t-372) - 0.26236$$

$$z22 = 0.681069z11 + 0.453889z12 + 0.168038z12z12$$

$$z11 = 0.80731X21(t-568) + 4.86315X21(t-568)X3(t-354) + 1.6519X21(t-568)X21(t-568) - 0.30402$$

$$z12 = 2.88032X21(t-554)X3(t-371) + 1.64839X21(t-554)X21(t-554) + 2.67408X3(t-371)X3(t-371) - 0.615497$$

$$z42 = 1.20196z32 - 0.262977z11z11$$

$$z11 = -0.585549X21(t-560) - 3.41694X21(t-560)X3(t-457) + 2.19727X21(t-560)X21(t-560) - 0.34873$$

$$z32 = 0.274753z11 + 0.773533z22 + 0.17126z11z11$$

Self-organized prediction models for land air and sea surface temperatures, Dec. 2009

$z_{11} = 2.88032X_{21}(t-554)X_3(t-371) + 1.64839X_{21}(t-554)X_{21}(t-554) + 2.67408X_3(t-371)X_3(t-371) - 0.615497$   
 $z_{22} = 0.505462z_{11} + 0.663727z_{12} + 0.535456z_{11}z_{12} - 0.224507z_{12}z_{12}$   
 $z_{11} = -4.39707X_3(t-354) - 1.04024X_3(t-457) - 12.5224X_3(t-354)X_3(t-457) + 2.46968X_3(t-354)X_3(t-354) -$   
0.656539  
 $z_{12} = 1.19956X_{21}(t-568) + 1.28055X_3(t-372) + 4.32998X_{21}(t-568)X_3(t-372) + 2.61026X_{21}(t-568)X_{21}(t-568) +$   
2.72136X\_3(t-372)X\_3(t-372) - 0.26236  
 $z_{52} = 1.18517z_{42} - 0.2373z_{11}z_{11}$   
 $z_{11} = 0.993488X_{21}(t-569) + 1.47806X_{21}(t-569)X_{21}(t-557) + 1.83206X_{21}(t-569)X_{21}(t-569) + 1.17408X_{21}(t-557)$   
X\_{21}(t-557) - 0.397208  
 $z_{42} = 0.551814z_{31} + 0.474386z_{32}$   
 $z_{31} = 0.285959z_{21} + 0.555876z_{22} + 0.188397z_{21}z_{21} - 0.147354$   
 $z_{21} = 0.681069z_{11} + 0.453889z_{12} + 0.168038z_{12}z_{12}$   
 $z_{11} = 0.80731X_{21}(t-568) + 4.86315X_{21}(t-568)X_3(t-354) + 1.6519X_{21}(t-568)X_{21}(t-568) - 0.30402$   
 $z_{12} = 2.88032X_{21}(t-554)X_3(t-371) + 1.64839X_{21}(t-554)X_{21}(t-554) + 2.67408X_3(t-371)X_3(t-371) - 0.615497$   
 $z_{22} = 0.534017z_{11} + 0.41772z_{12} + 0.562165z_{11}z_{12} - 0.169527z_{12}z_{12}$   
 $z_{11} = 6.10634X_{21}(t-565)X_3(t-354) - 0.352253$   
 $z_{12} = -5.2251X_3(t-354) - 1.21303X_3(t-457) - 13.2321X_3(t-354)X_3(t-457) - 0.662349$   
 $z_{32} = 0.284229z_{11} + 0.746507z_{22} + 0.166369z_{11}z_{11}$   
 $z_{11} = 2.7789X_{21}(t-557)X_3(t-371) + 1.75914X_{21}(t-557)X_{21}(t-557) + 2.458X_3(t-371)X_3(t-371) - 0.620399$   
 $z_{22} = 0.505462z_{11} + 0.663727z_{12} + 0.535456z_{11}z_{12} - 0.224507z_{12}z_{12}$   
 $z_{11} = -4.39707X_3(t-354) - 1.04024X_3(t-457) - 12.5224X_3(t-354)X_3(t-457) + 2.46968X_3(t-354)X_3(t-354) -$   
0.656539  
 $z_{12} = 1.19956X_{21}(t-568) + 1.28055X_3(t-372) + 4.32998X_{21}(t-568)X_3(t-372) + 2.61026X_{21}(t-568)X_{21}(t-568) +$   
2.72136X\_3(t-372)X\_3(t-372) - 0.26236

TARGET VARIABLE:

X21(t) : S70-90\_sst (V)

RELEVANT INPUT VARIABLES: 10

X3(t-354) : anomalies\_sh\_land\_sea (D)  
X3(t-371) : anomalies\_sh\_land\_sea (D)  
X3(t-372) : anomalies\_sh\_land\_sea (D)  
X3(t-457) : anomalies\_sh\_land\_sea (D)  
X21(t-554) : S70-90\_sst (V)  
X21(t-557) : S70-90\_sst (V)  
X21(t-560) : S70-90\_sst (V)  
X21(t-565) : S70-90\_sst (V)  
X21(t-568) : S70-90\_sst (V)  
X21(t-569) : S70-90\_sst (V)

MODEL ACCURACY: 0,6

CHOSEN PARAMETERS:

Number of samples: 1440  
Starting at row: 6  
Number of potential inputs: 4025  
Noise immunity: VERY GOOD  
Model type: non-linear dynamic input-output model  
Max. time lag: 840  
Forecast horizon: 36  
Number of models to survive: 30  
Network layers used: 7

MODEL EVALUATION: VALID

The model seems to reflect a valid relationship. The Descriptive Power of the model for the requested noise immunity relative to a chance model is 31%.

The model was generated by self-organizing high-dimensional modeling.

