



Supplement of

On the challenges of global entity-aware deep learning models for ground-water level prediction

Benedikt Heudorfer et al.

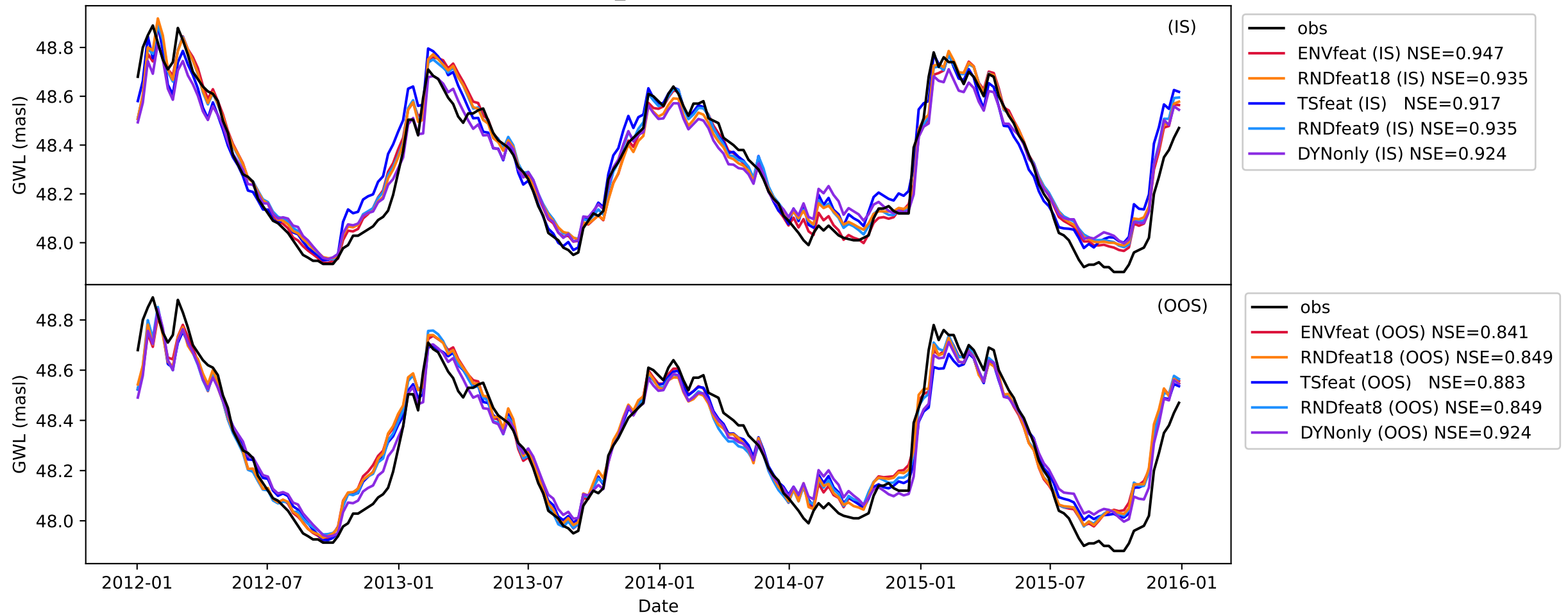
Correspondence to: Benedikt Heudorfer (benedikt.heudorfer@kit.edu)

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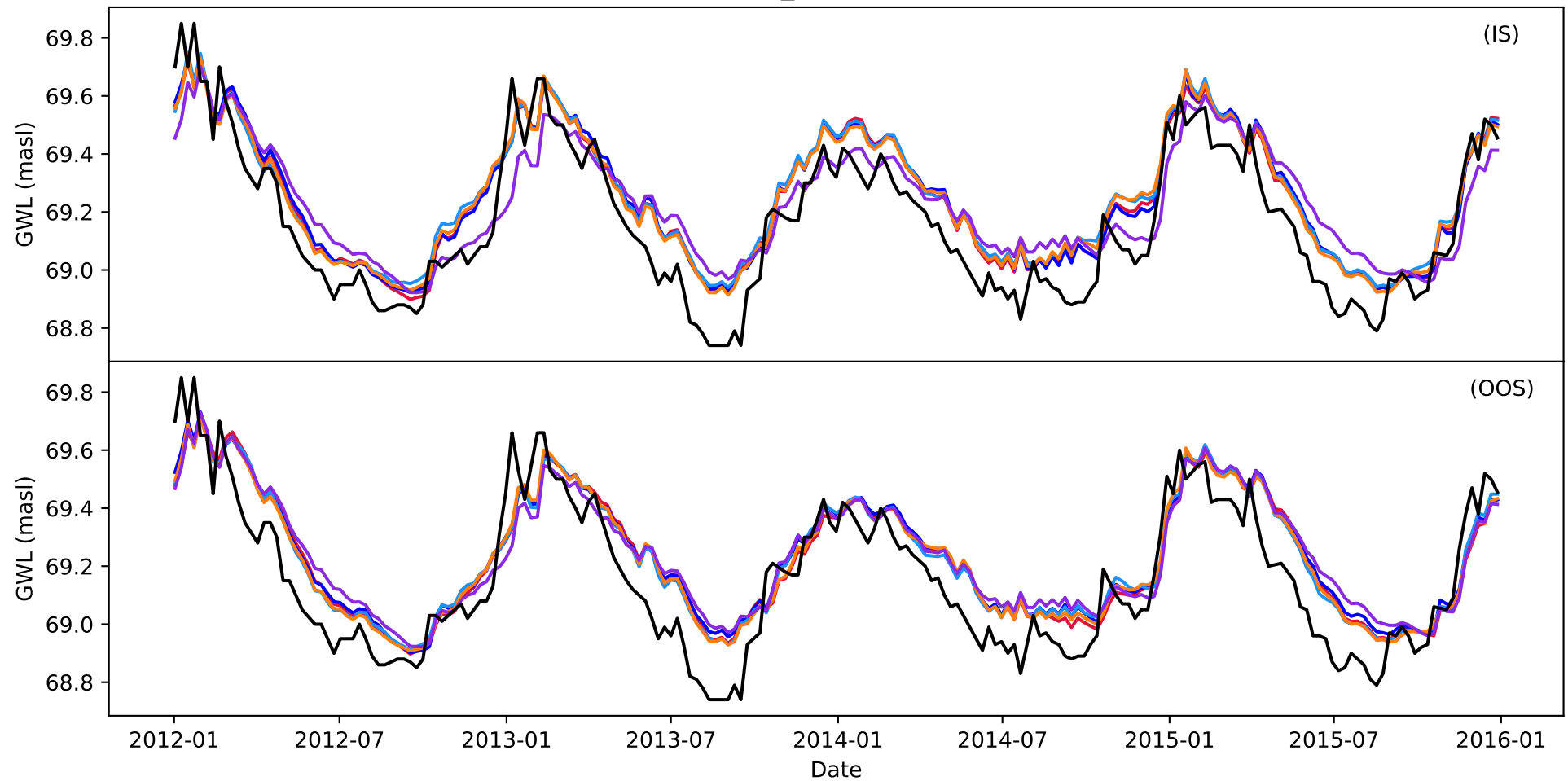
Supplementary Material

Predictions of groundwater levels in the test period (2012-2015) for all 108 considered wells, for all model variants, including NSE scores.

BB_27381010



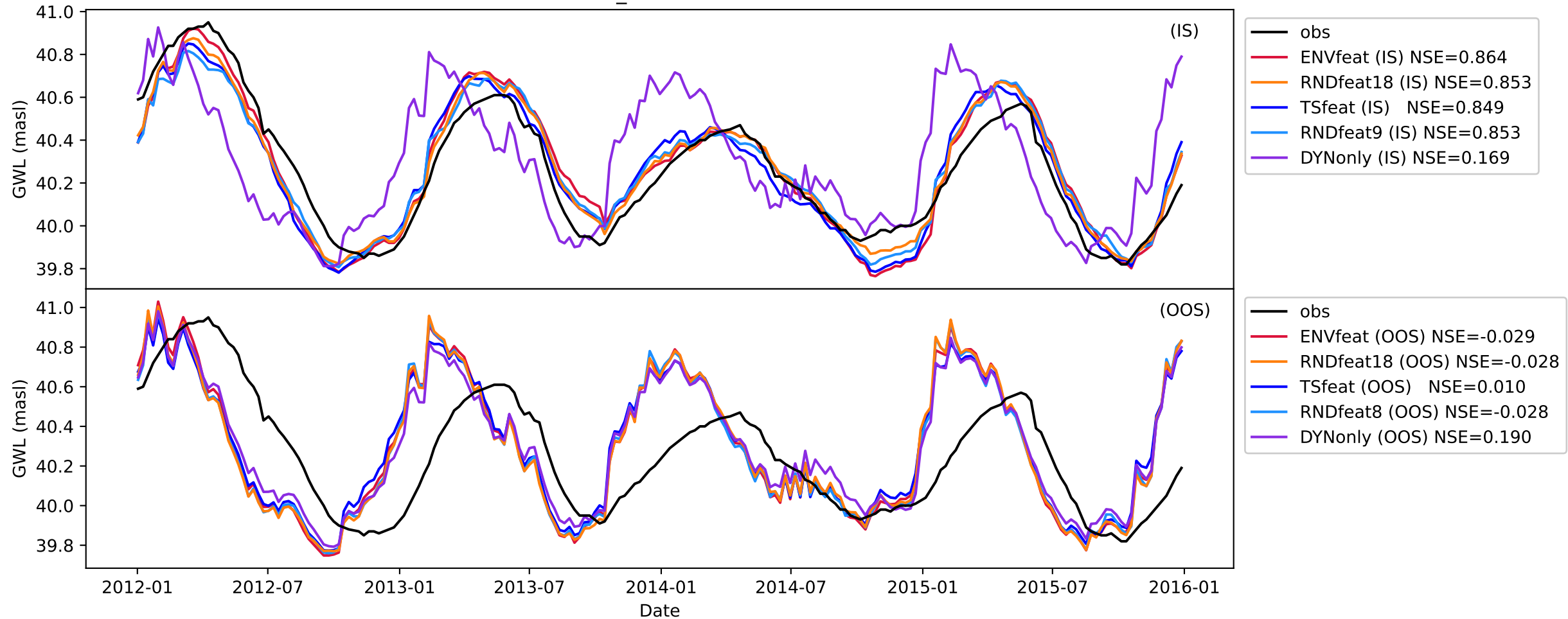
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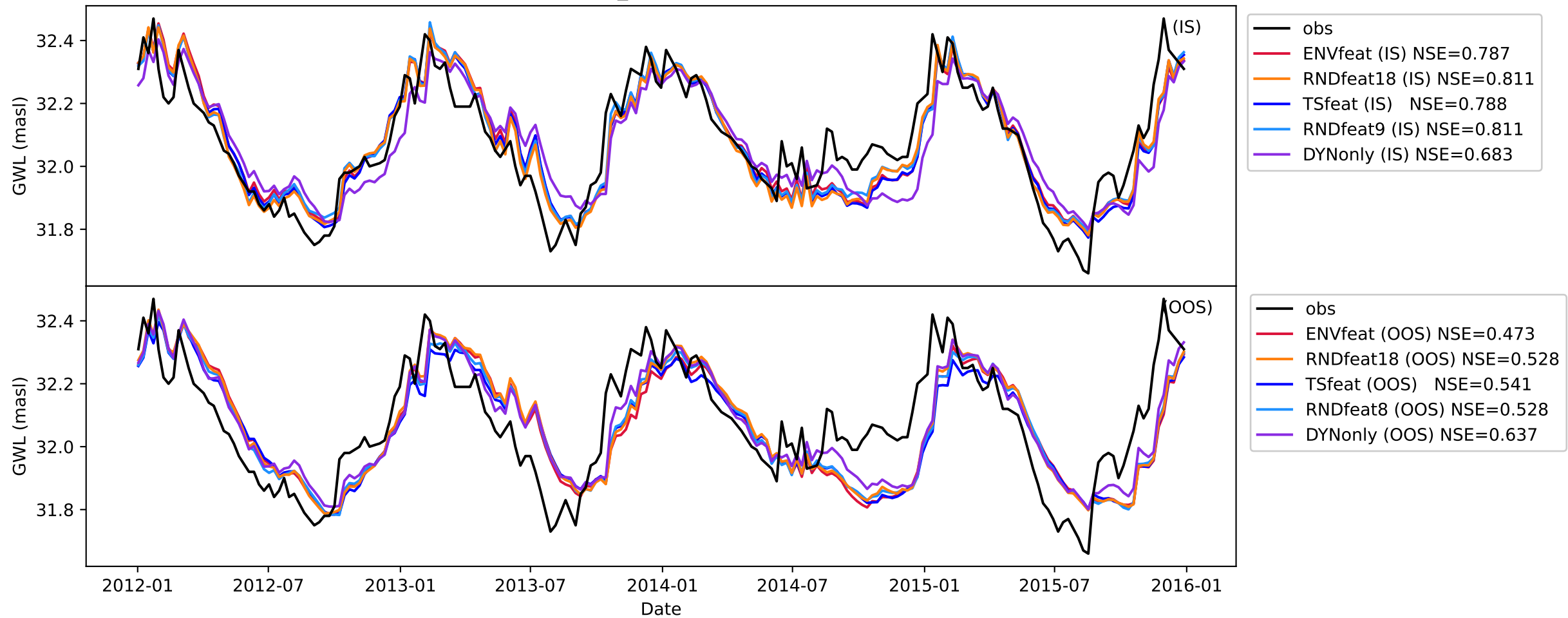
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- ENVfeat (IS) NSE=0.799
- RNDfeat18 (IS) NSE=0.773
- TSfeat (IS) NSE=0.794
- RNDfeat9 (IS) NSE=0.773
- DYNOnly (IS) NSE=0.722

- obs
- ENVfeat (OOS) NSE=0.745
- RNDfeat18 (OOS) NSE=0.761
- TSfeat (OOS) NSE=0.738
- RNDfeat8 (OOS) NSE=0.761
- DYNOnly (OOS) NSE=0.696

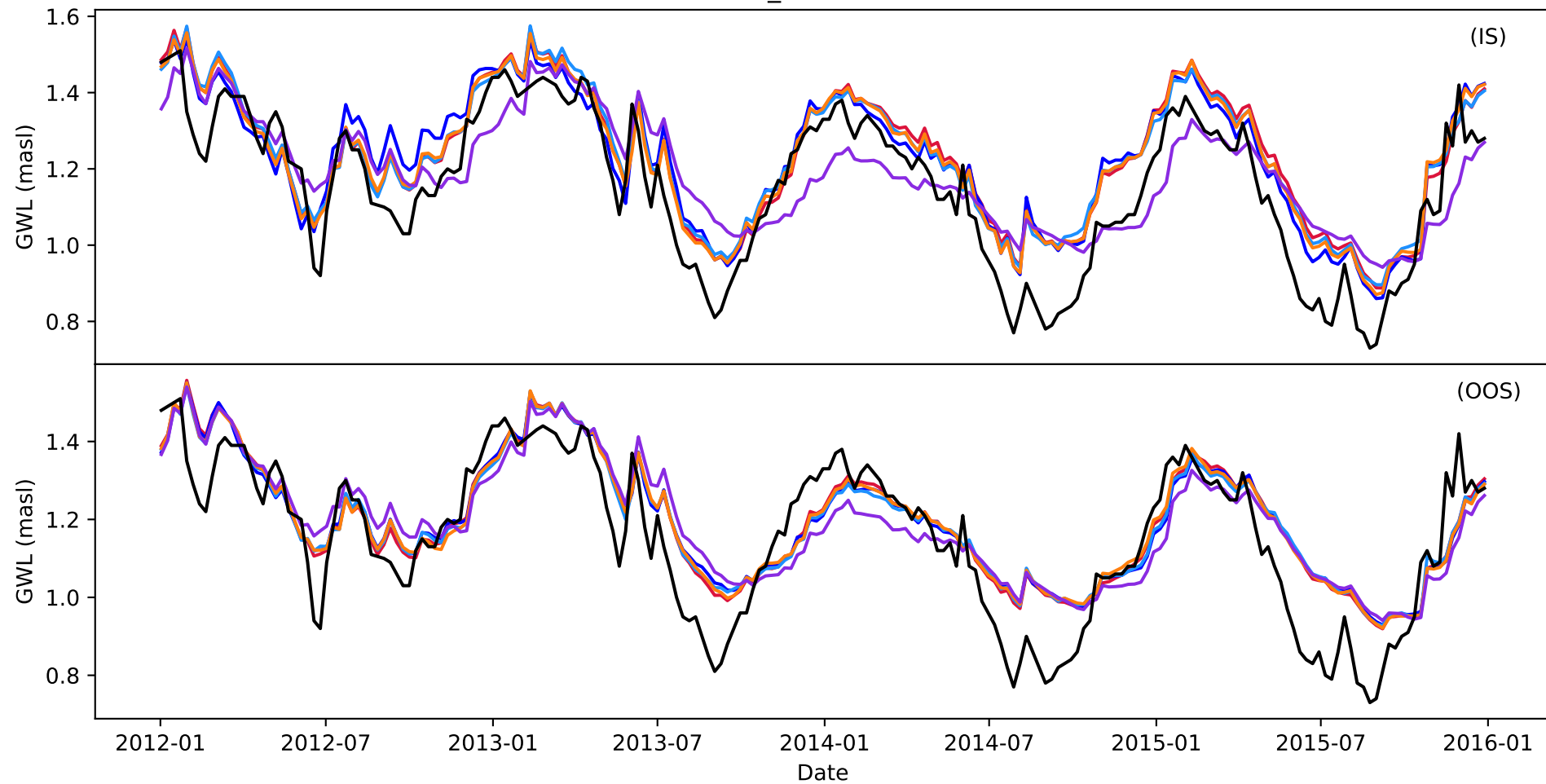
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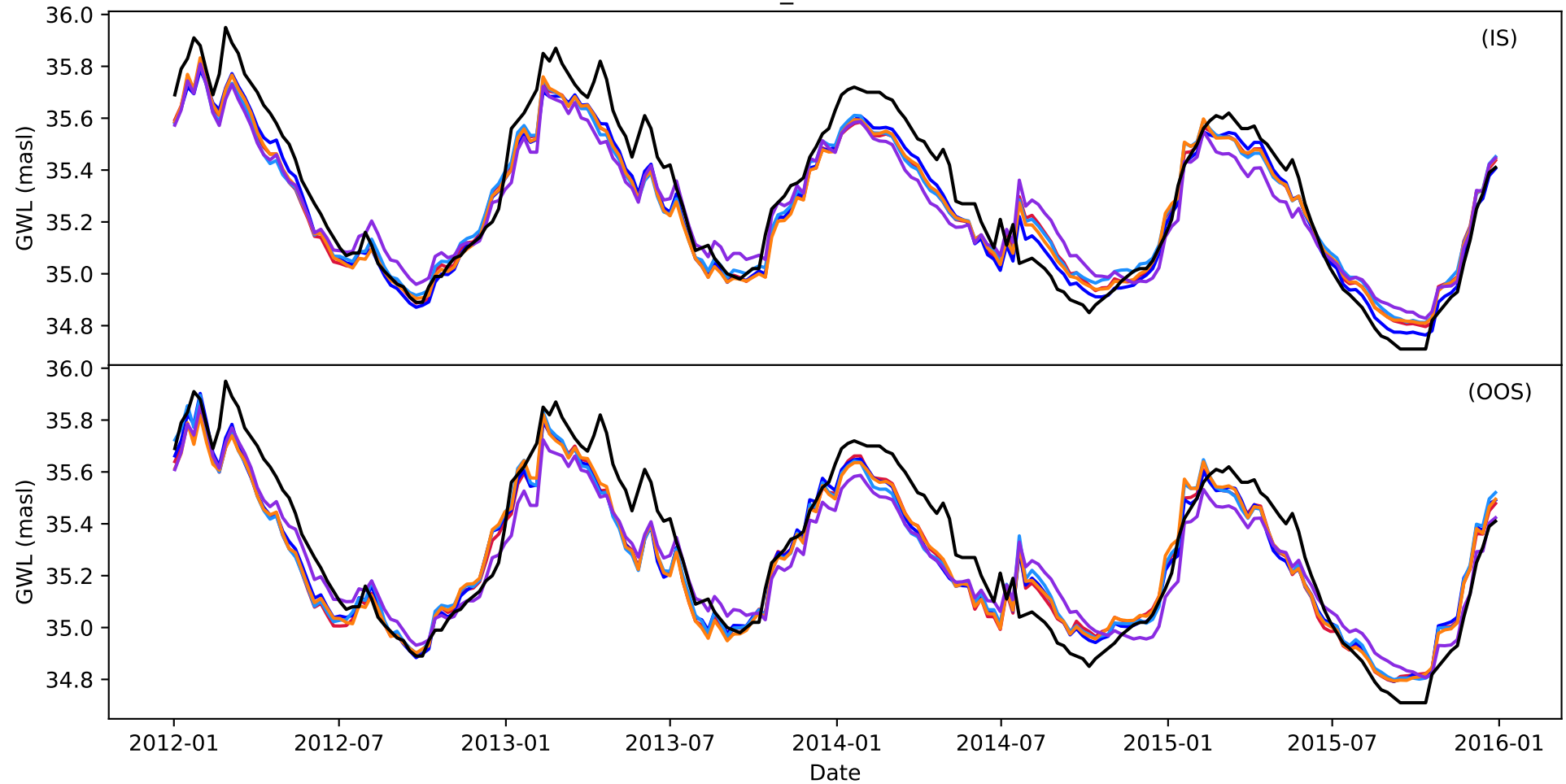
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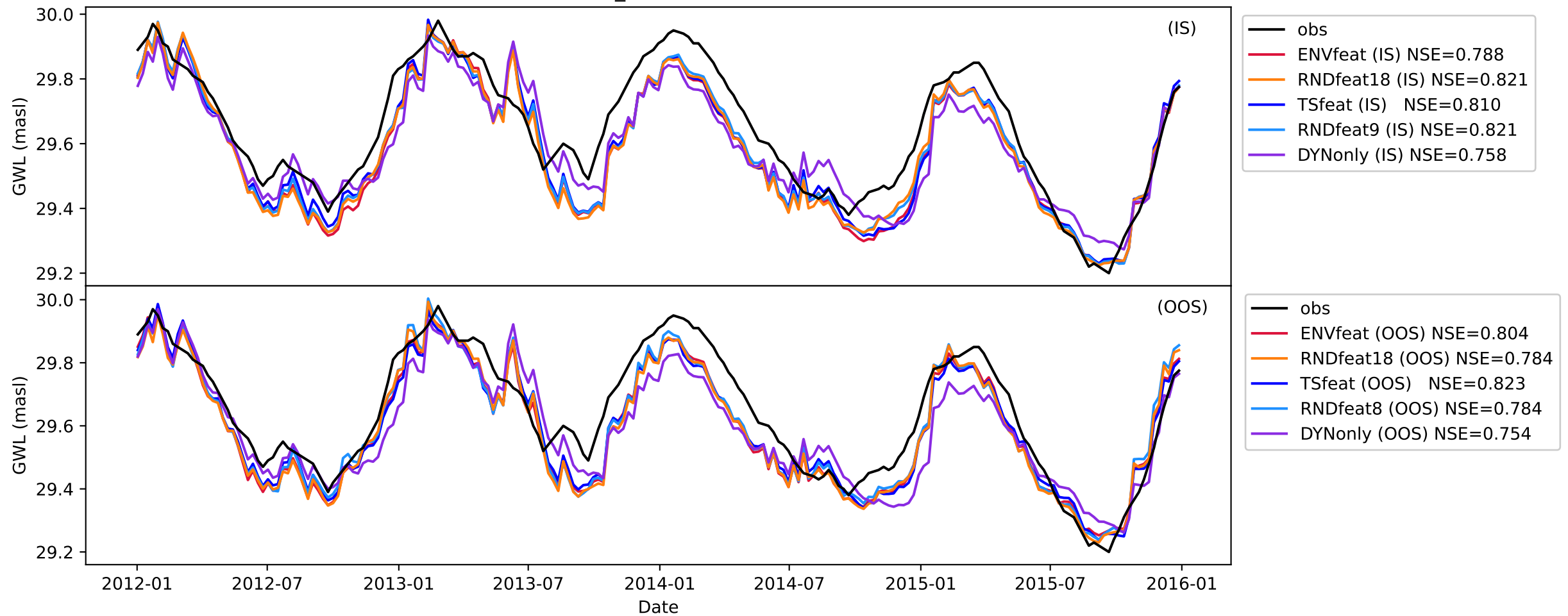
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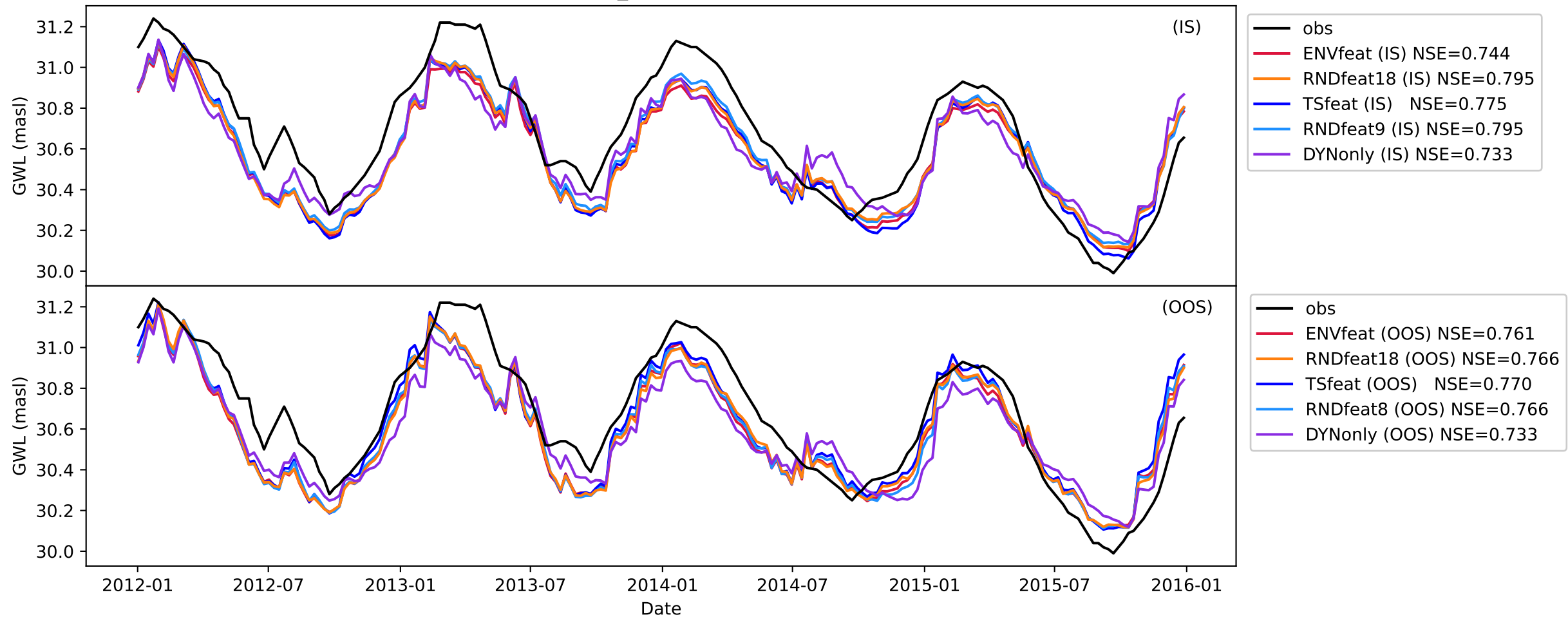
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- ENVfeat (IS) NSE=0.892
- RNDfeat18 (IS) NSE=0.890
- TSfeat (IS) NSE=0.922
- RNDfeat9 (IS) NSE=0.890
- DYNOnly (IS) NSE=0.847

- obs
- ENVfeat (OOS) NSE=0.790
- RNDfeat18 (OOS) NSE=0.817
- TSfeat (OOS) NSE=0.859
- RNDfeat8 (OOS) NSE=0.817
- DYNOnly (OOS) NSE=0.859

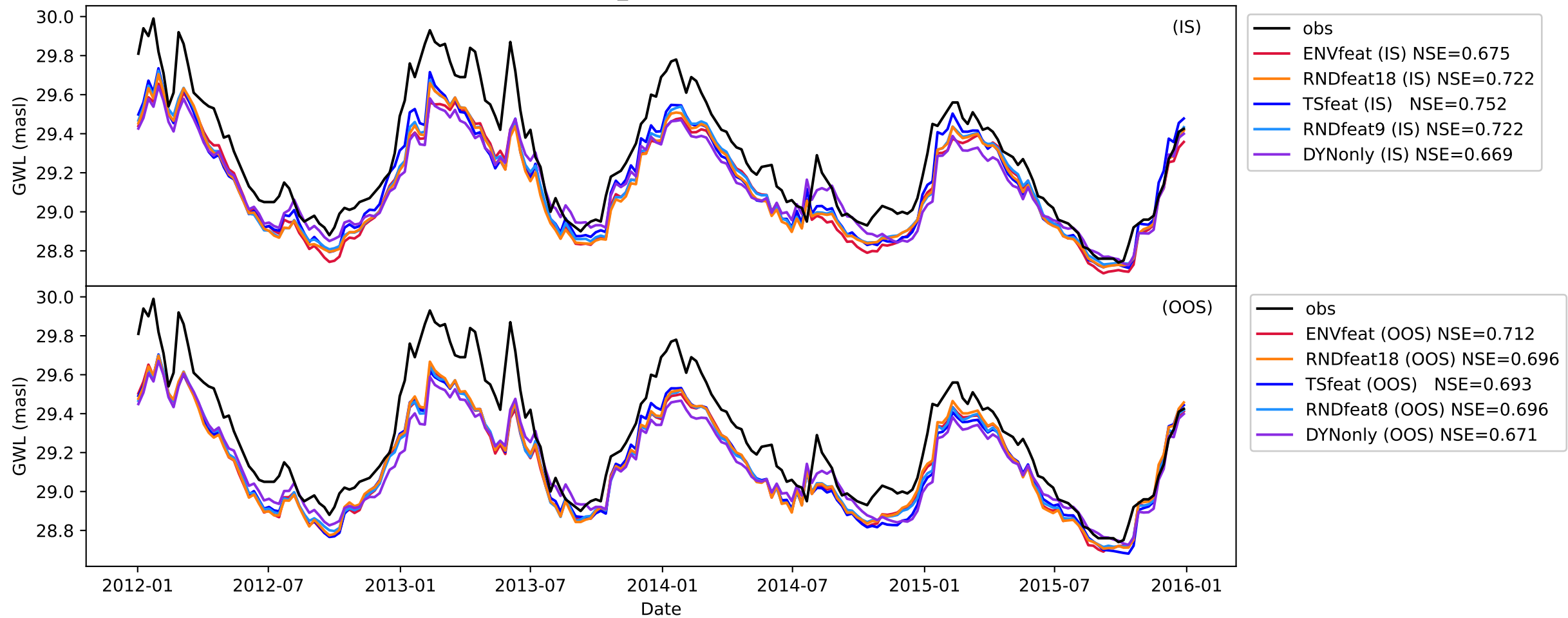
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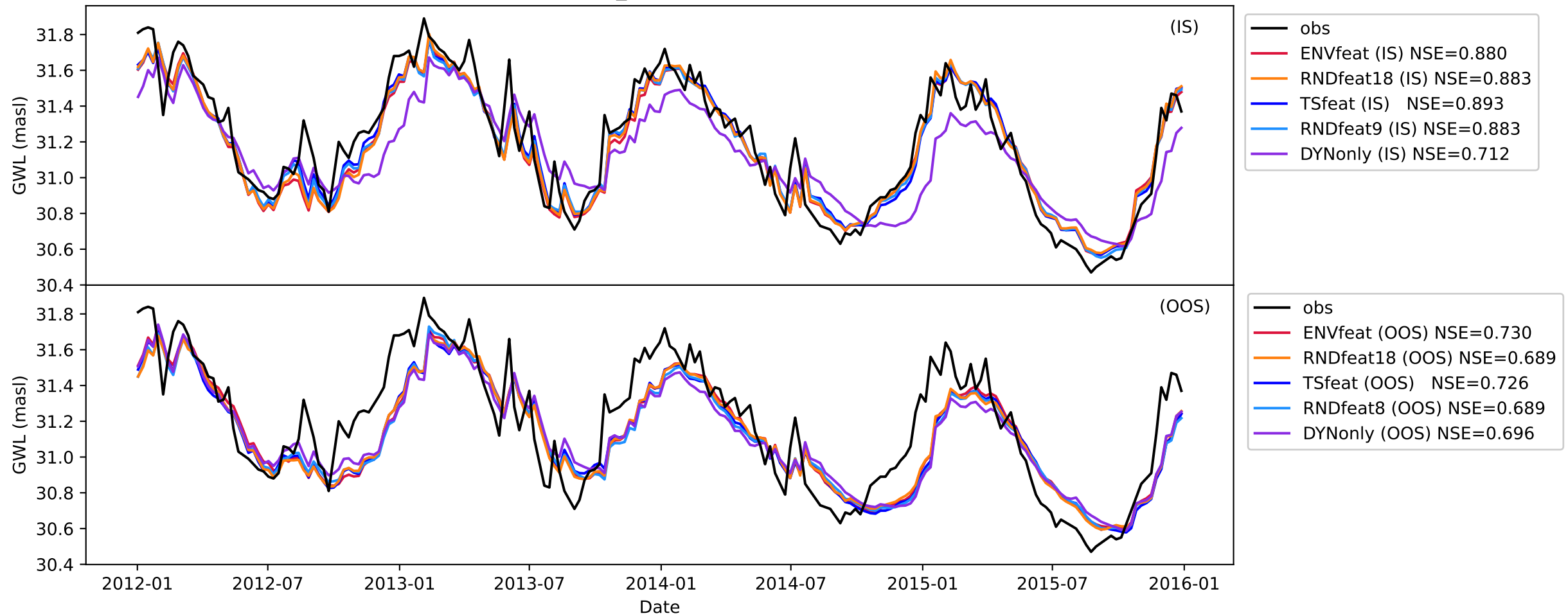
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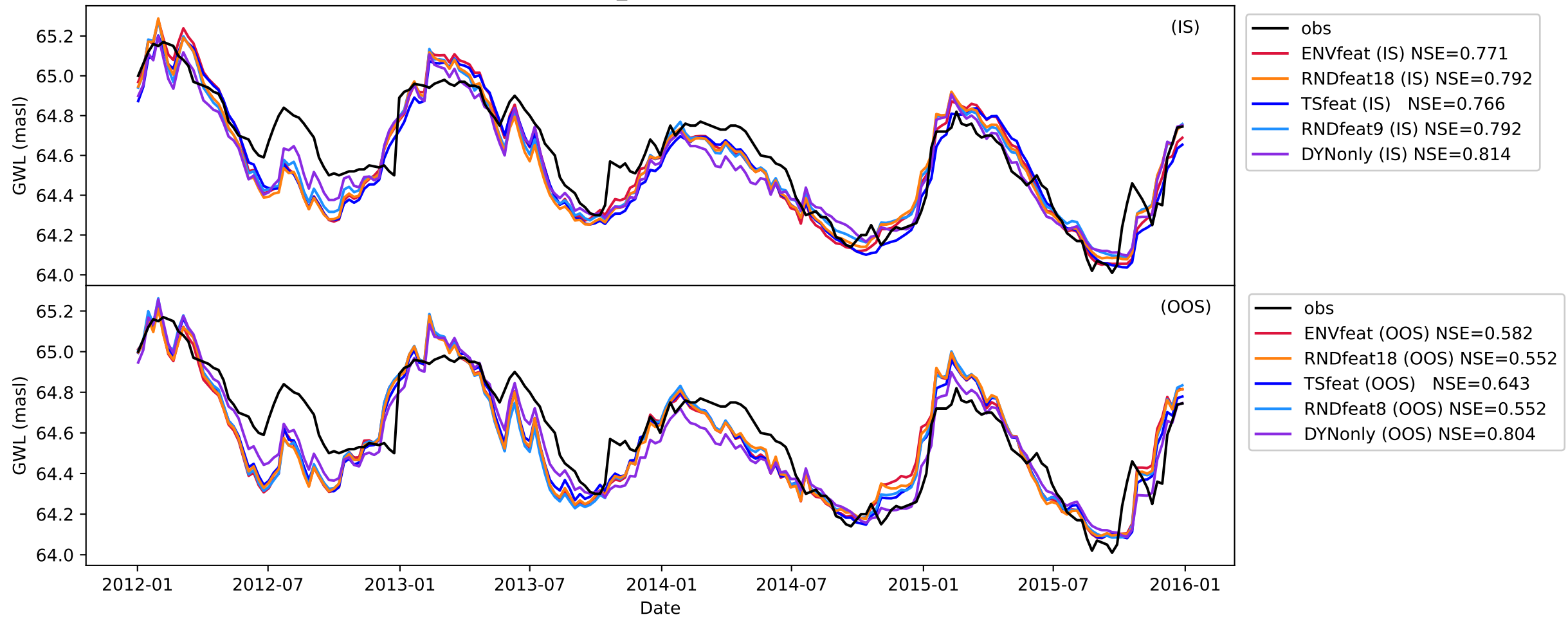
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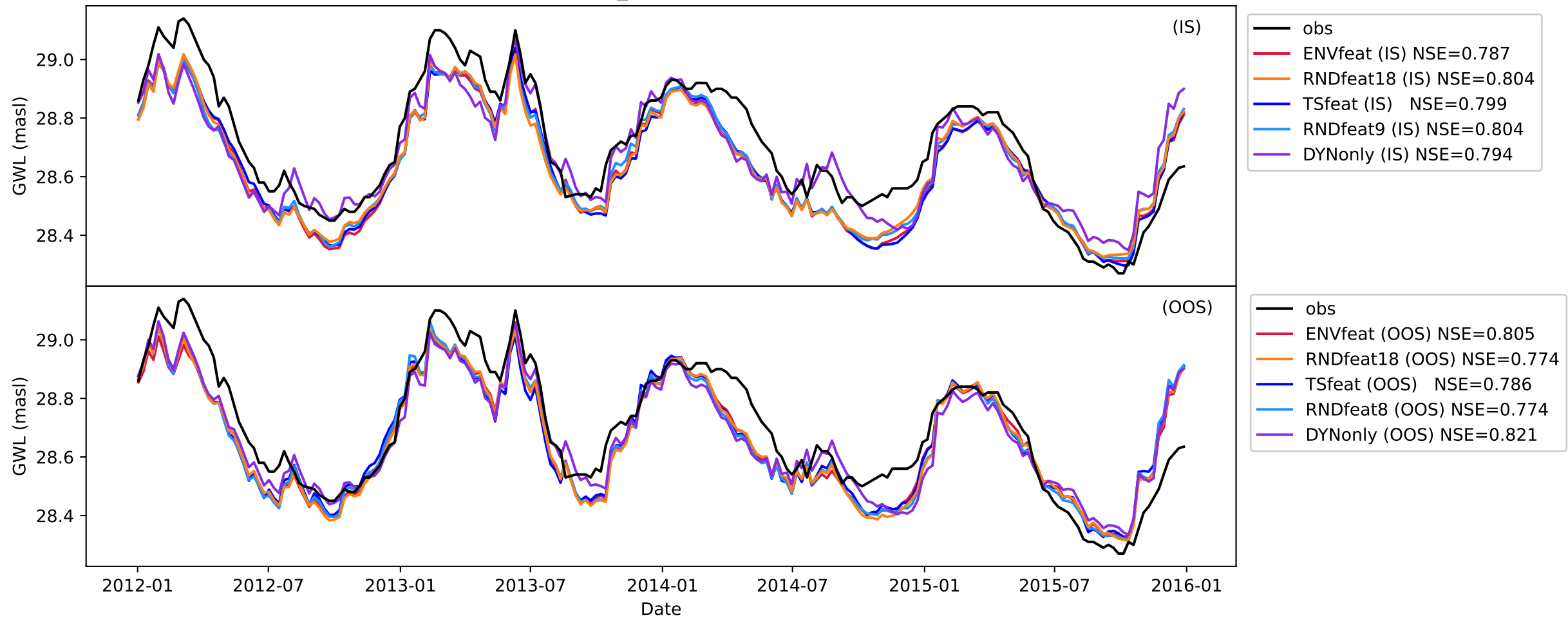
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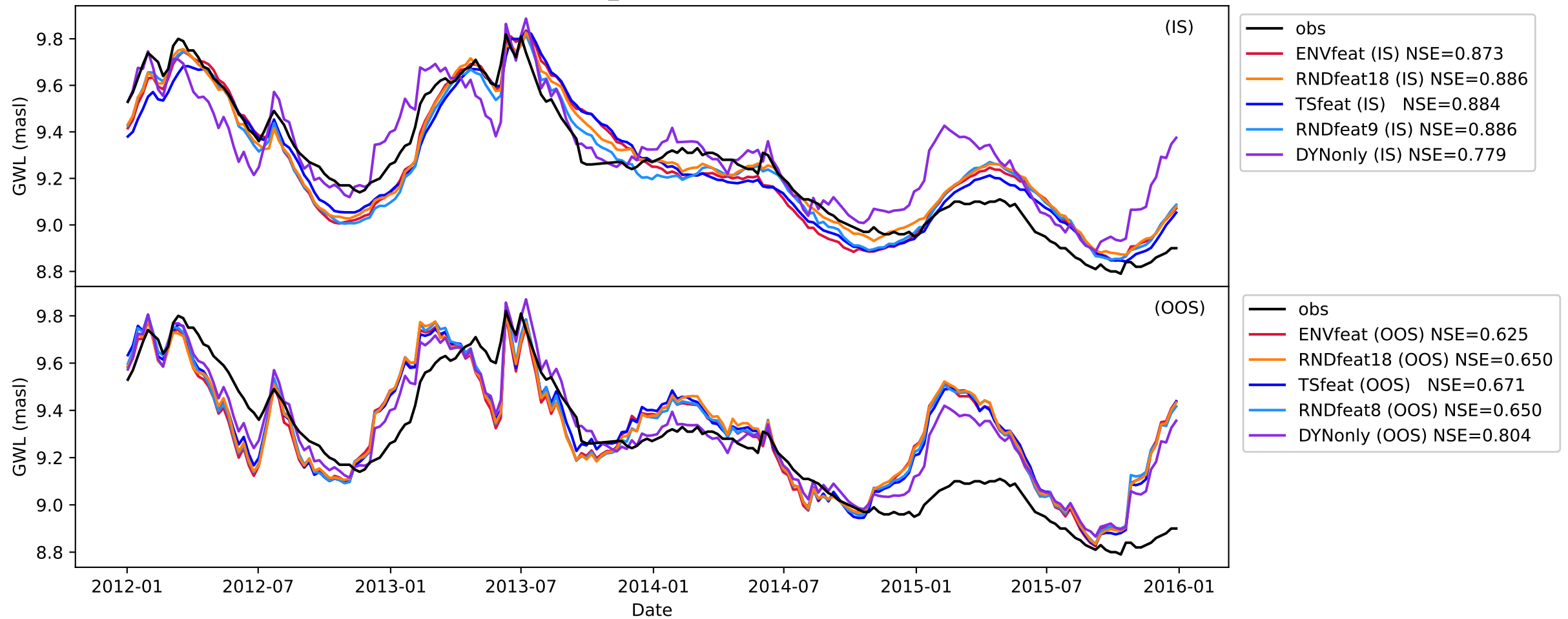
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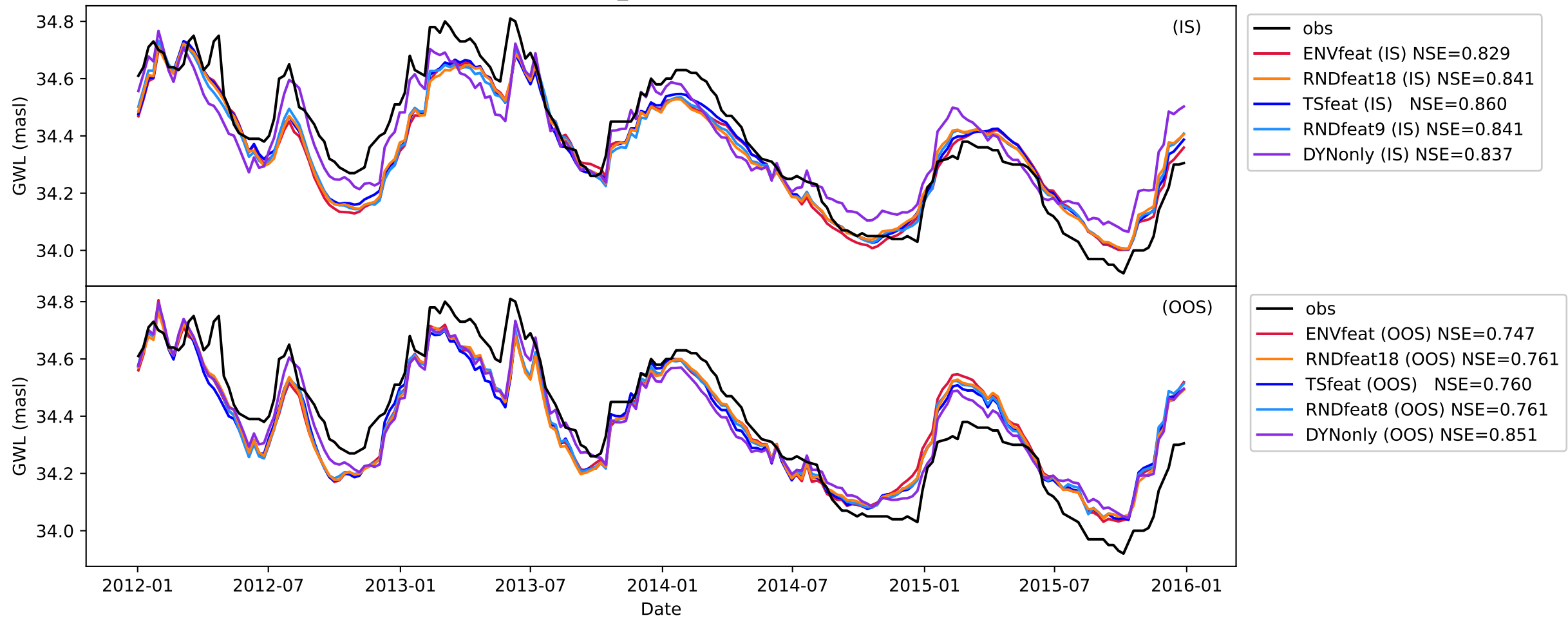
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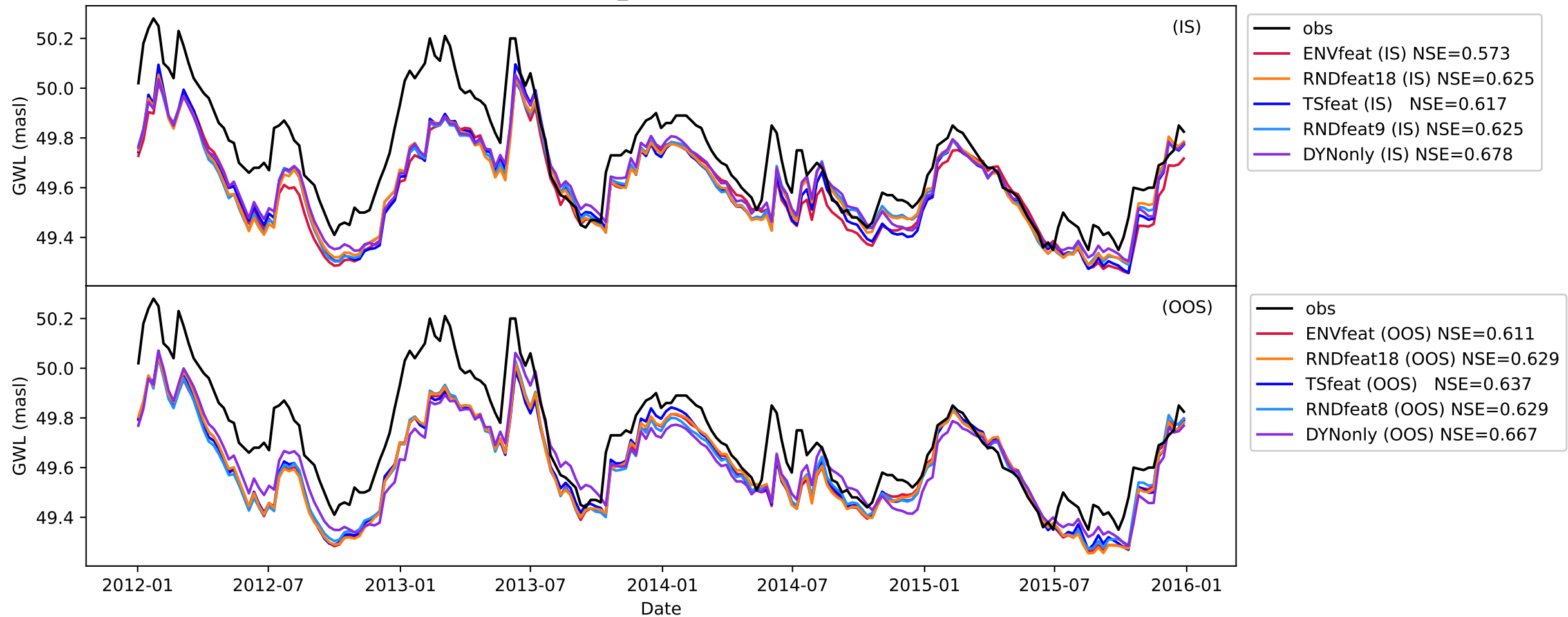
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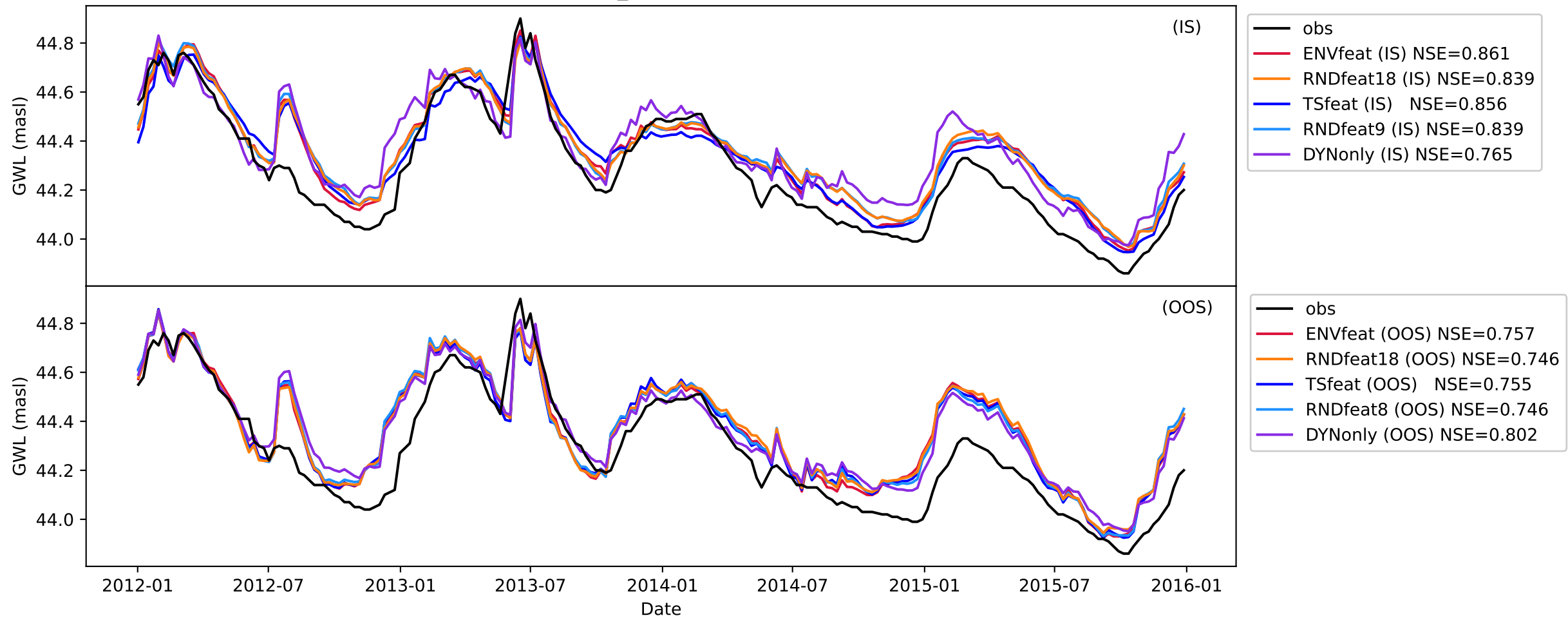
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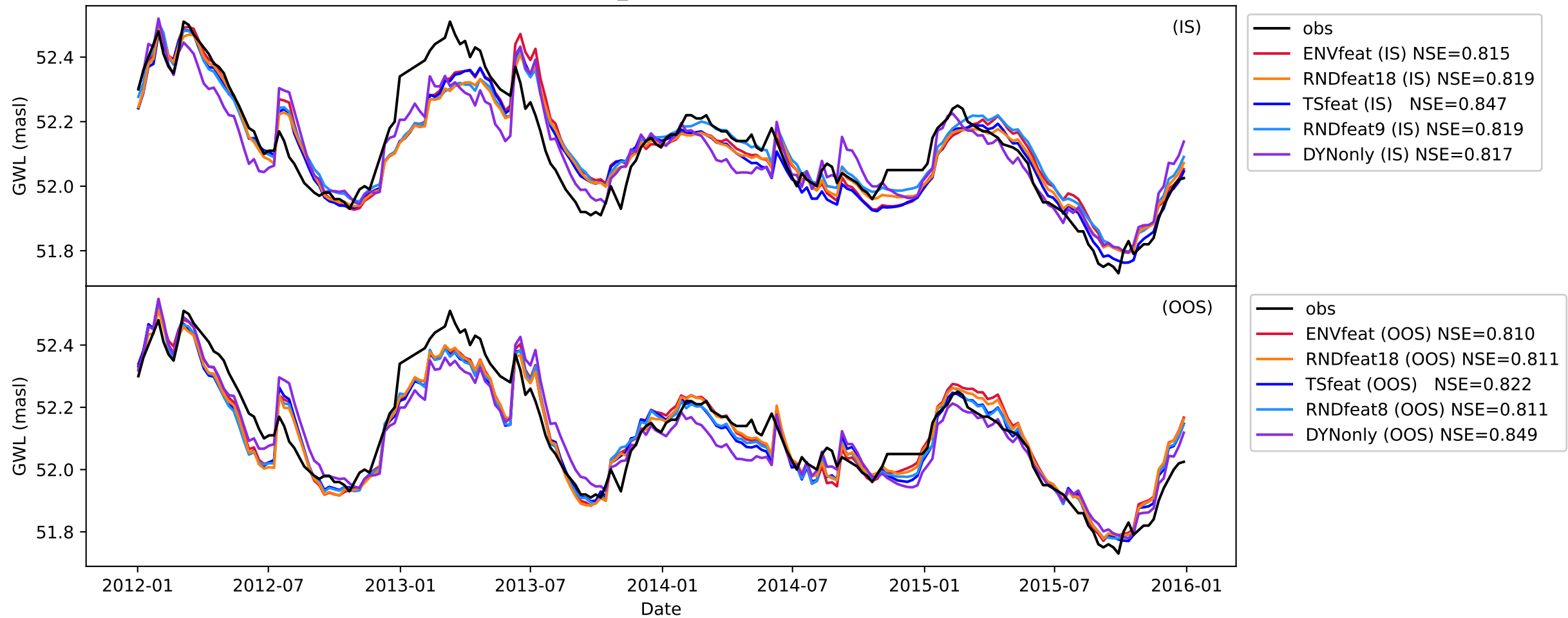
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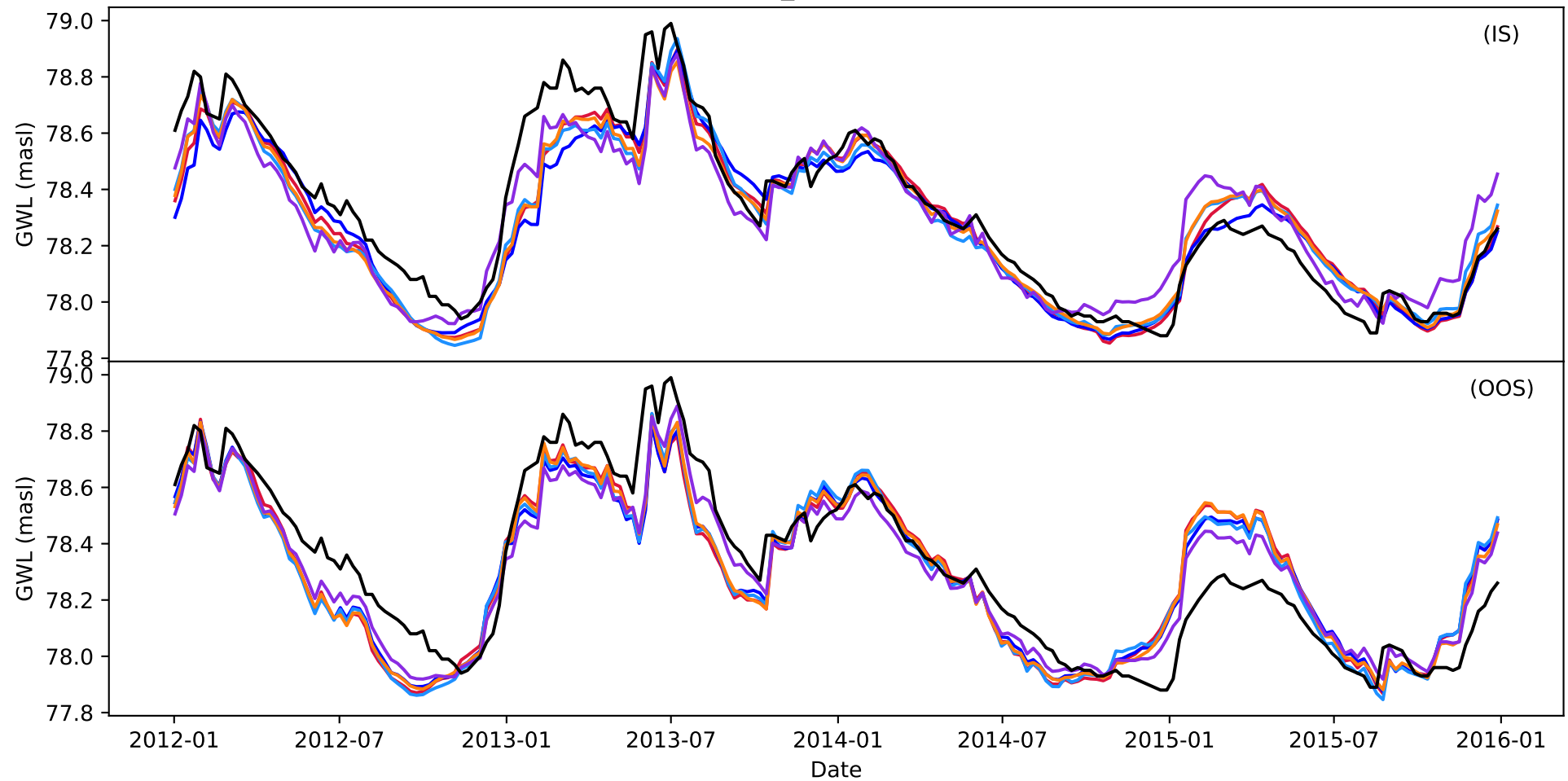
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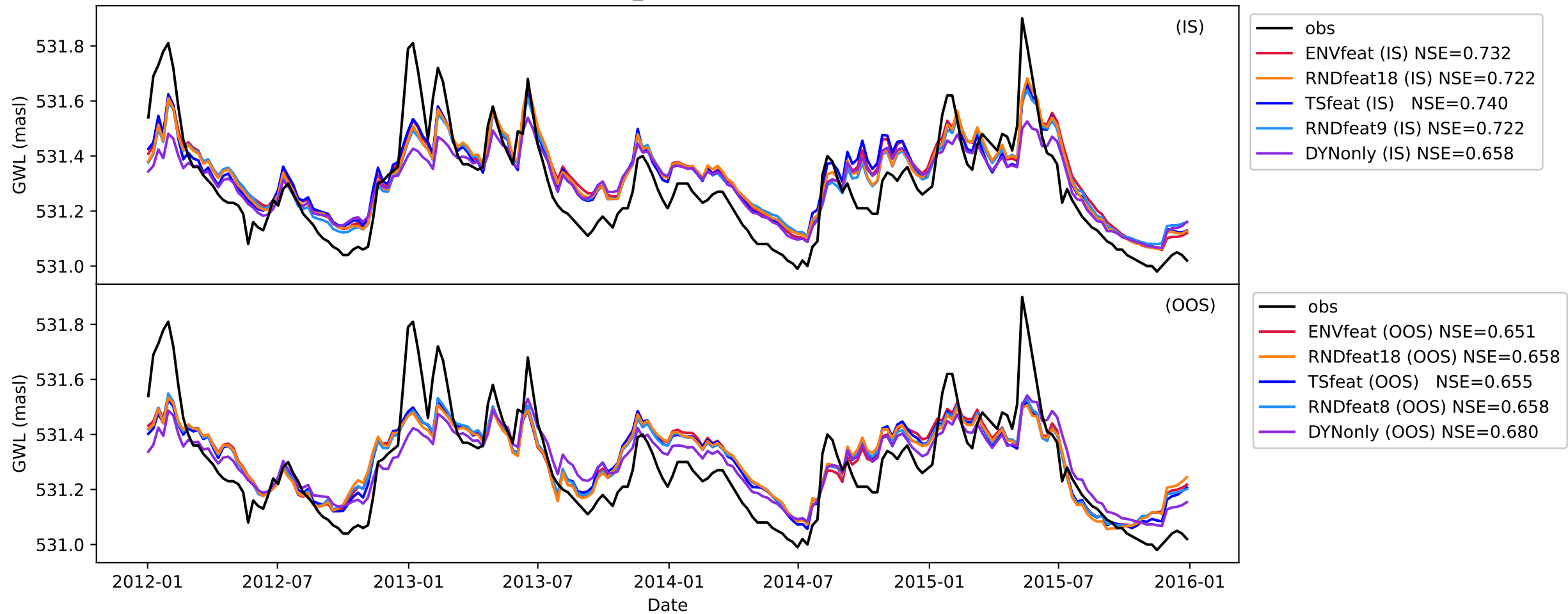
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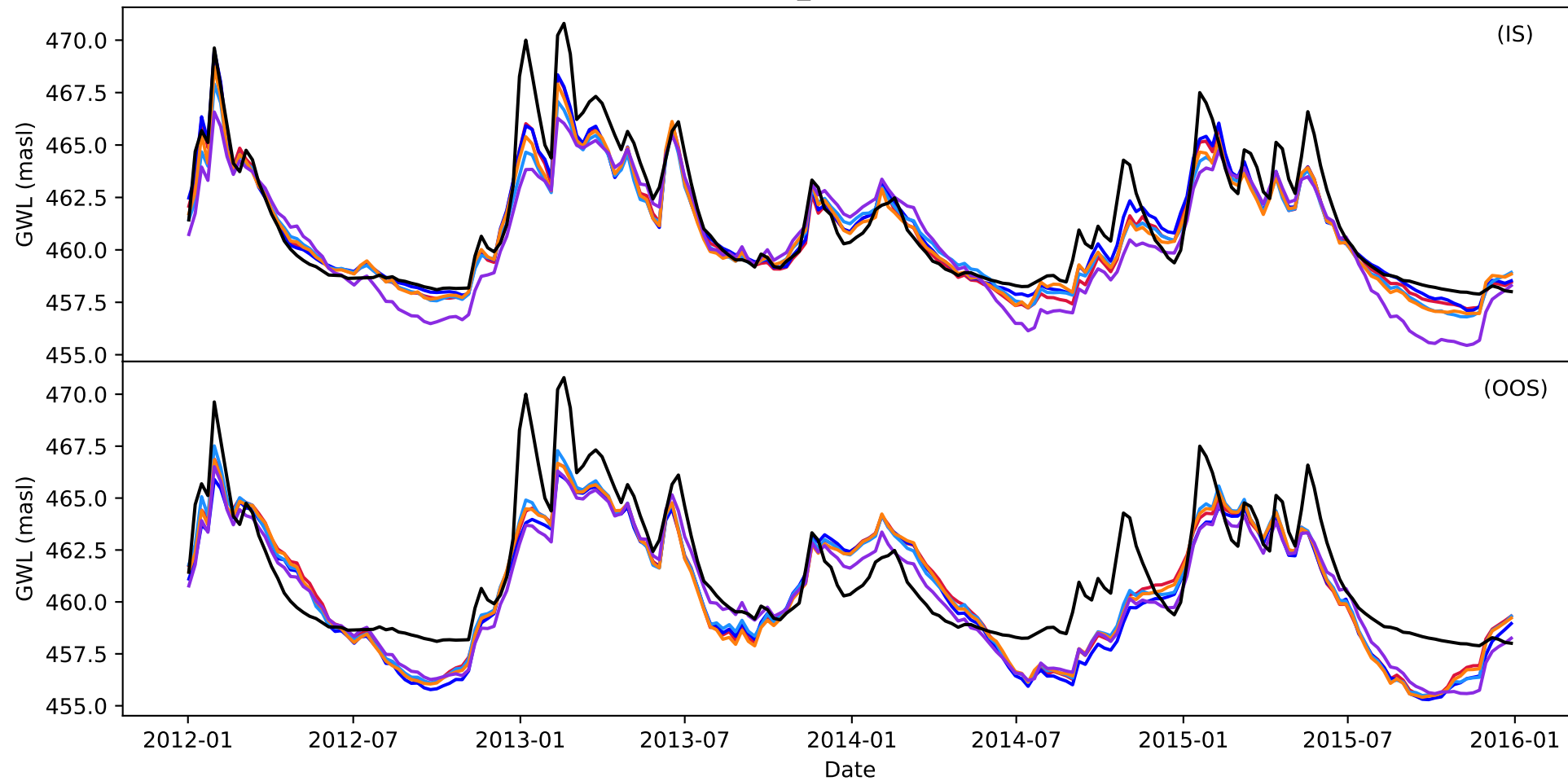
- obs
- ENVfeat (IS) NSE=0.868
- RNDfeat18 (IS) NSE=0.857
- TSfeat (IS) NSE=0.850
- RNDfeat9 (IS) NSE=0.857
- DYNOnly (IS) NSE=0.845

- obs
- ENVfeat (OOS) NSE=0.754
- RNDfeat18 (OOS) NSE=0.781
- TSfeat (OOS) NSE=0.798
- RNDfeat8 (OOS) NSE=0.781
- DYNOnly (OOS) NSE=0.867

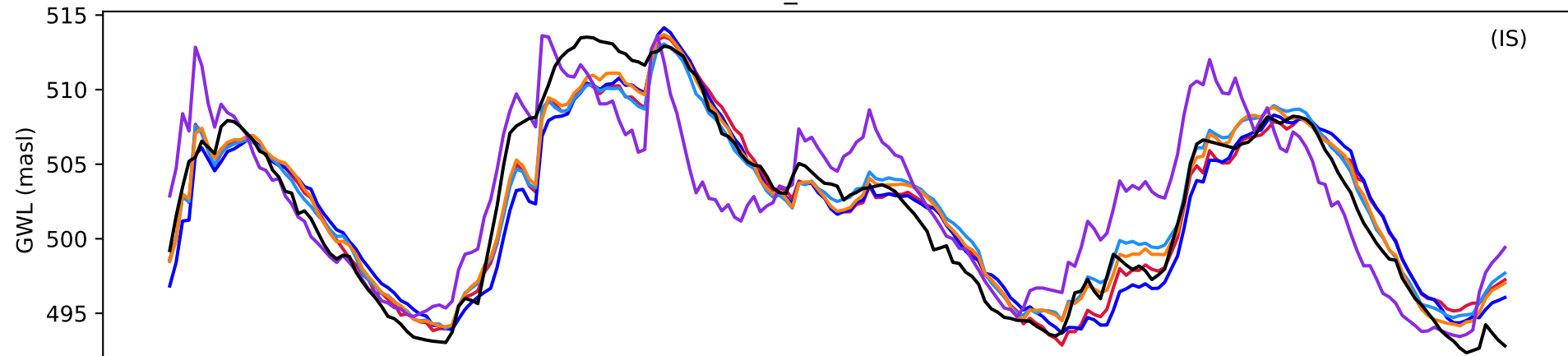
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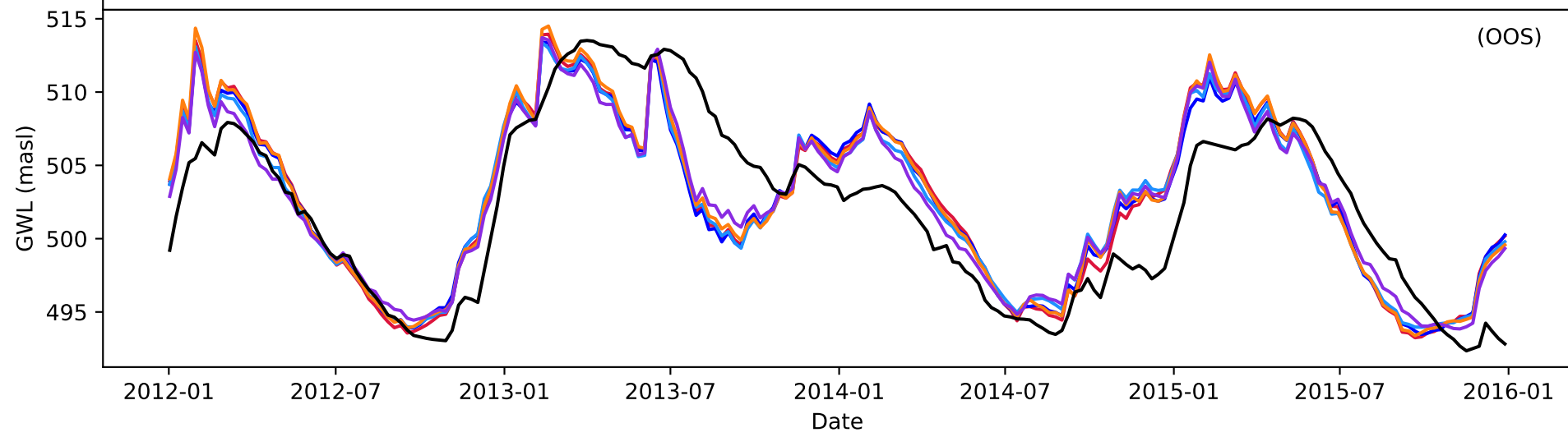
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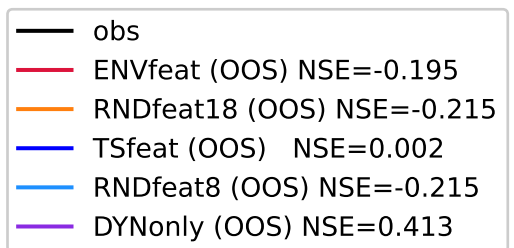
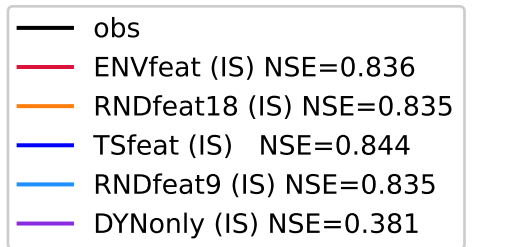
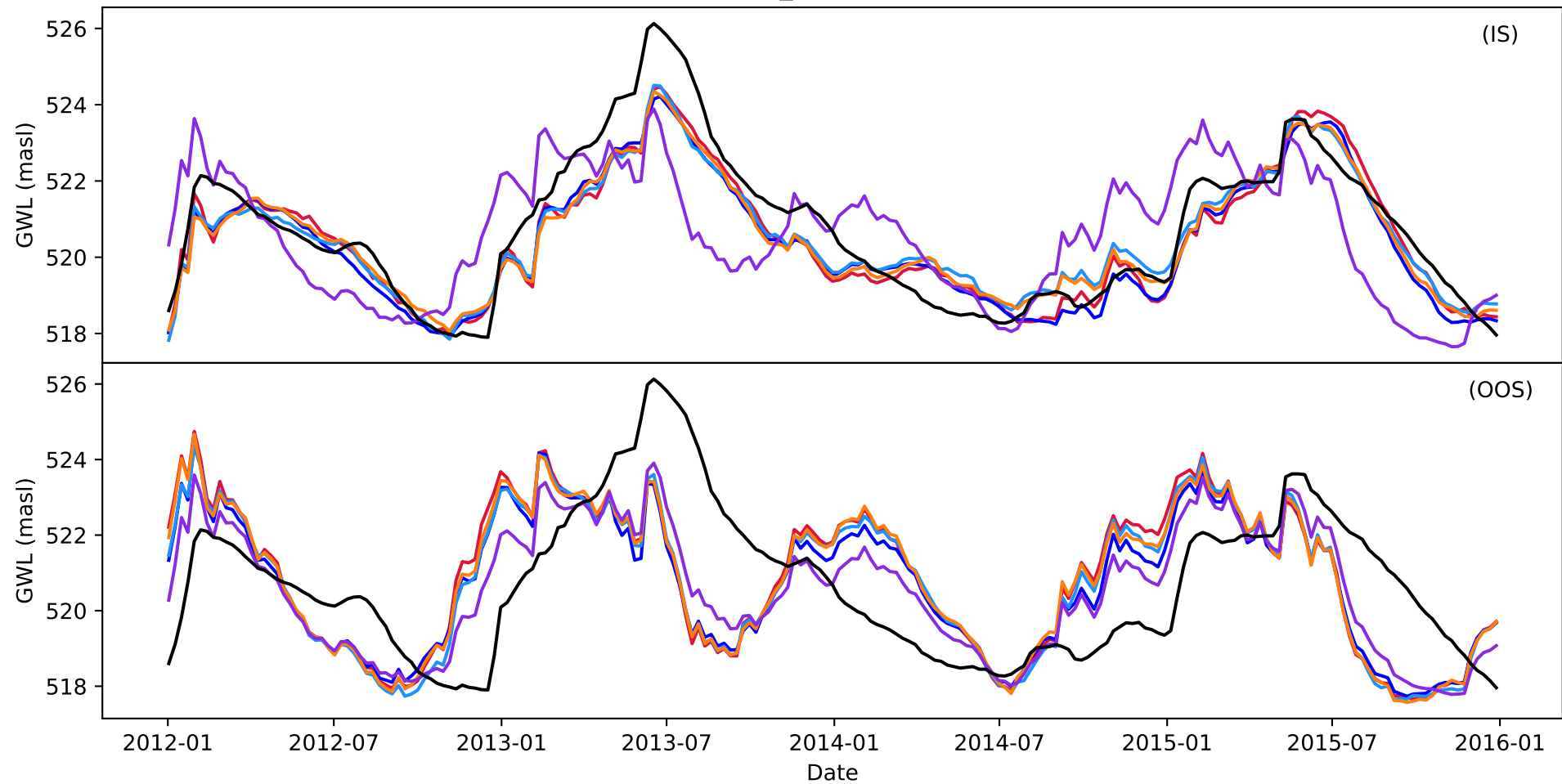


- obs
- ENVfeat (IS) NSE=0.934
- RNDfeat18 (IS) NSE=0.930
- TSfeat (IS) NSE=0.916
- RNDfeat9 (IS) NSE=0.930
- DYNOnly (IS) NSE=0.804

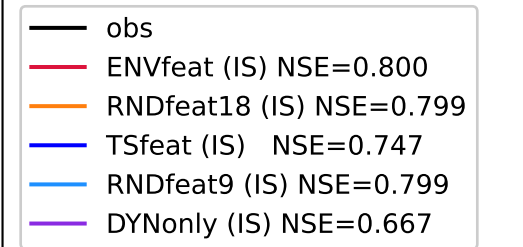
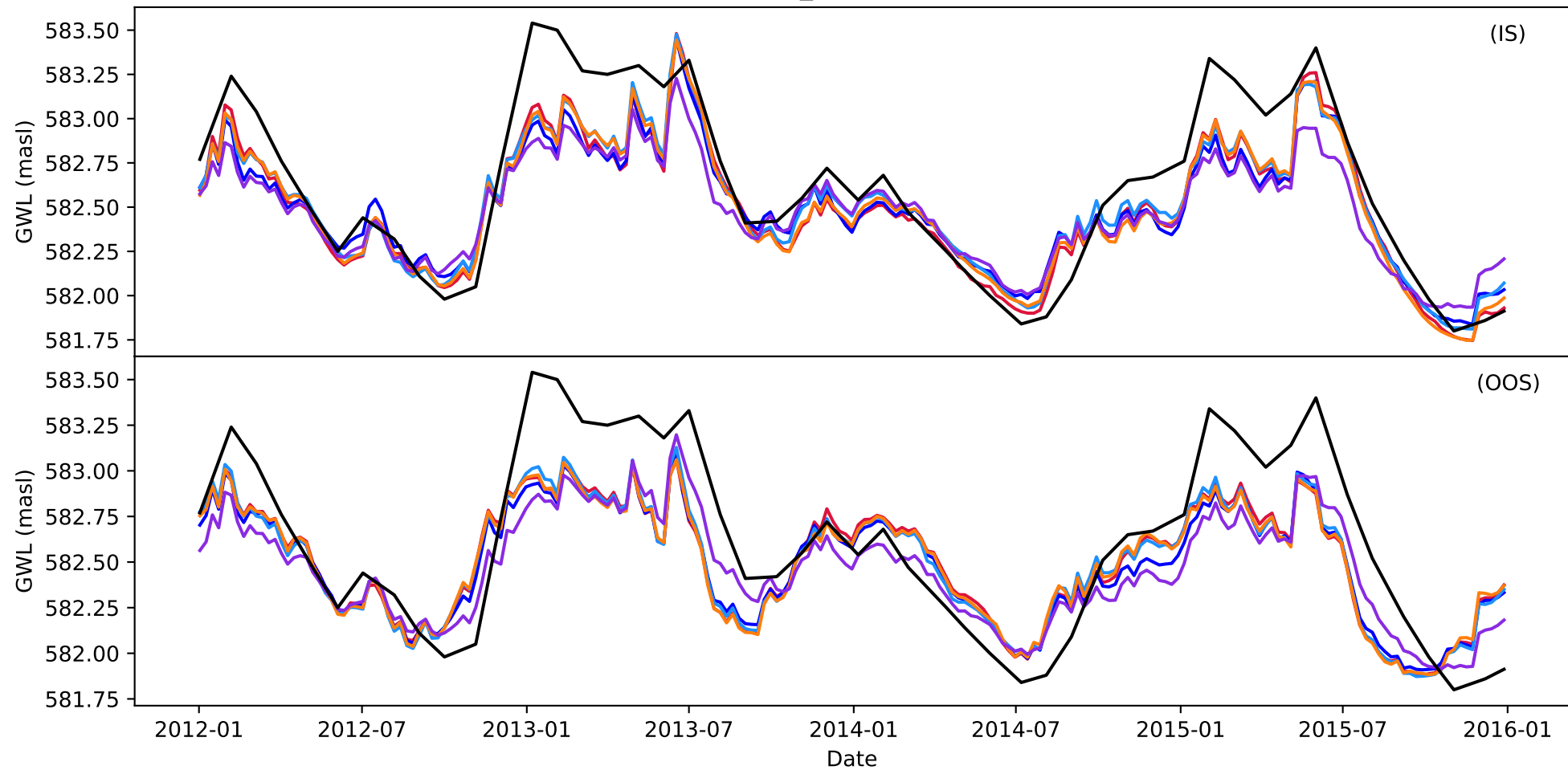


- obs
- ENVfeat (OOS) NSE=0.767
- RNDfeat18 (OOS) NSE=0.762
- TSfeat (OOS) NSE=0.764
- RNDfeat8 (OOS) NSE=0.762
- DYNOnly (OOS) NSE=0.807

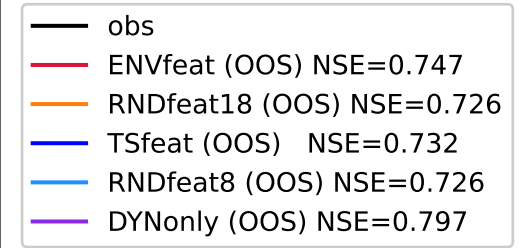
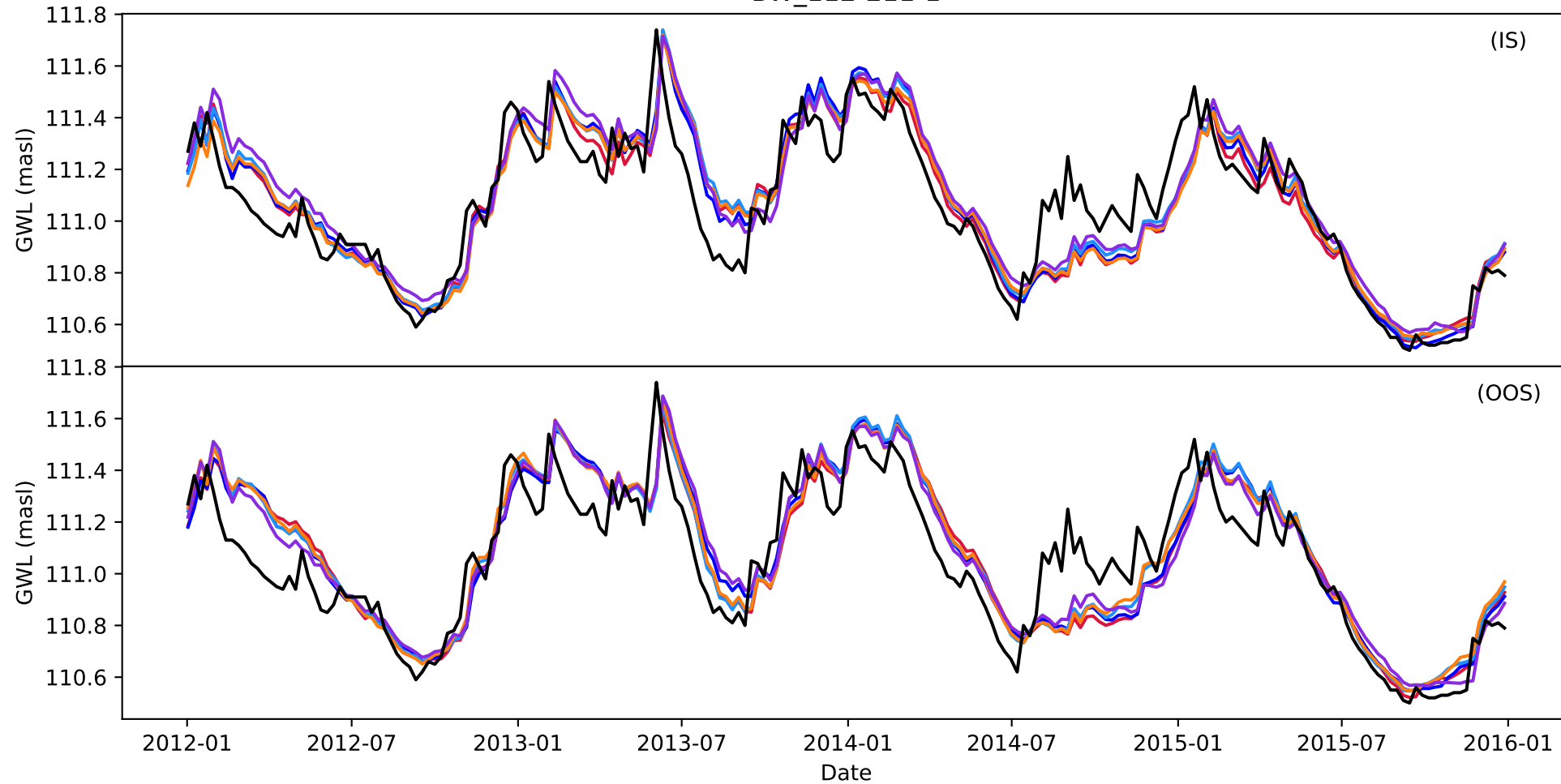
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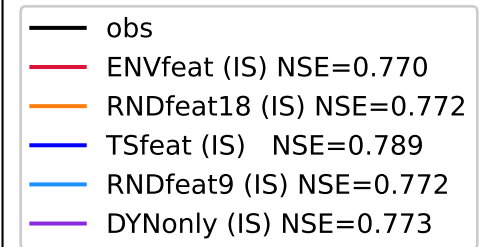
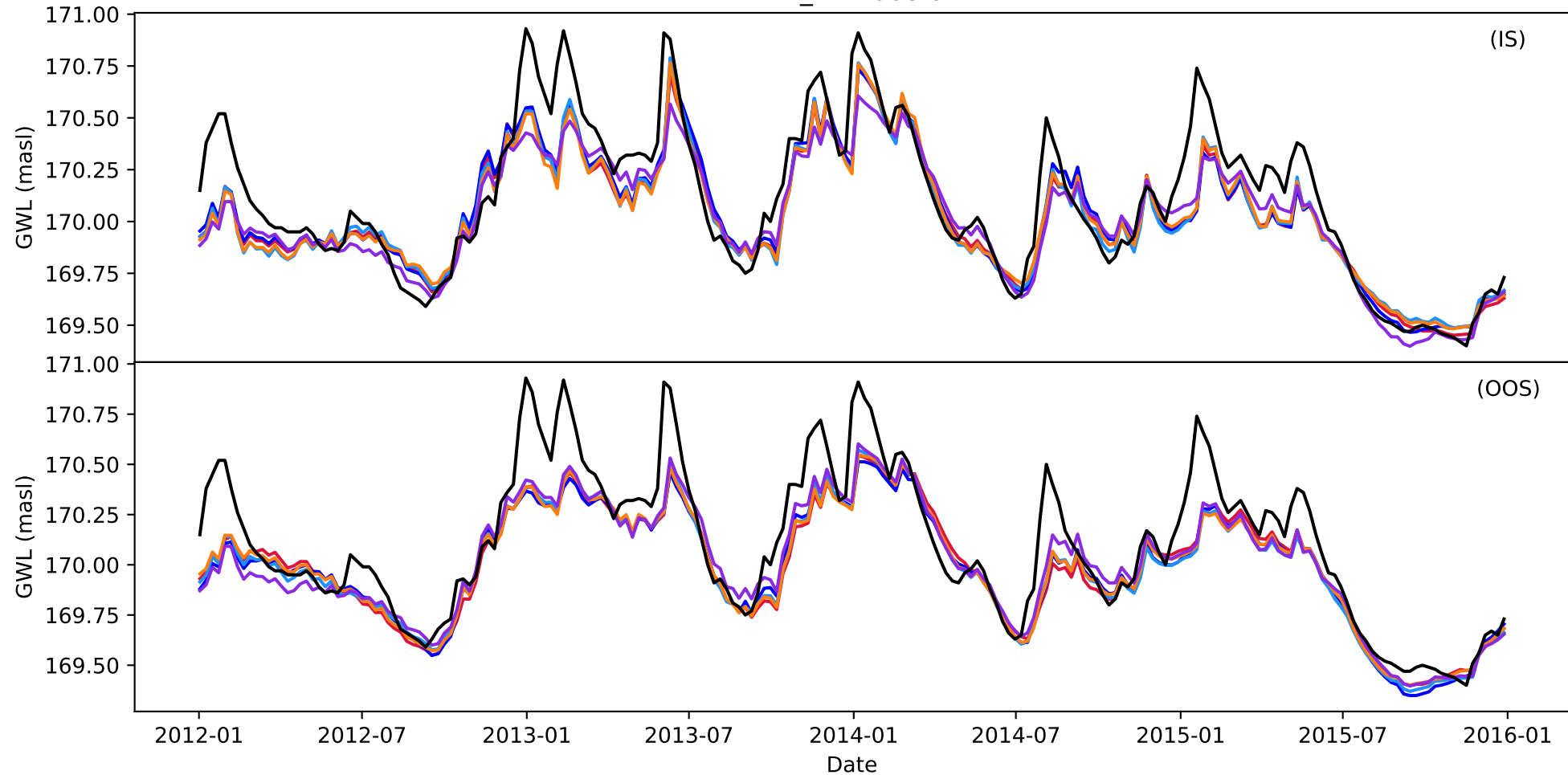
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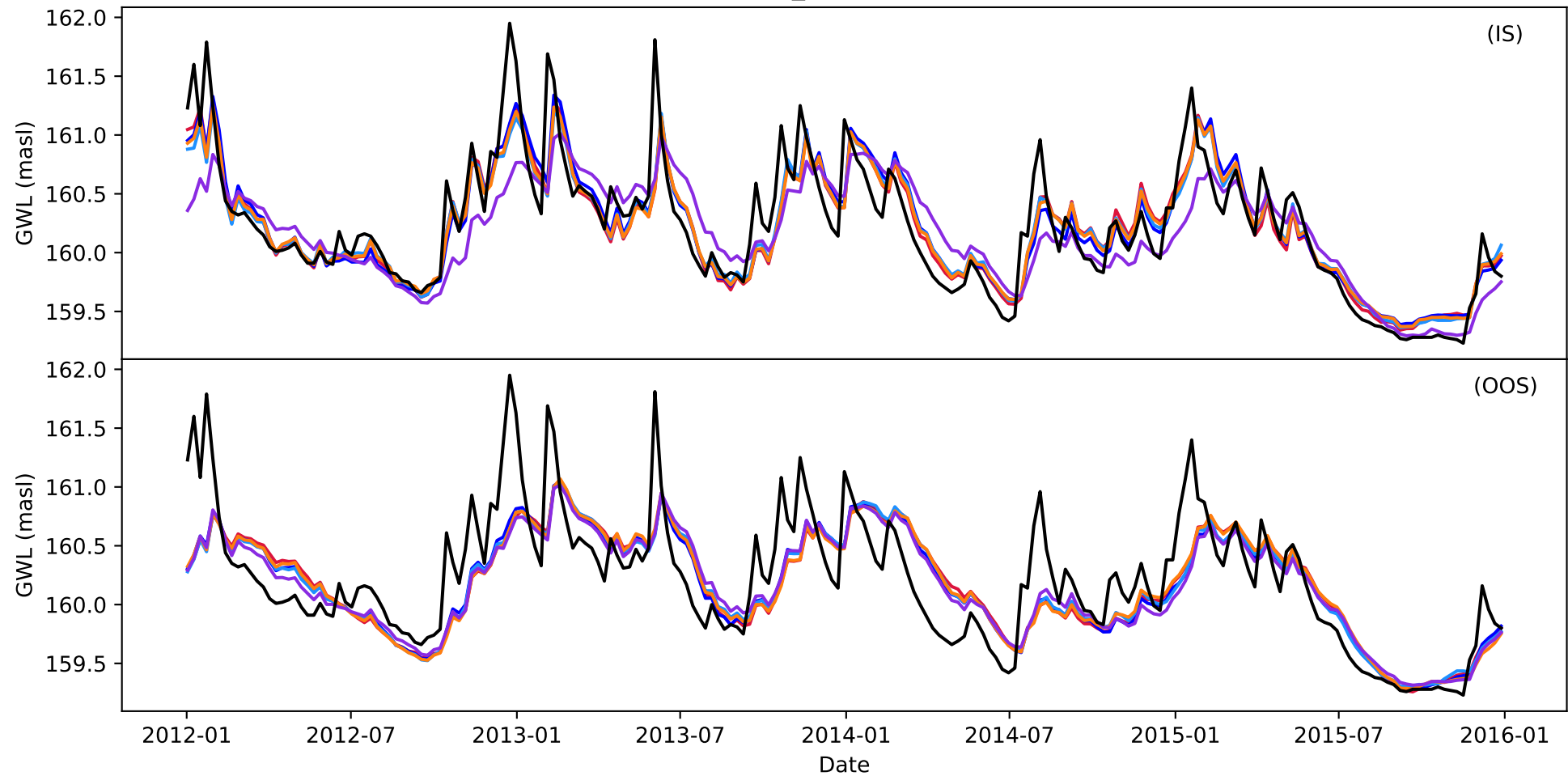
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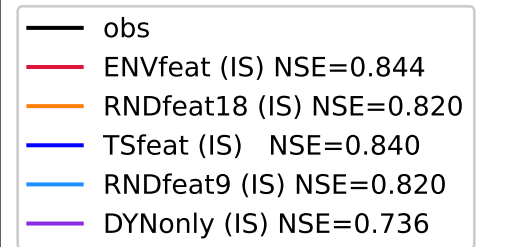
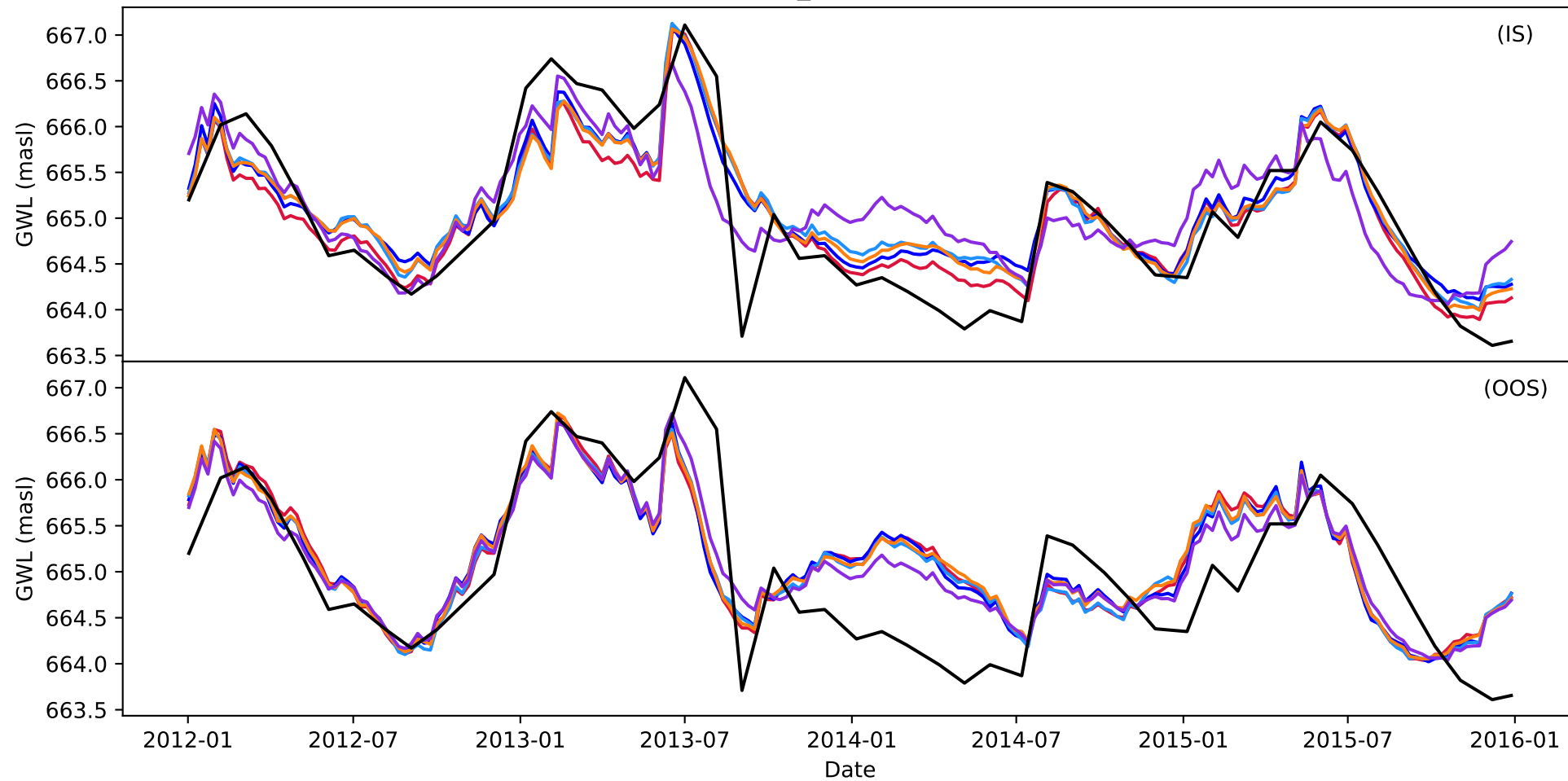
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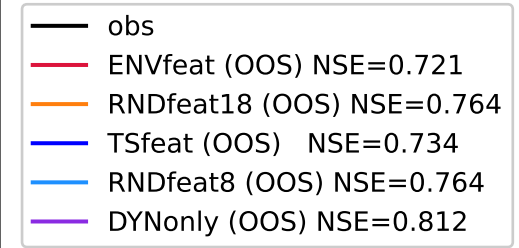
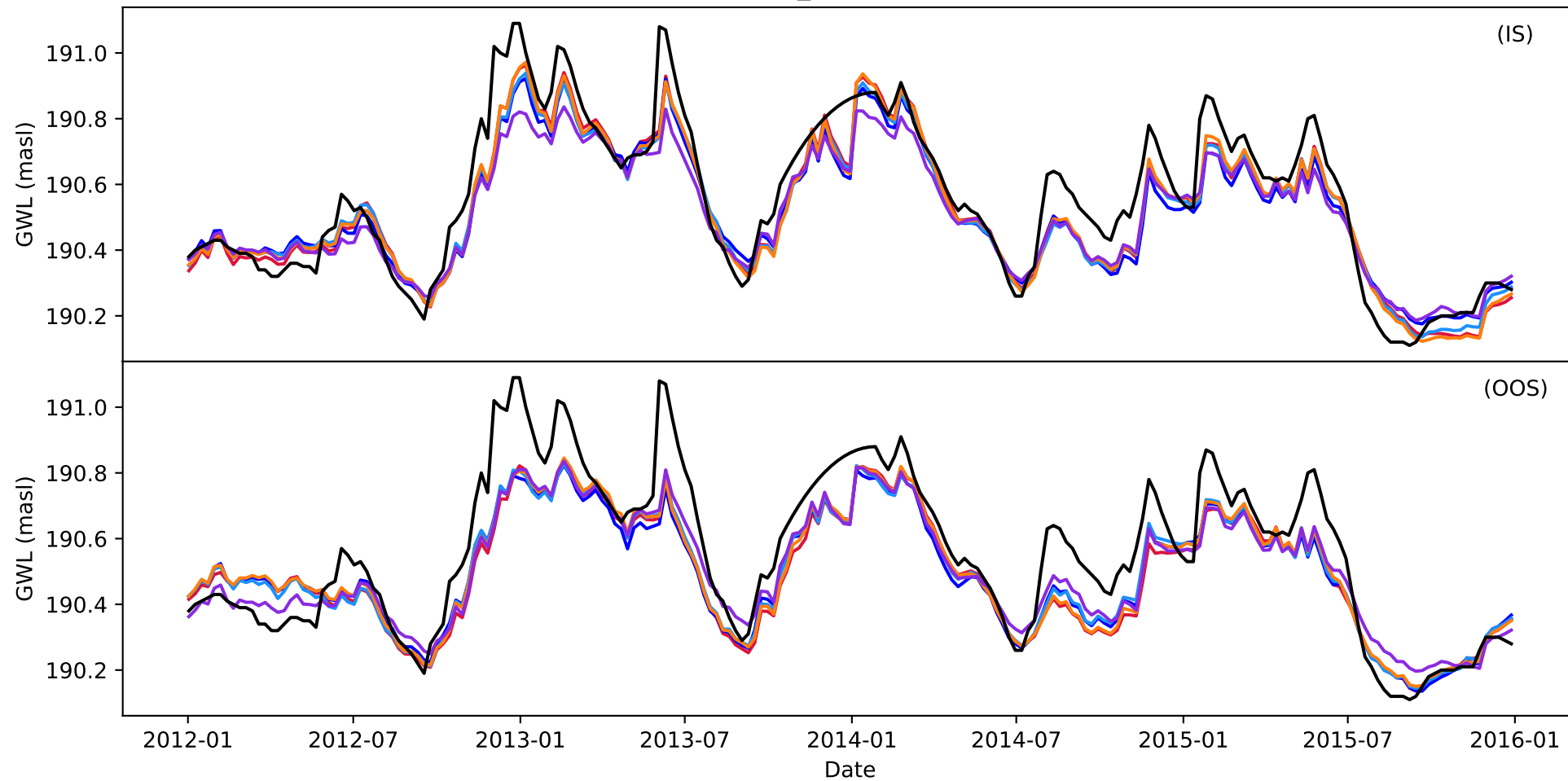
- obs
- ENVfeat (IS) NSE=0.781
- RNDfeat18 (IS) NSE=0.771
- TSfeat (IS) NSE=0.767
- RNDfeat9 (IS) NSE=0.771
- DYNonly (IS) NSE=0.578

- obs
- ENVfeat (OOS) NSE=0.501
- RNDfeat18 (OOS) NSE=0.533
- TSfeat (OOS) NSE=0.568
- RNDfeat8 (OOS) NSE=0.533
- DYNonly (OOS) NSE=0.560

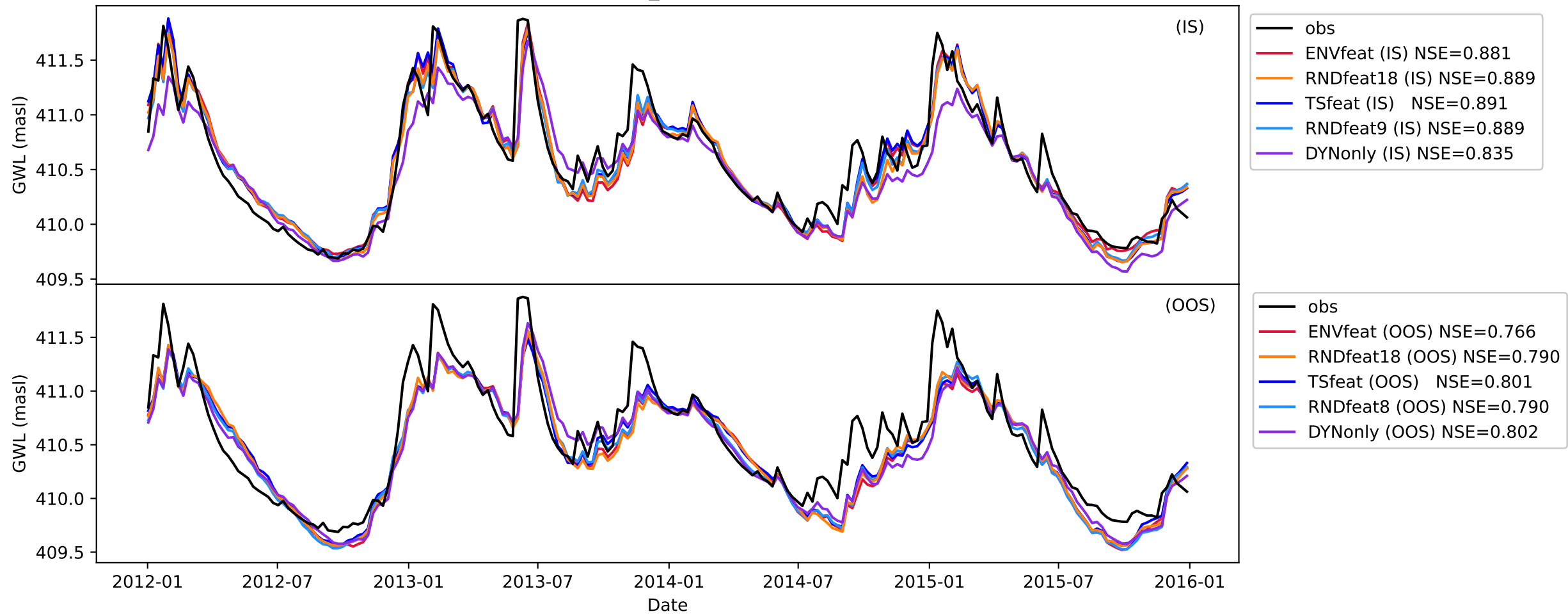
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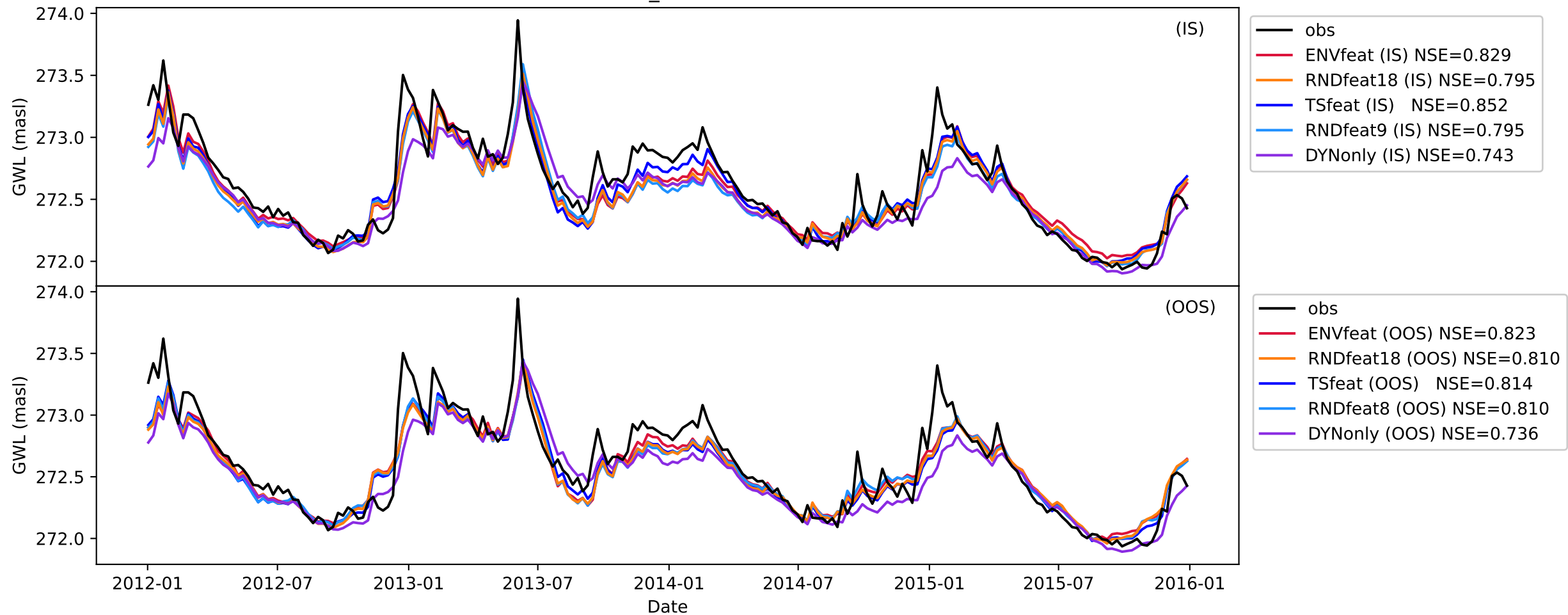
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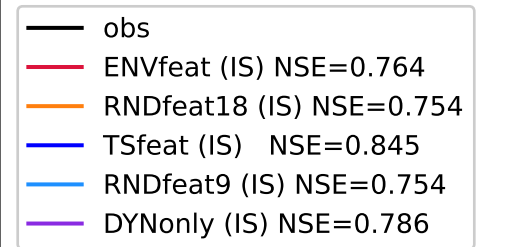
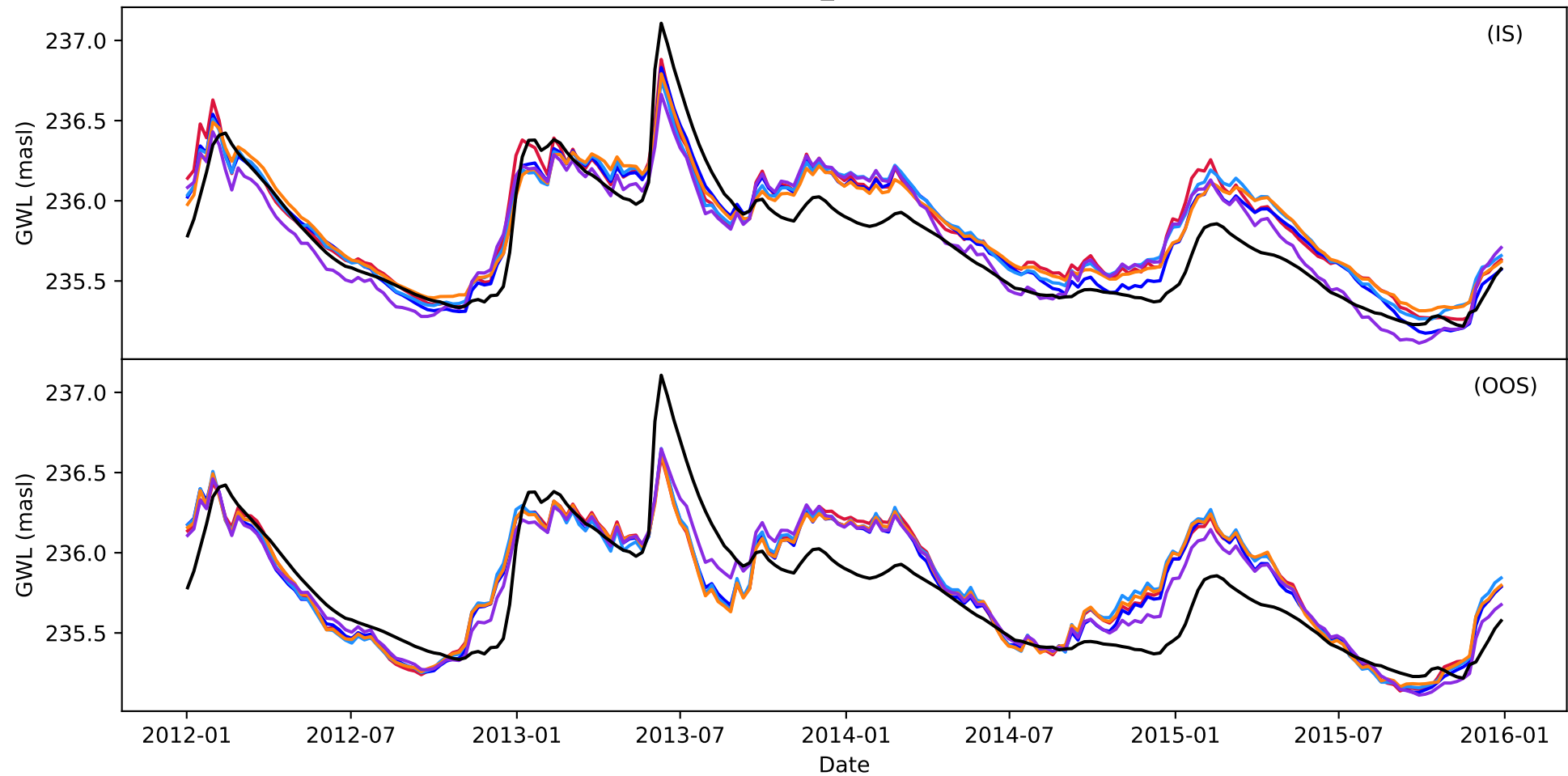
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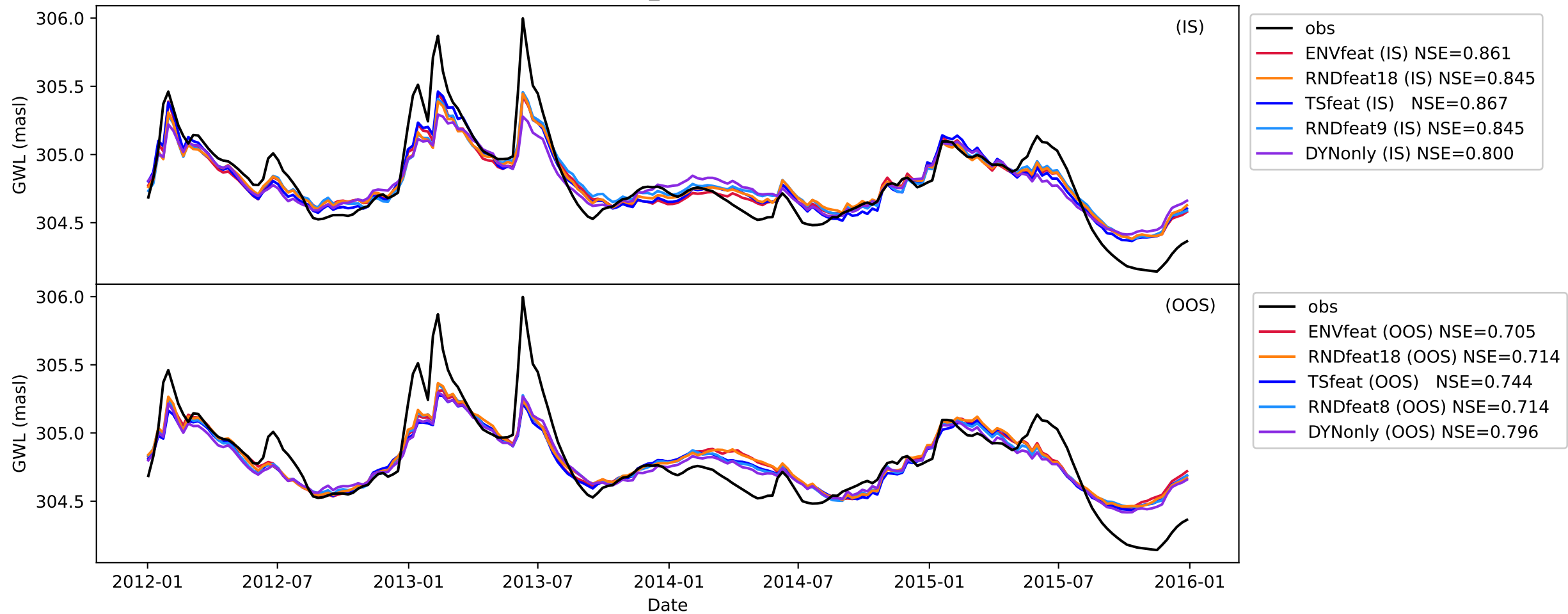
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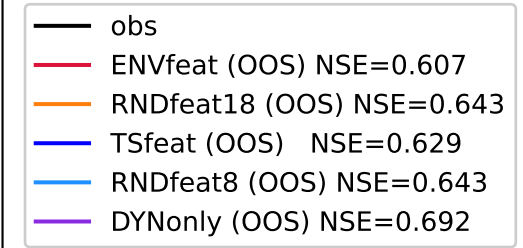
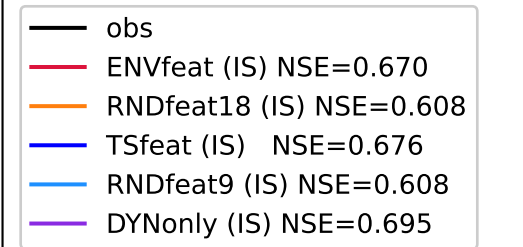
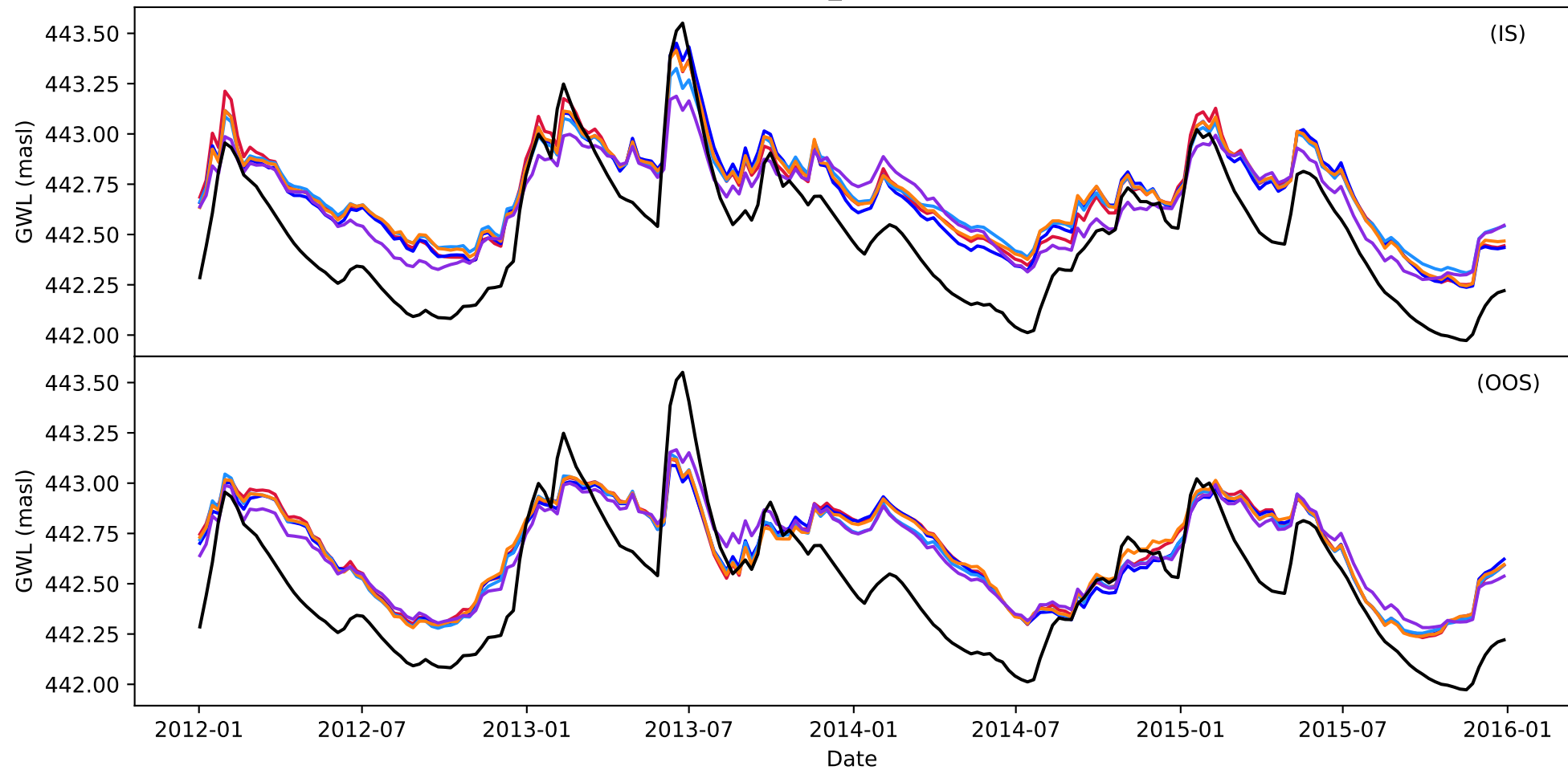
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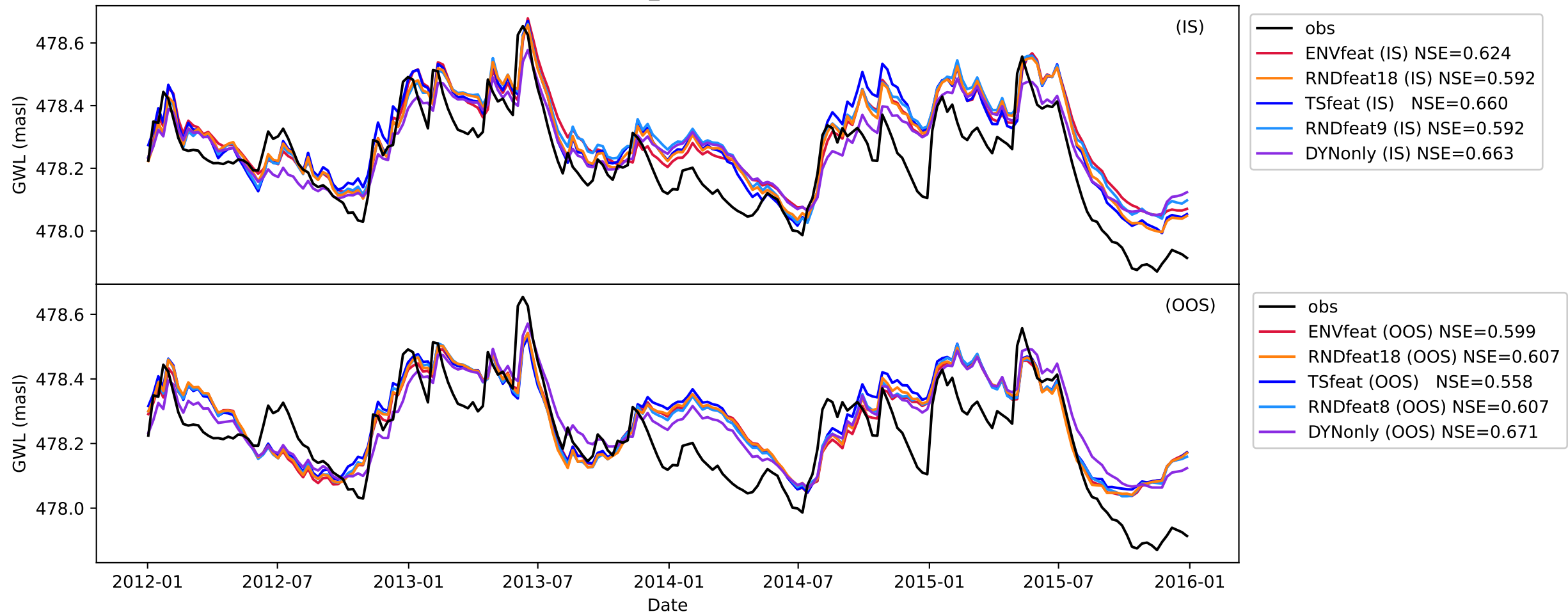
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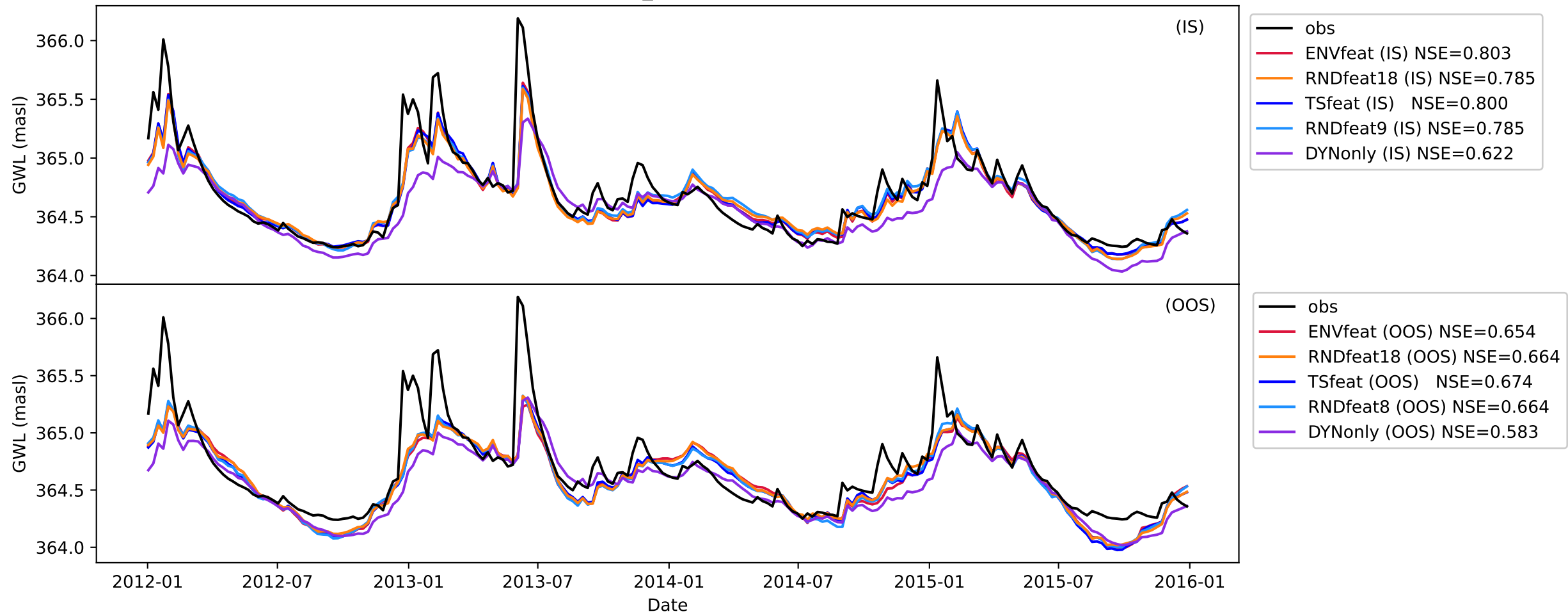
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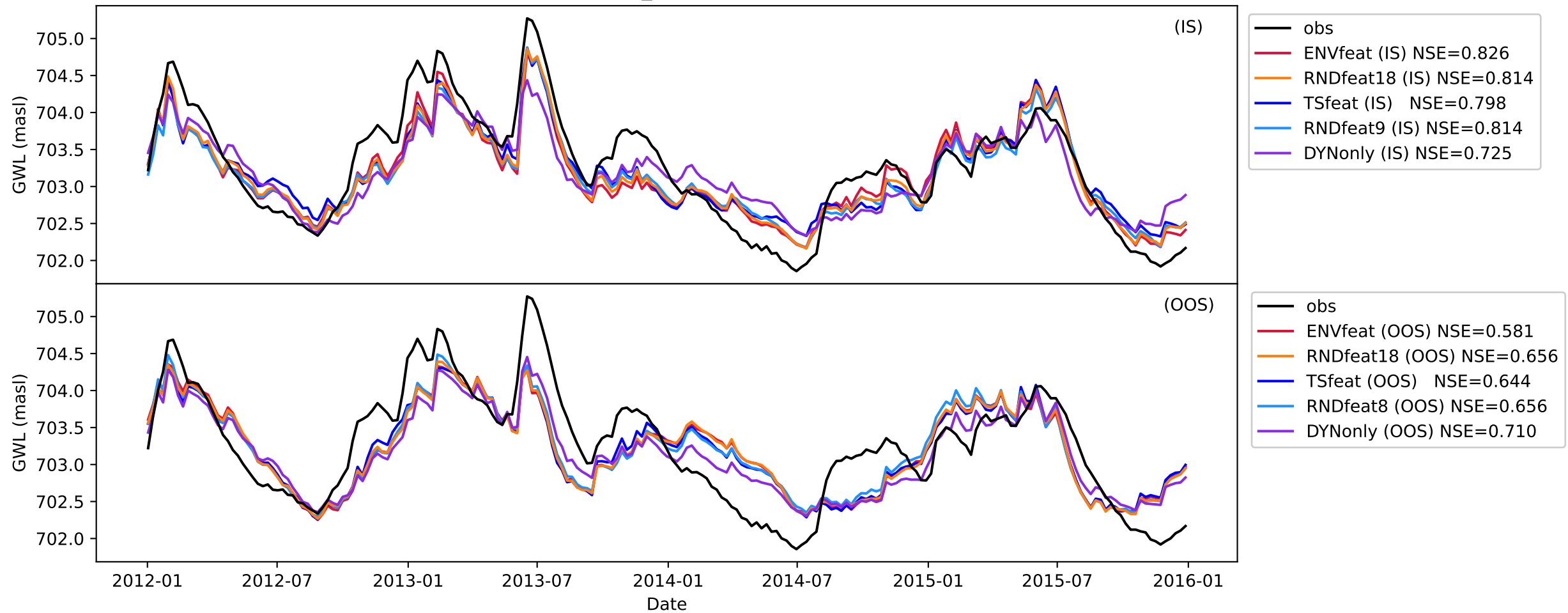
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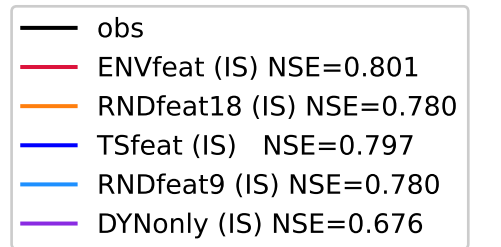
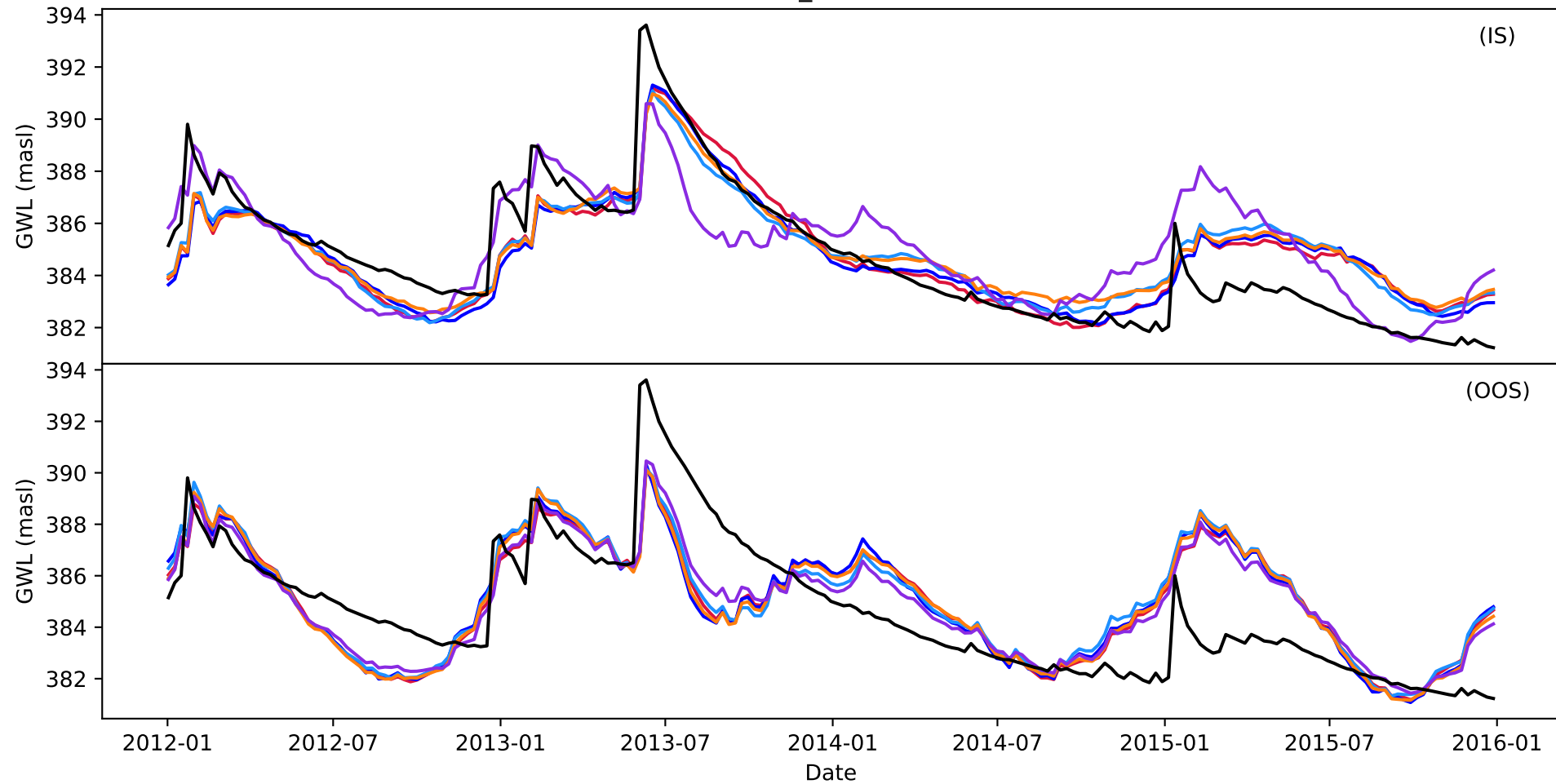
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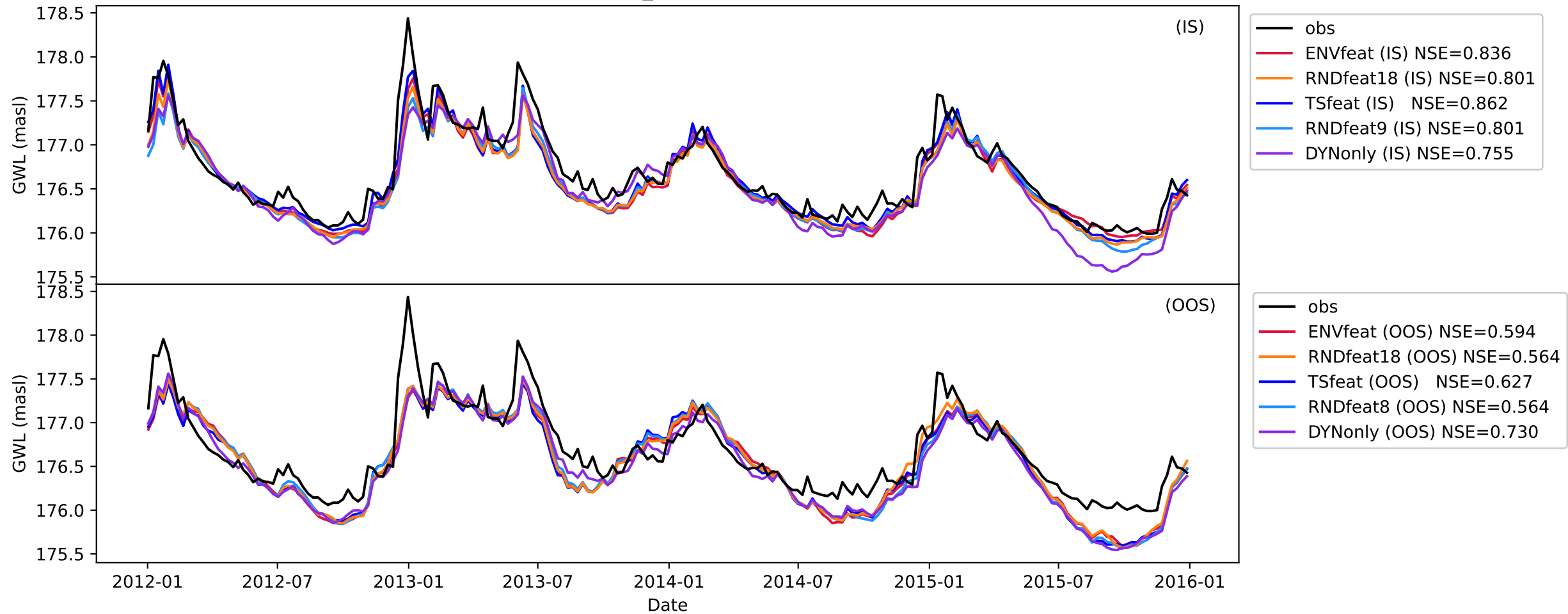
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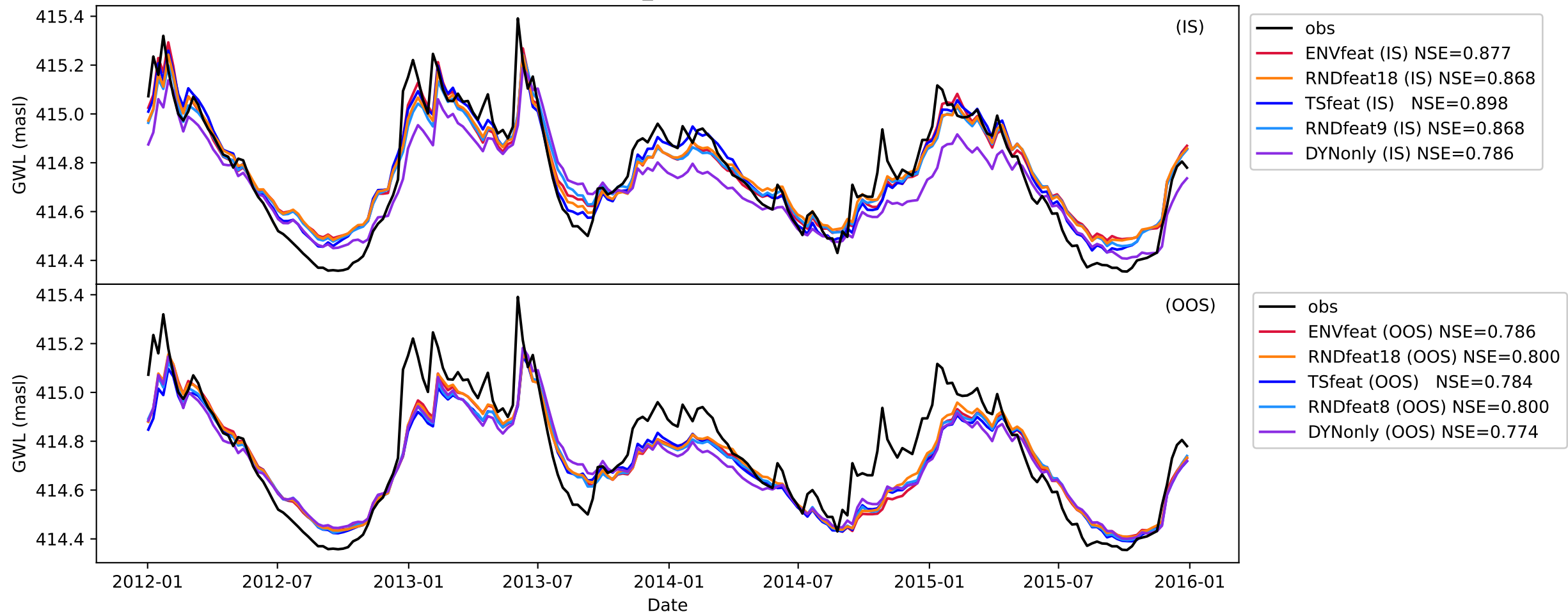
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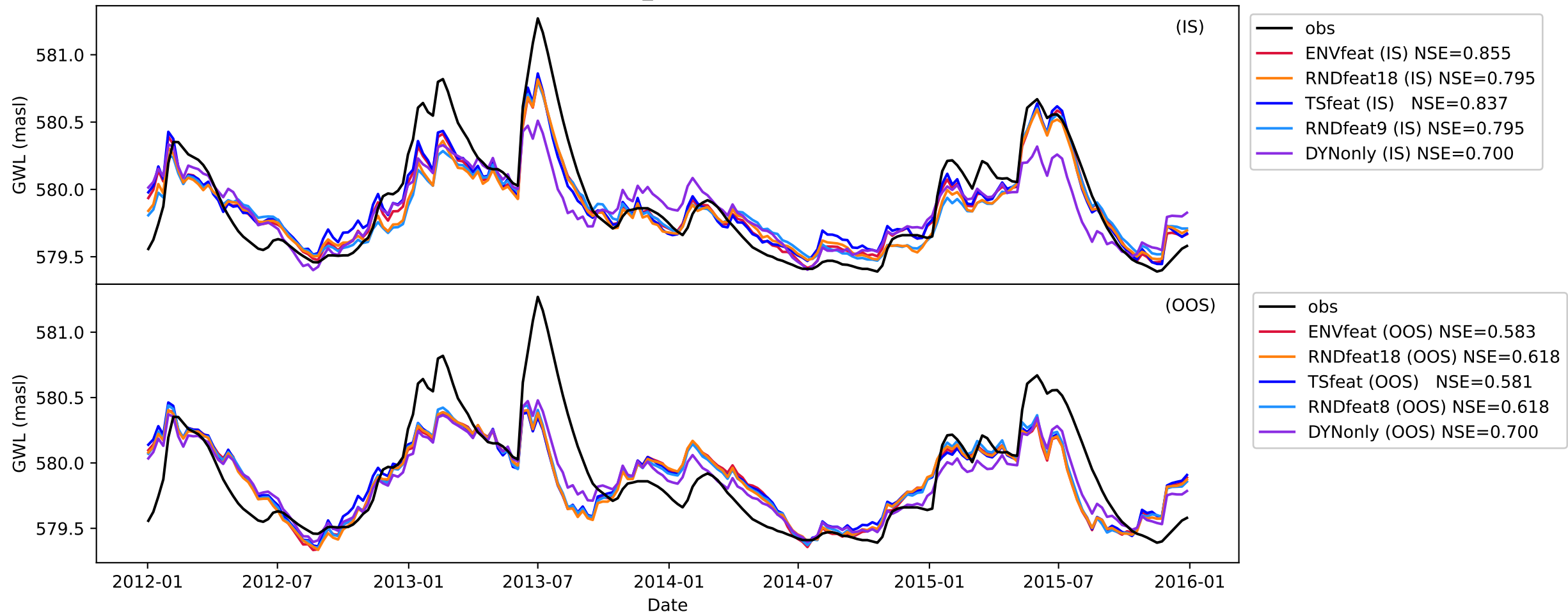
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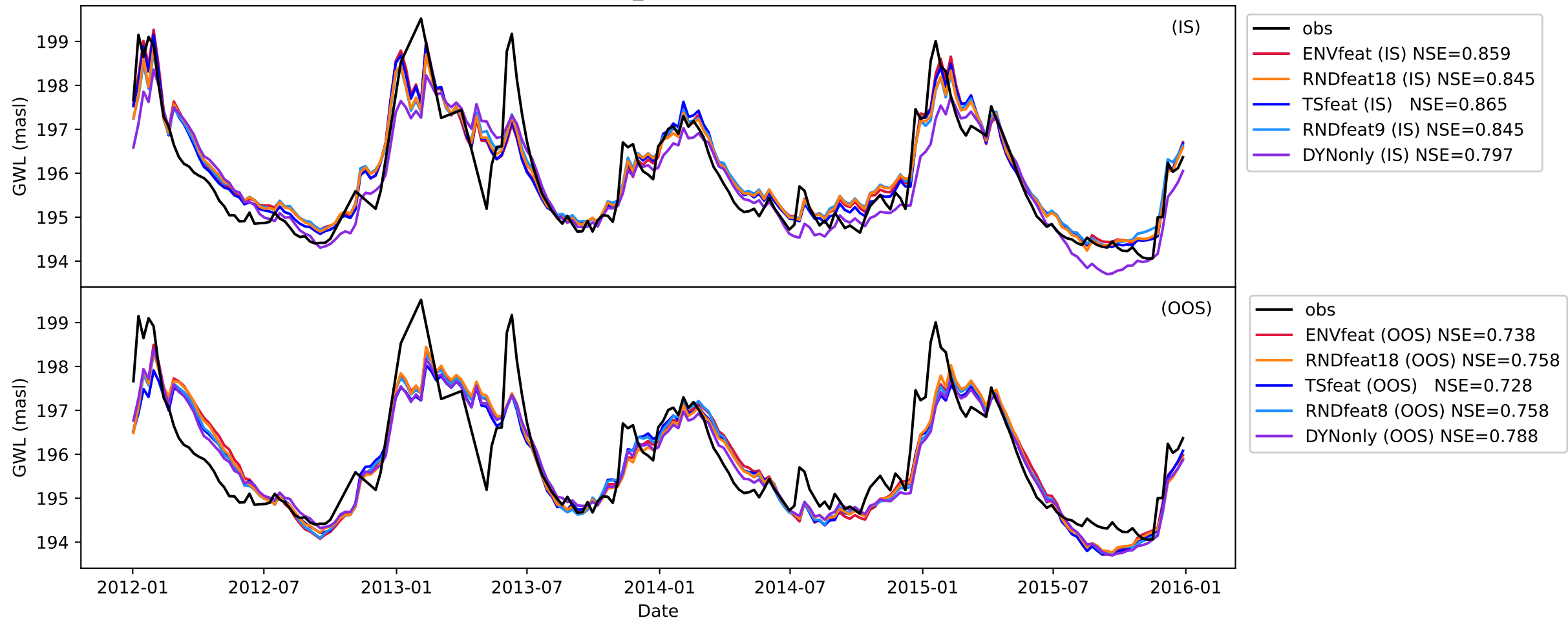
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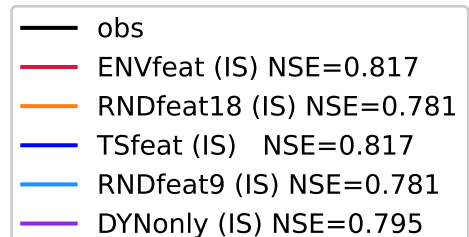
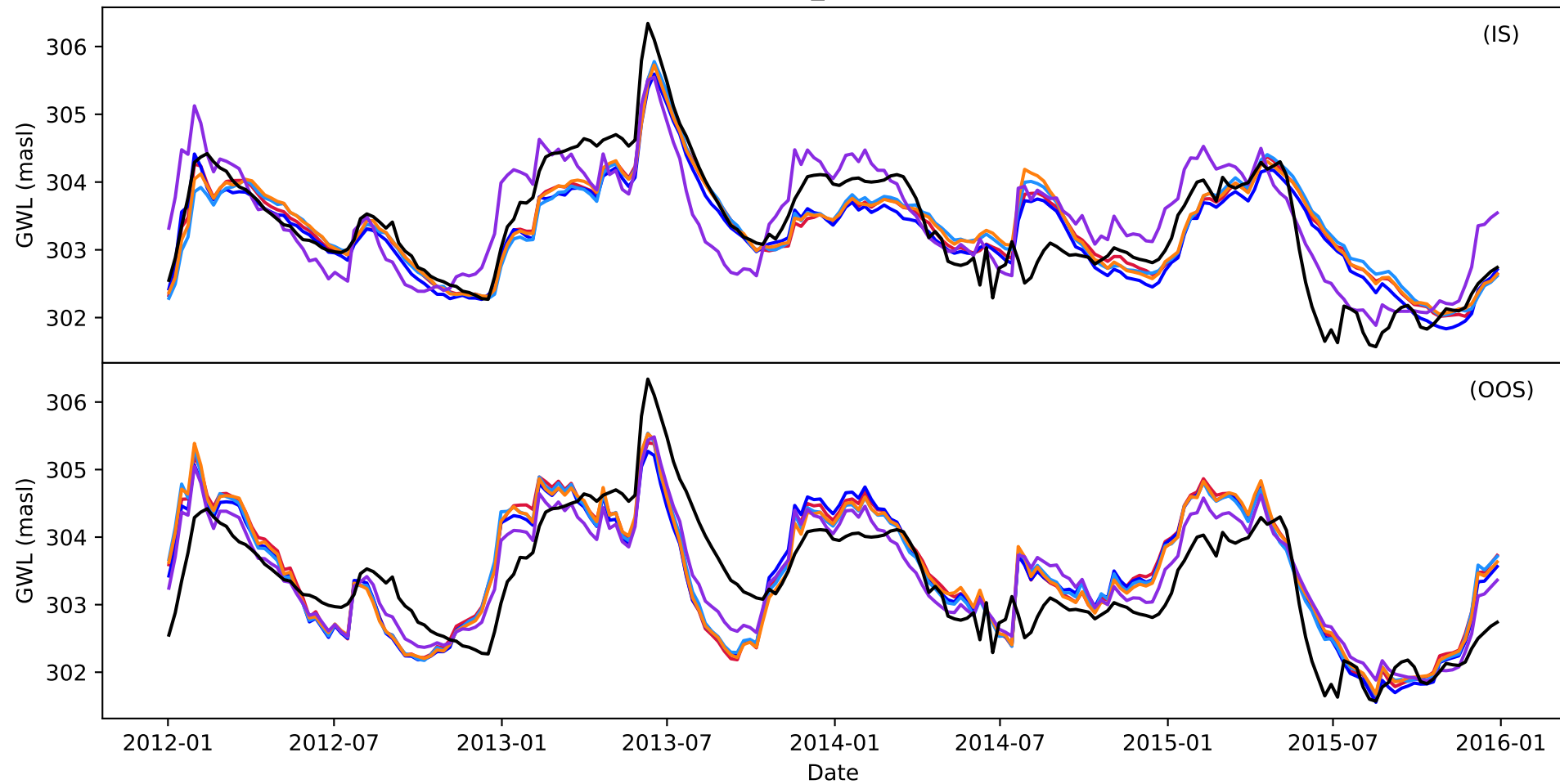
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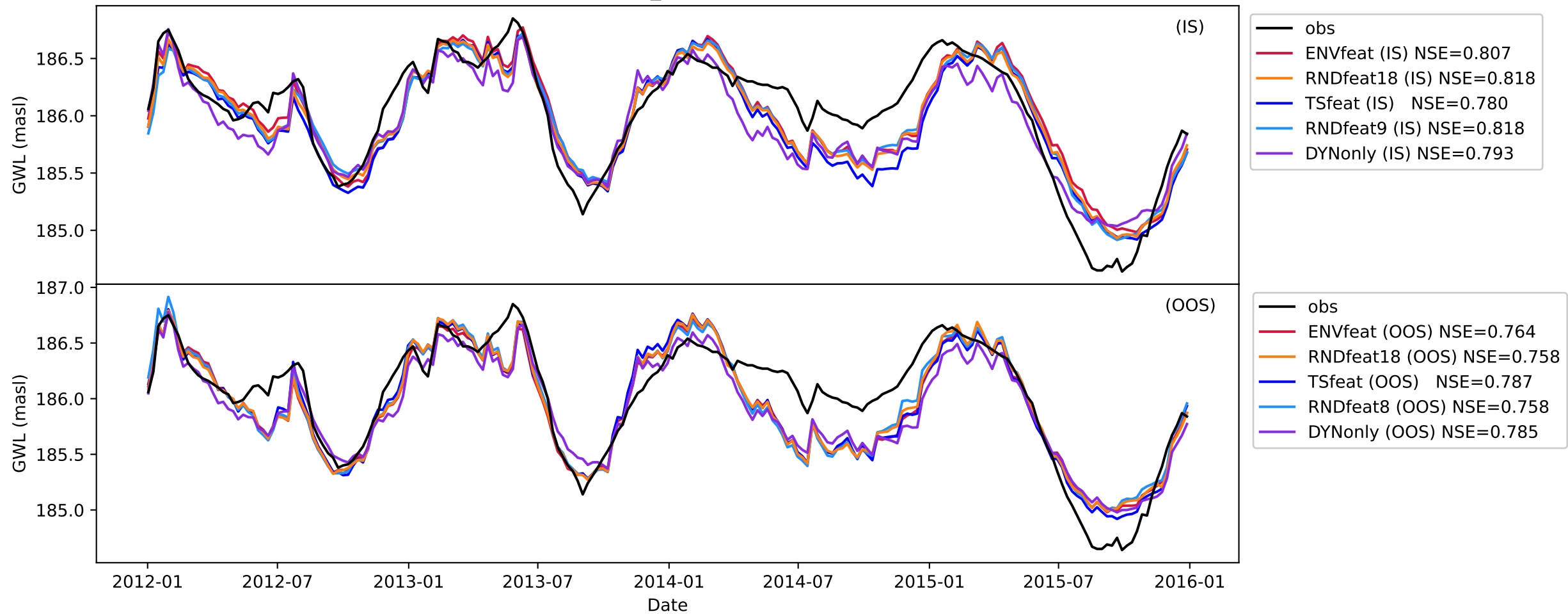
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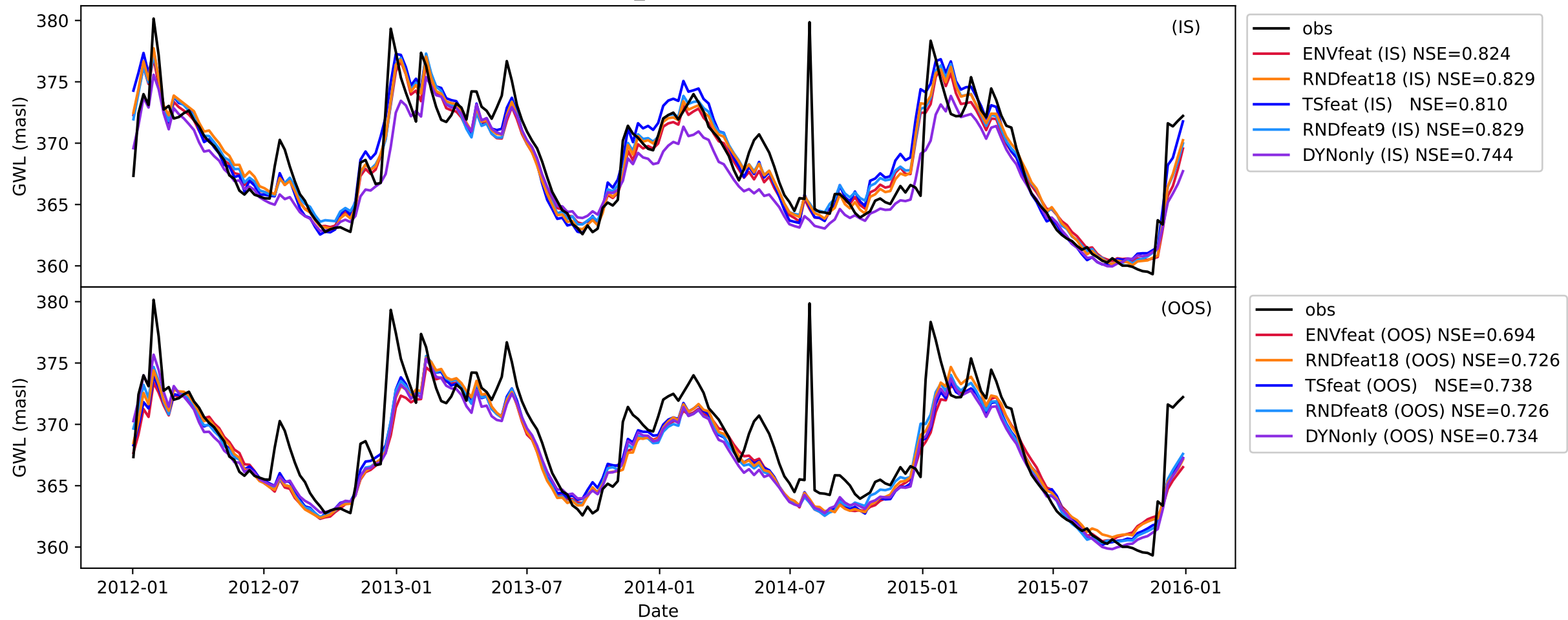
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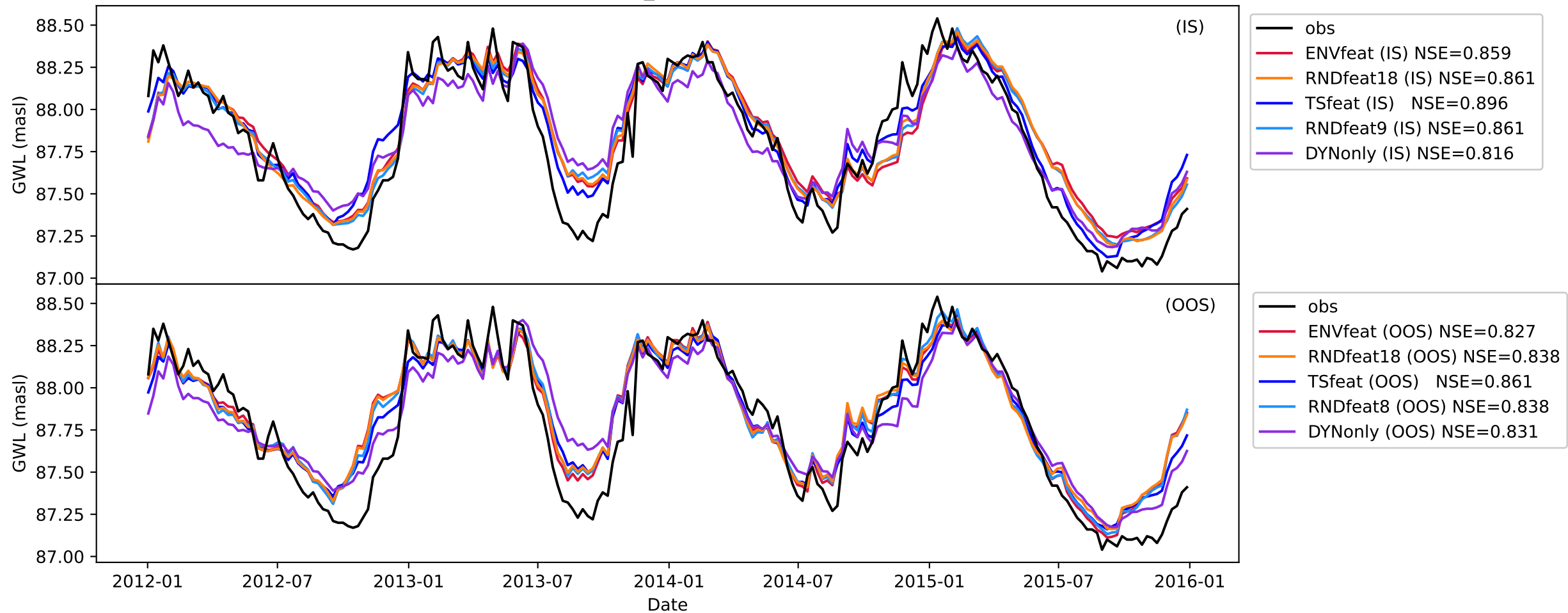
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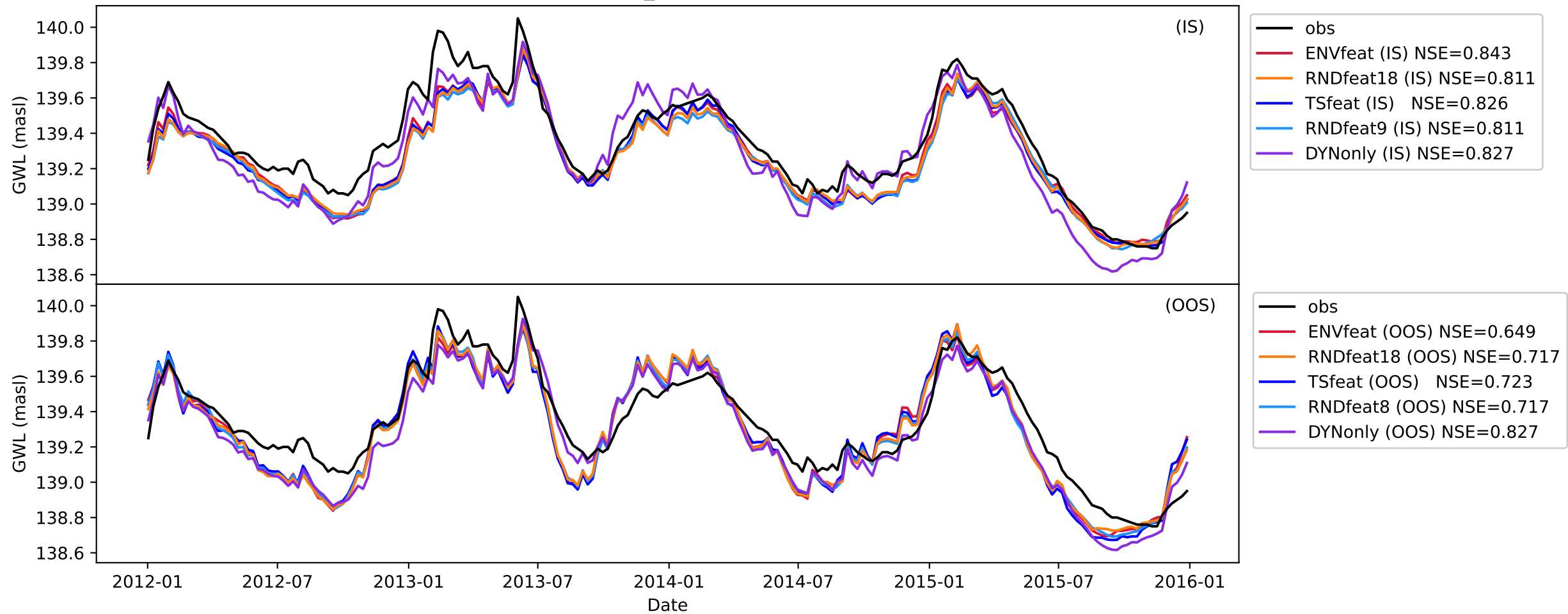
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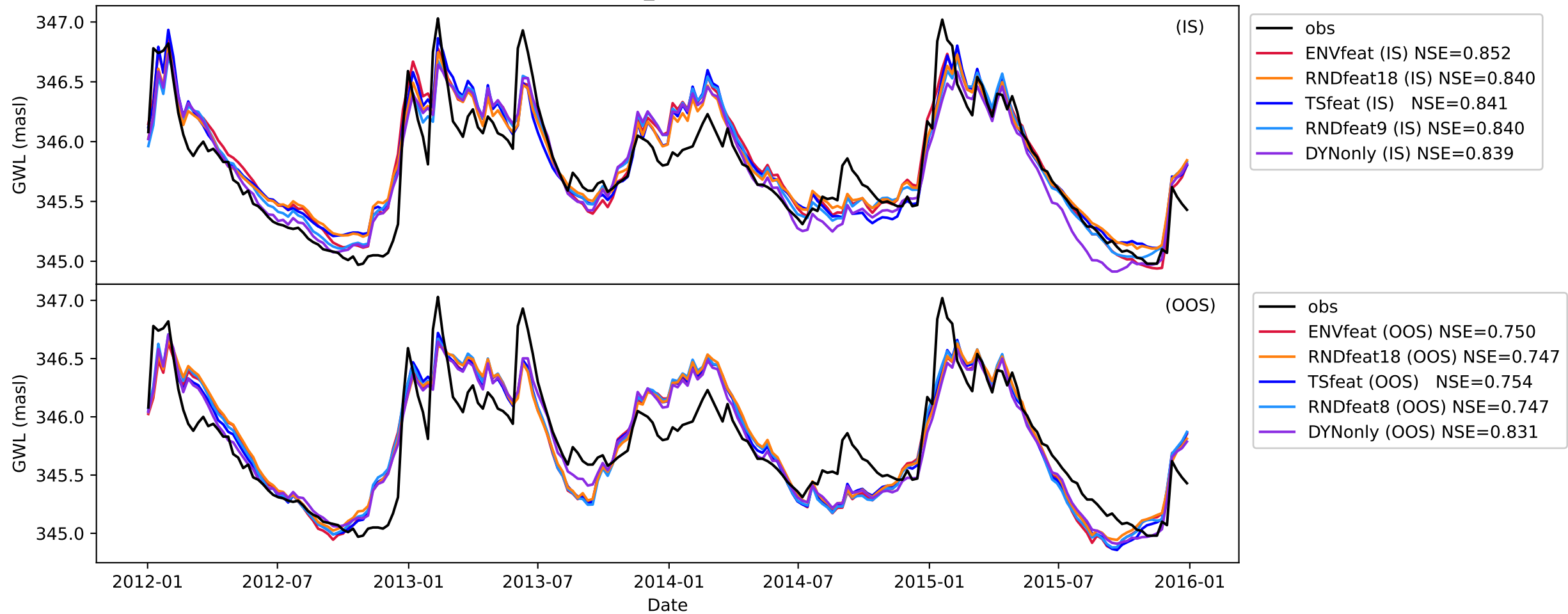
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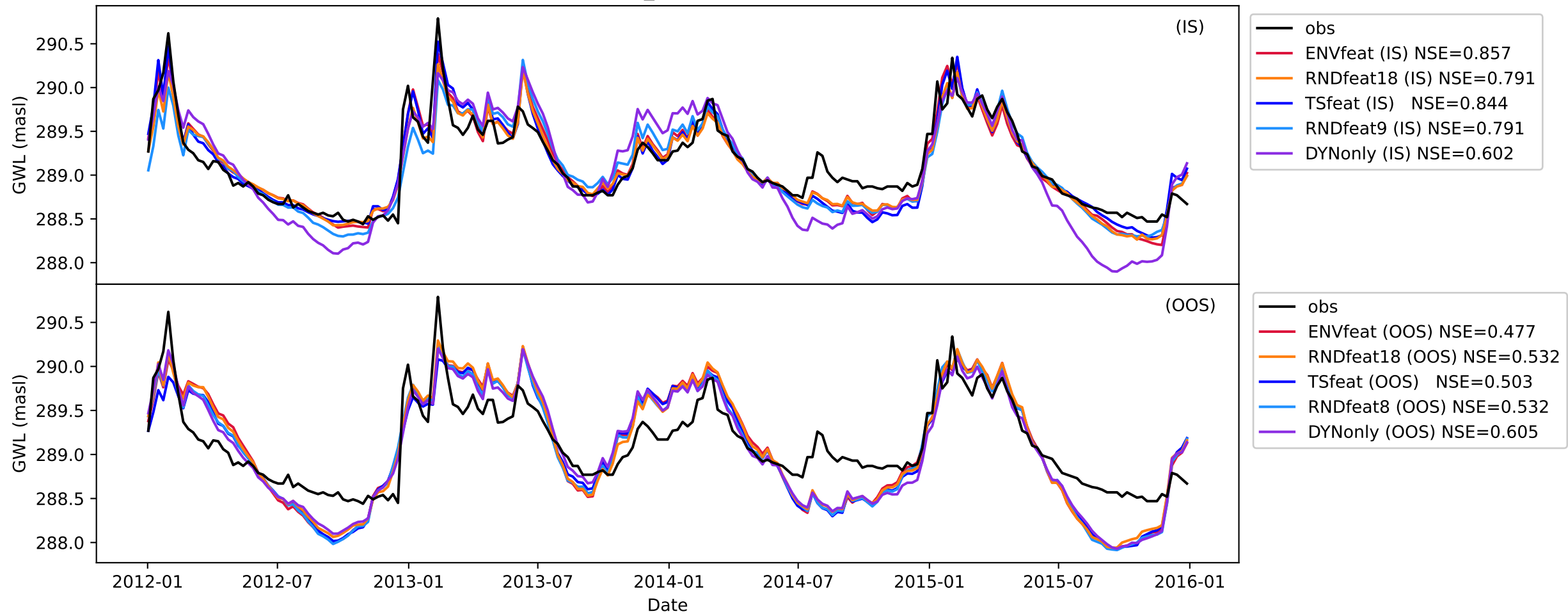
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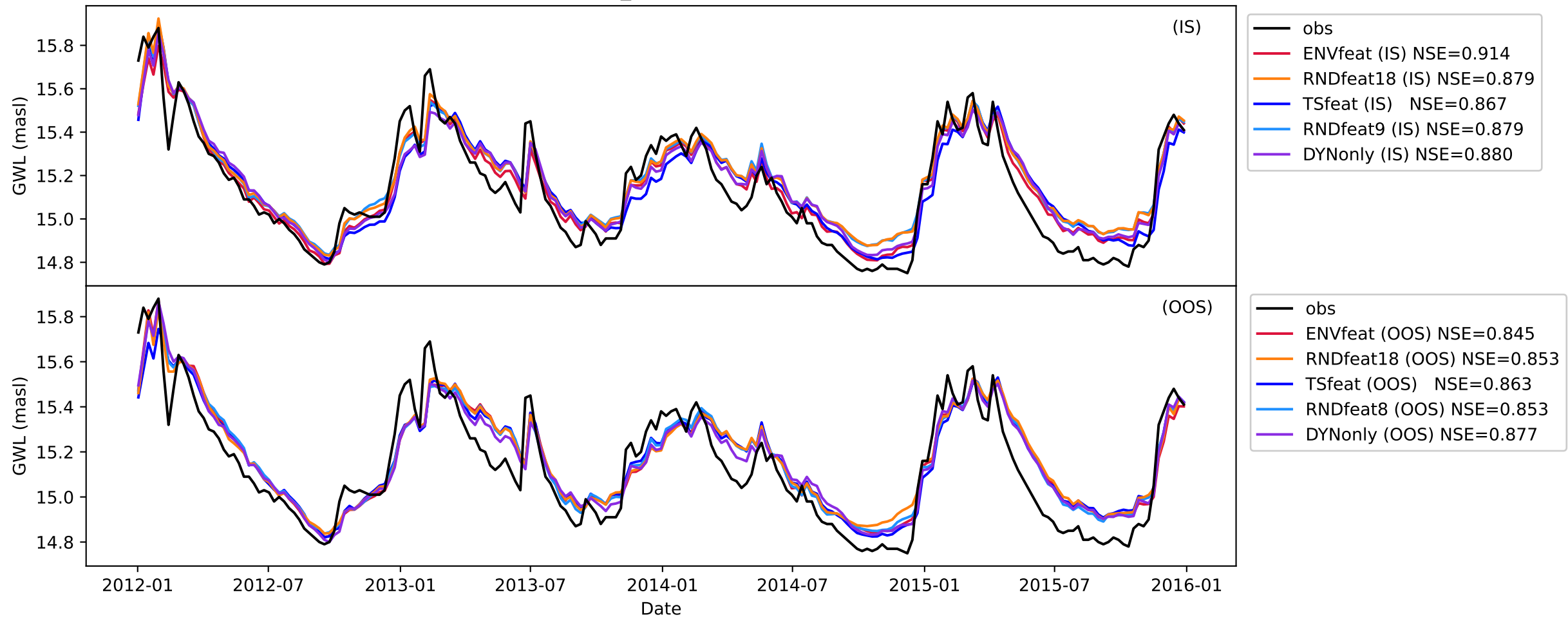
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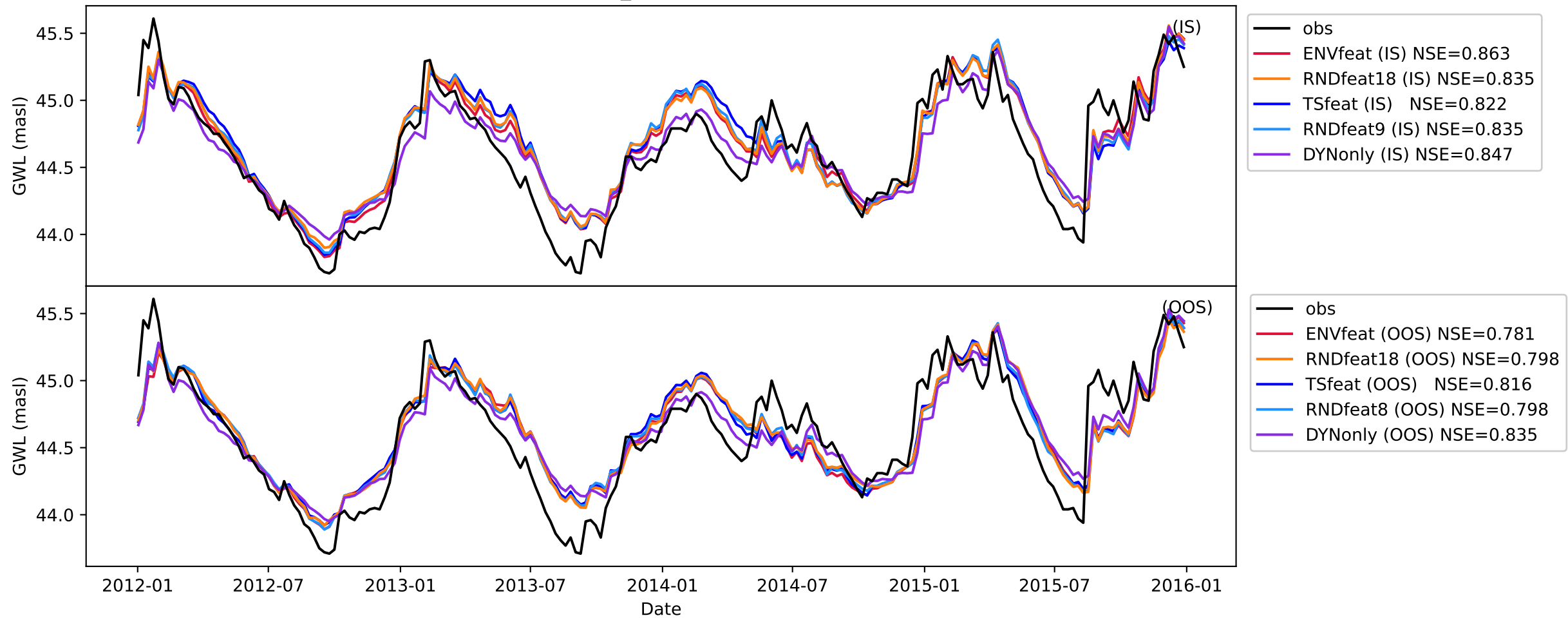
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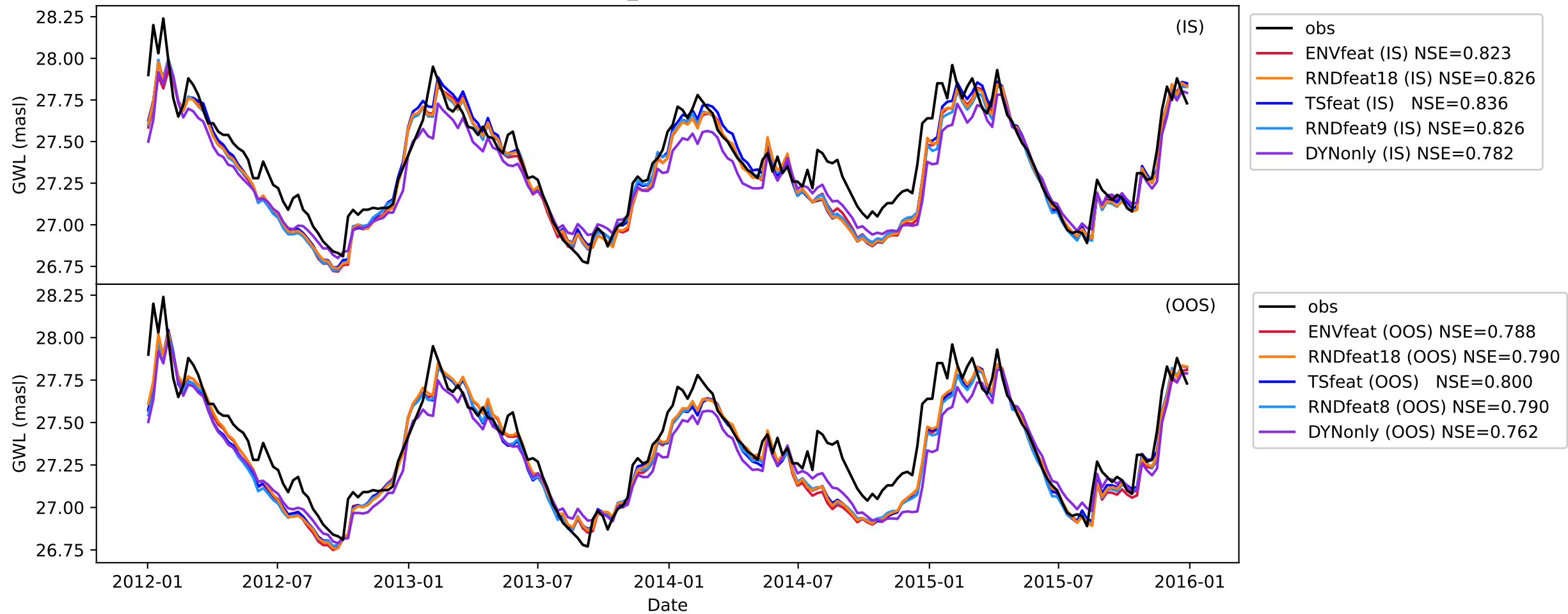
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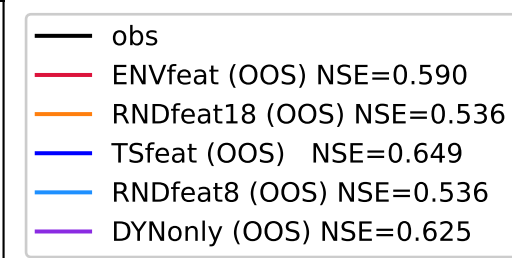
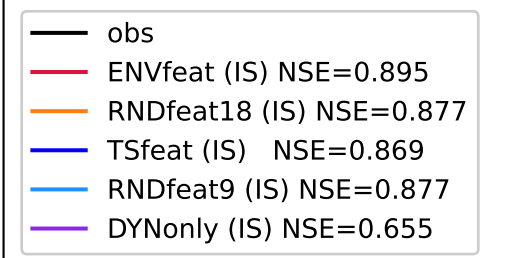
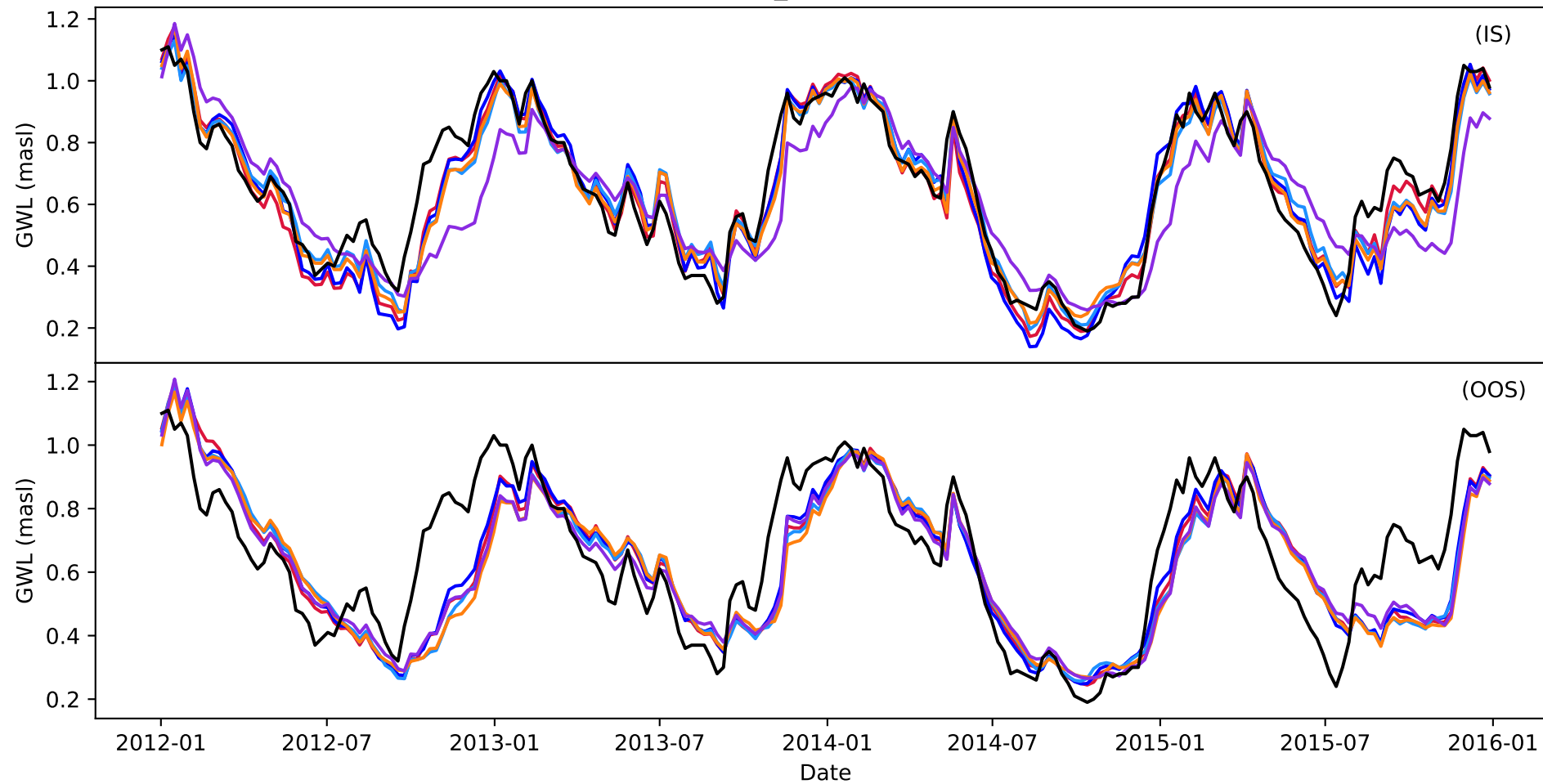
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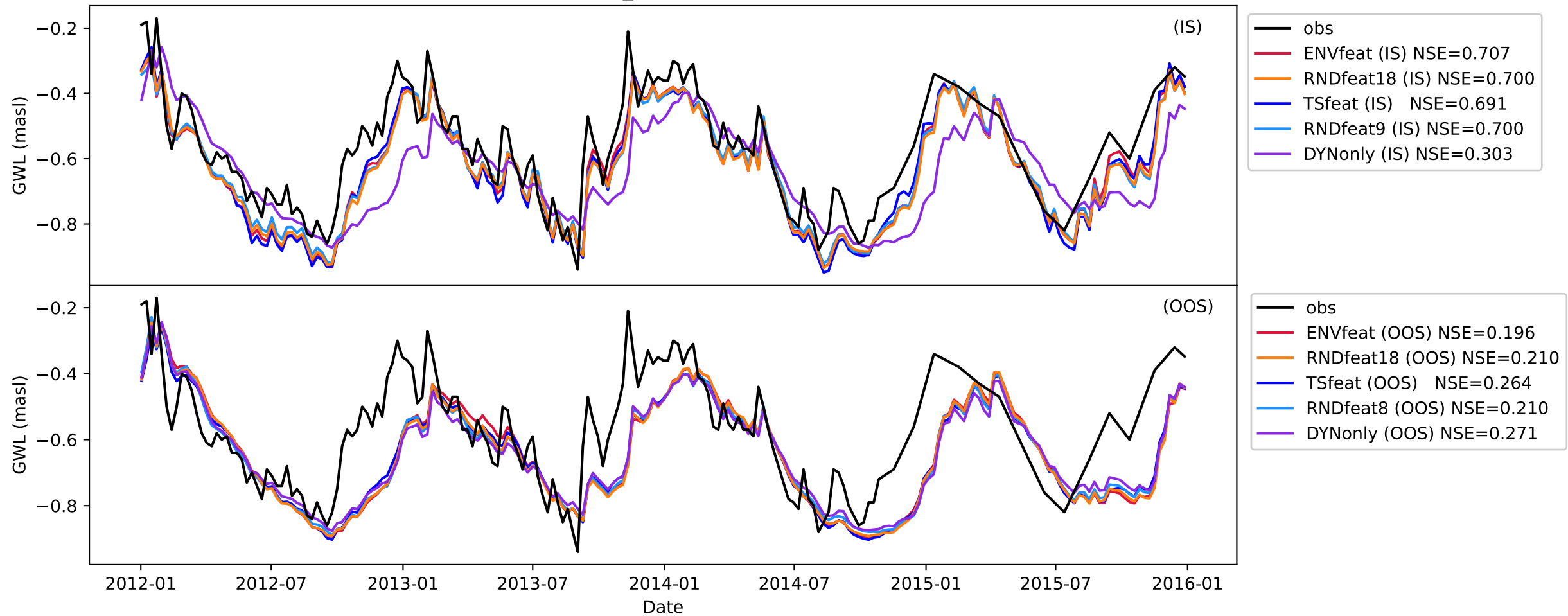
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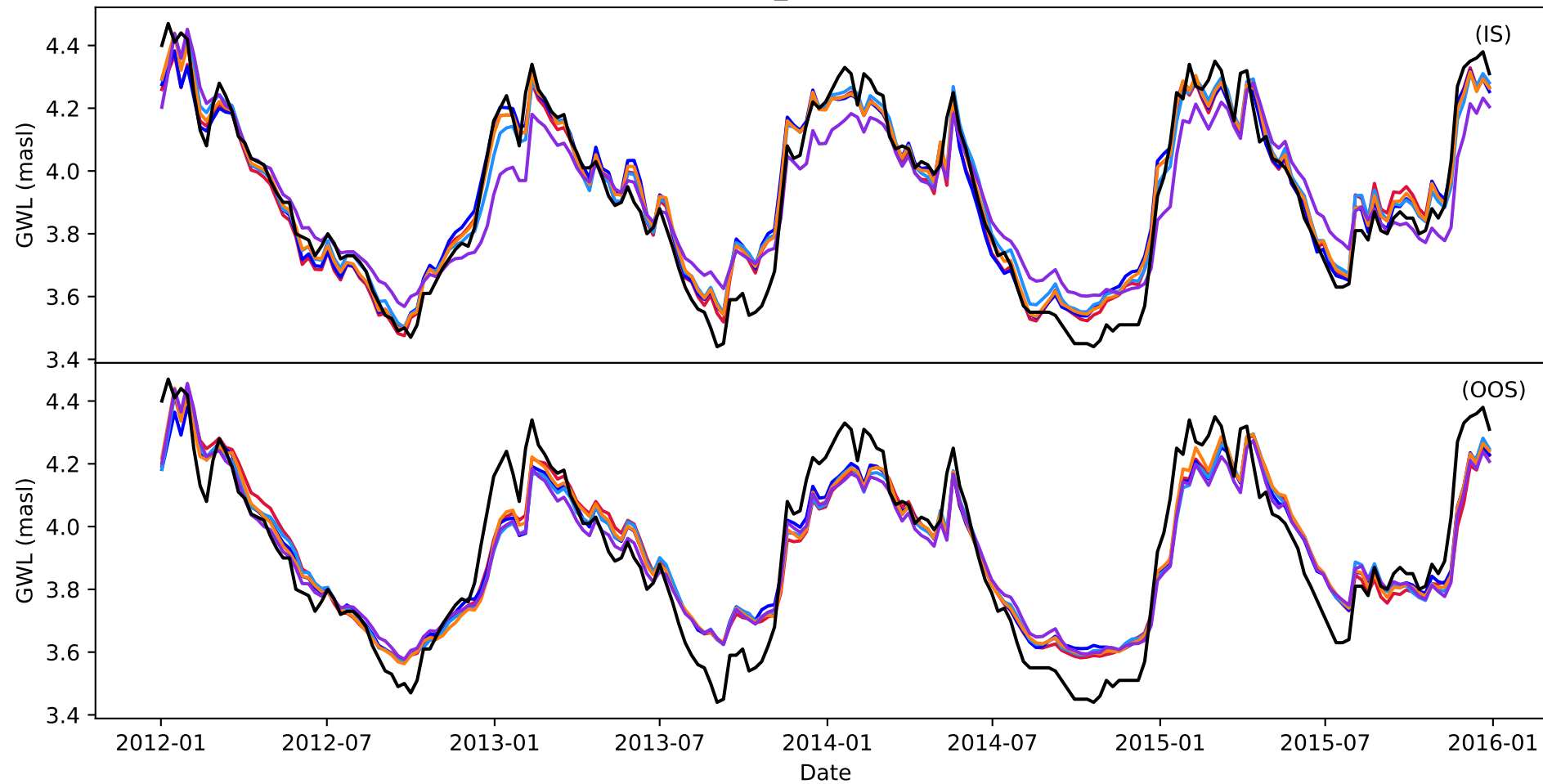
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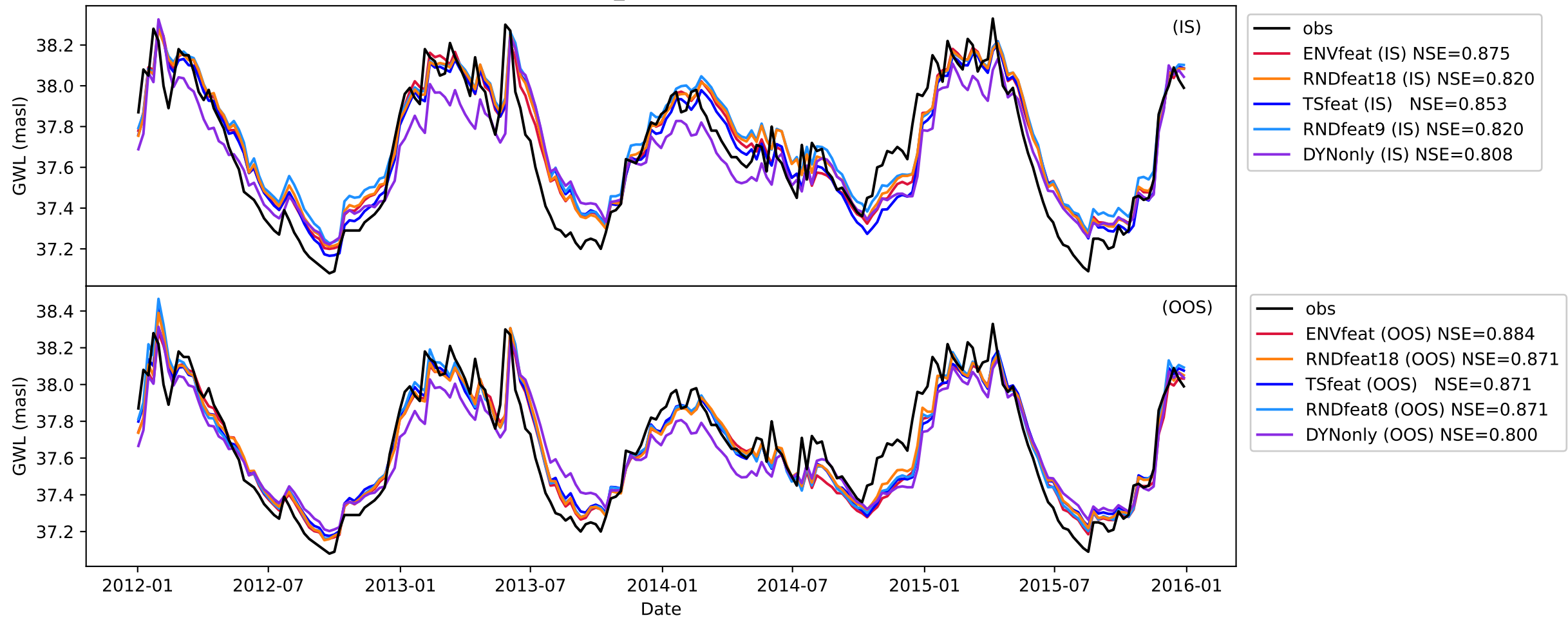
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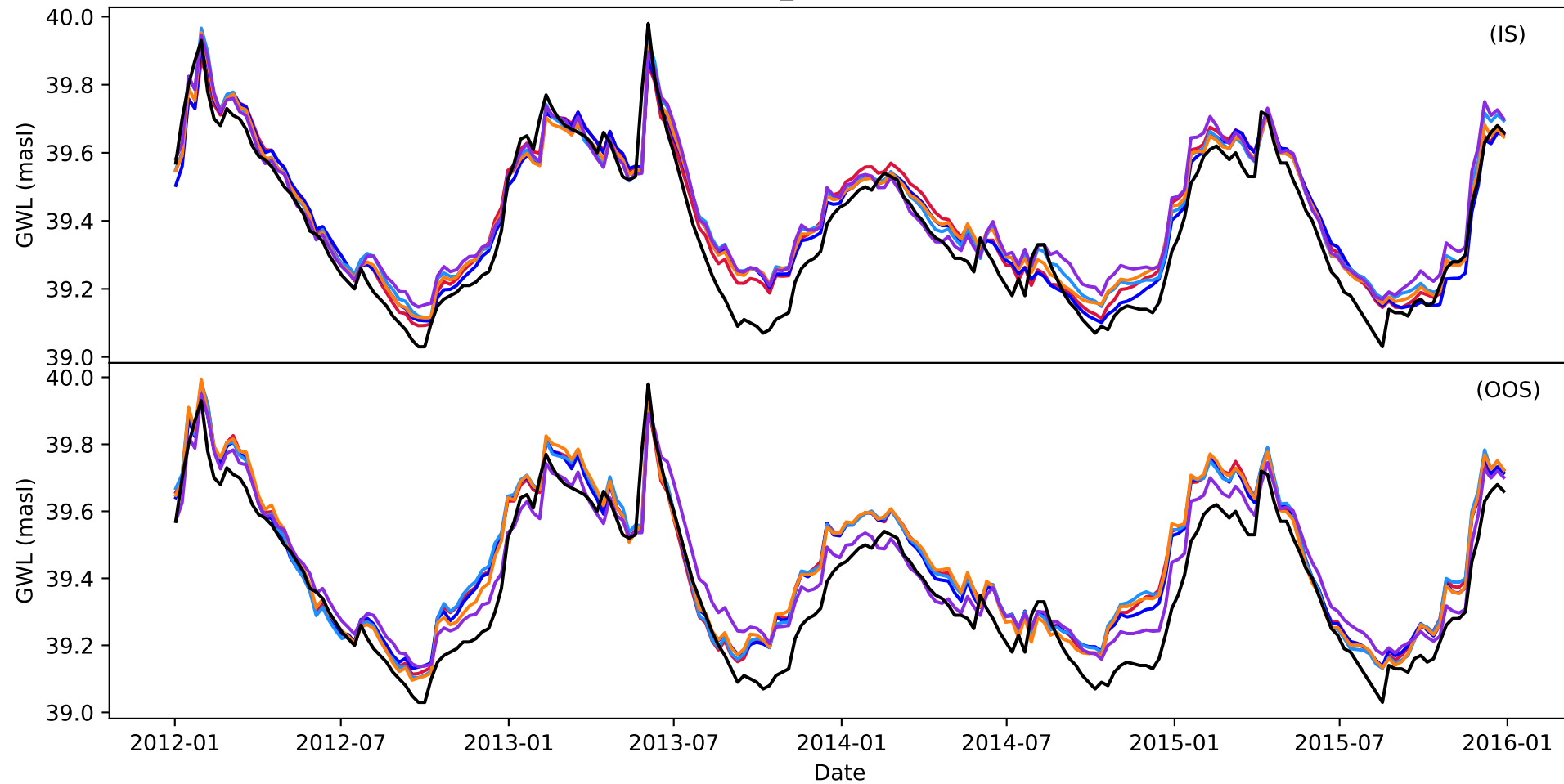
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- ENVfeat (IS) NSE=0.939
- RNDfeat18 (IS) NSE=0.936
- TSfeat (IS) NSE=0.935
- RNDfeat9 (IS) NSE=0.936
- DYNonly (IS) NSE=0.858

- obs
- ENVfeat (OOS) NSE=0.861
- RNDfeat18 (OOS) NSE=0.851
- TSfeat (OOS) NSE=0.879
- RNDfeat8 (OOS) NSE=0.851
- DYNonly (OOS) NSE=0.861

NI_40000175



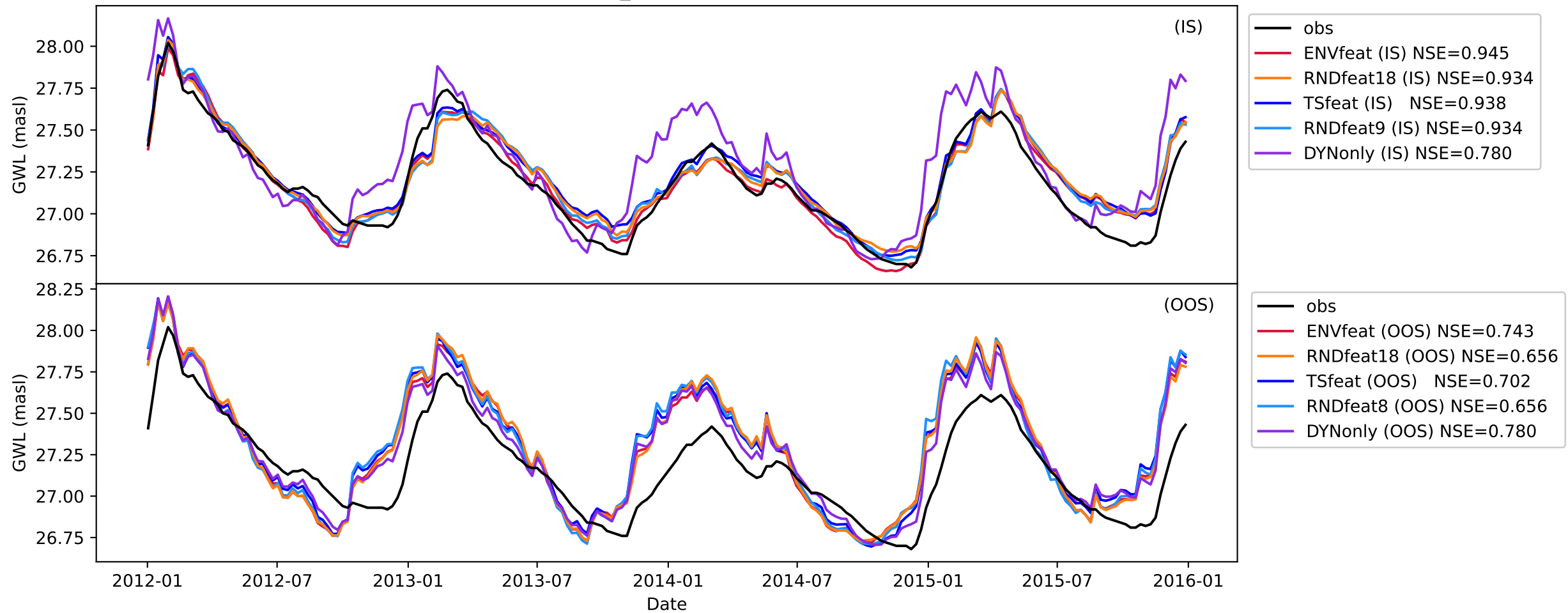
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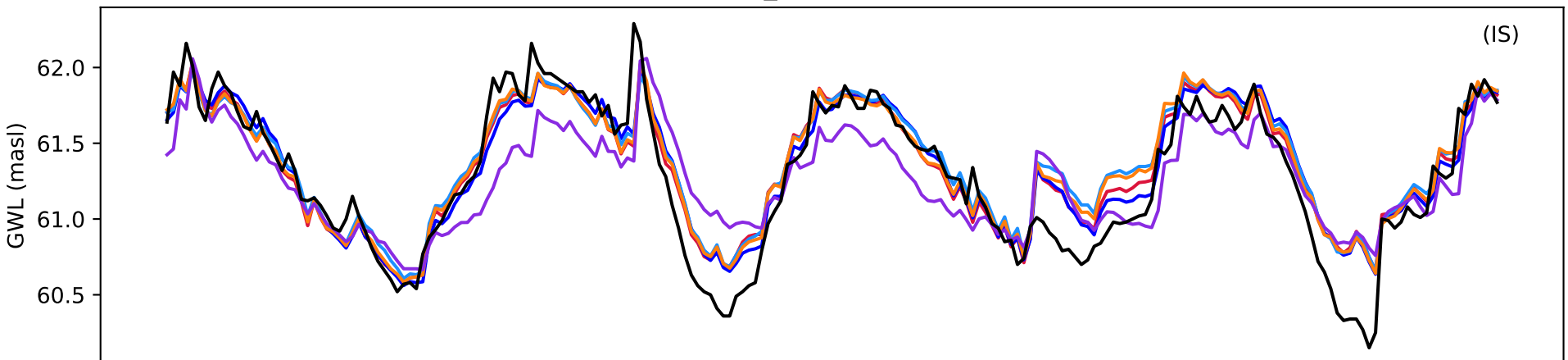
- obs
- ENVfeat (IS) NSE=0.932
- RNDfeat18 (IS) NSE=0.917
- TSfeat (IS) NSE=0.932
- RNDfeat9 (IS) NSE=0.917
- DYNOnly (IS) NSE=0.898

- obs
- ENVfeat (OOS) NSE=0.828
- RNDfeat18 (OOS) NSE=0.838
- TSfeat (OOS) NSE=0.859
- RNDfeat8 (OOS) NSE=0.838
- DYNOnly (OOS) NSE=0.913

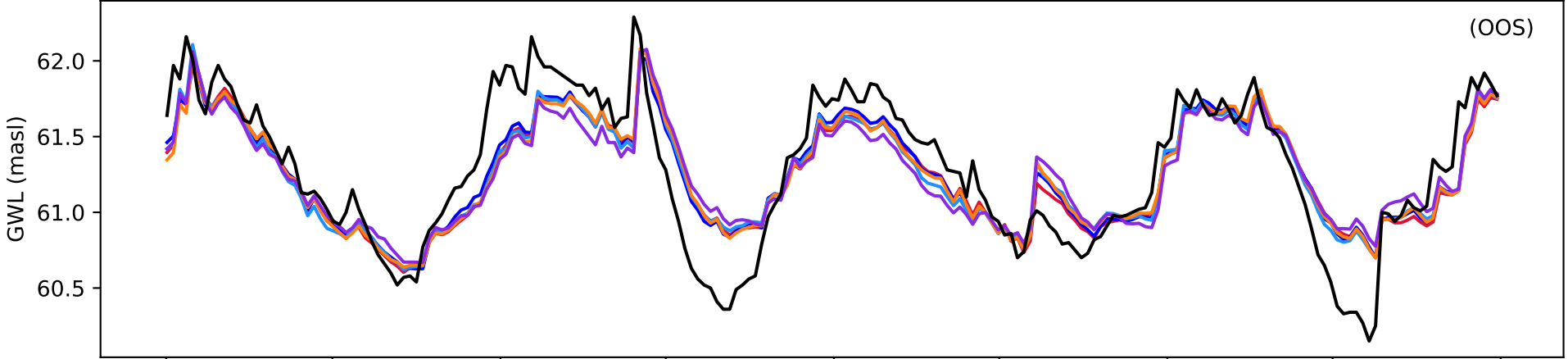
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NI_100000728



- obs
- ENVfeat (IS) NSE=0.843
- RNDfeat18 (IS) NSE=0.811
- TSfeat (IS) NSE=0.854
- RNDfeat9 (IS) NSE=0.811
- DYNOnly (IS) NSE=0.645



- obs
- ENVfeat (OOS) NSE=0.724
- RNDfeat18 (OOS) NSE=0.718
- TSfeat (OOS) NSE=0.763
- RNDfeat8 (OOS) NSE=0.718
- DYNOnly (OOS) NSE=0.655

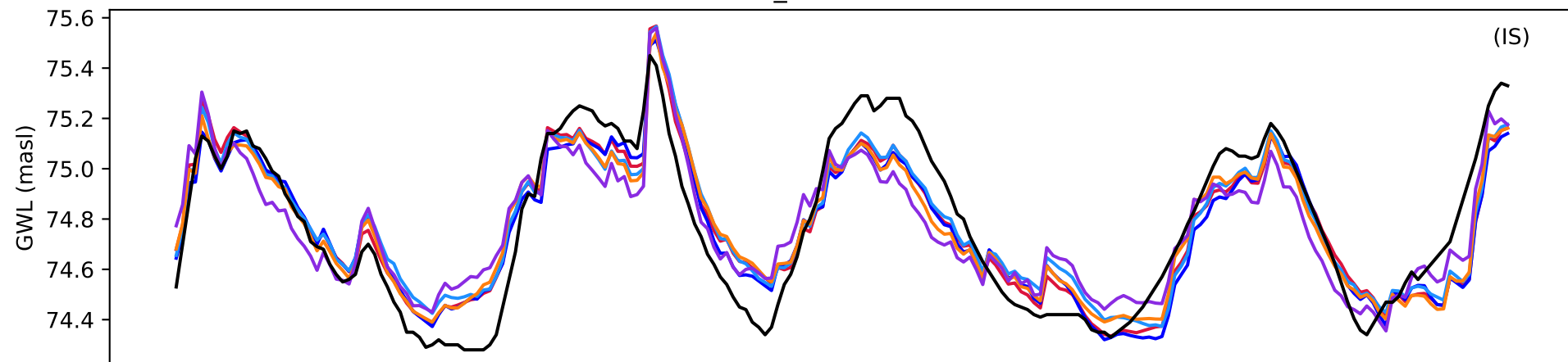
2012-01 2012-07 2013-01 2013-07 2014-01 2014-07 2015-01 2015-07 2016-01

Date

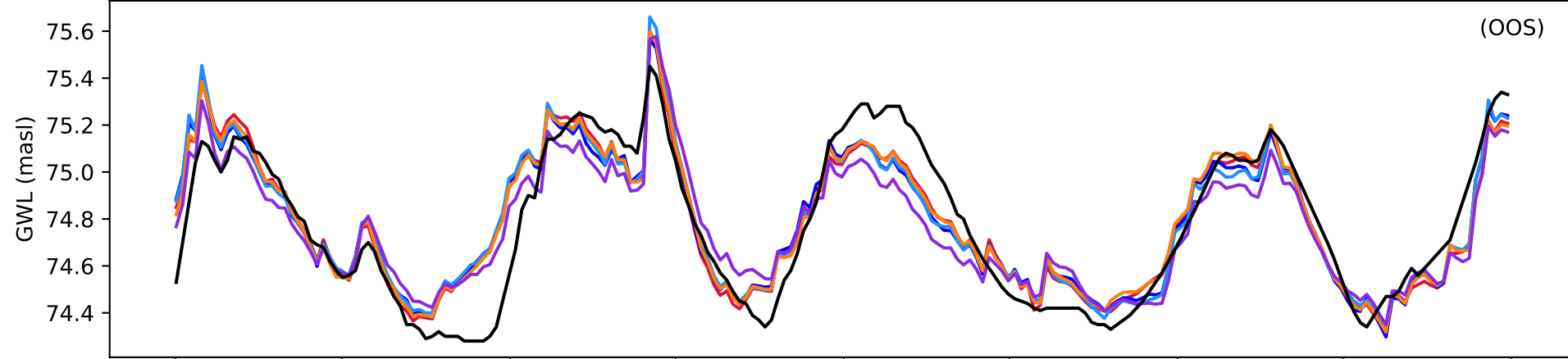
GWL (masl)

GWL (masl)

NI_100000842



- obs
- ENVfeat (IS) NSE=0.854
- RNDfeat18 (IS) NSE=0.832
- TSfeat (IS) NSE=0.852
- RNDfeat9 (IS) NSE=0.832
- DYNOnly (IS) NSE=0.786

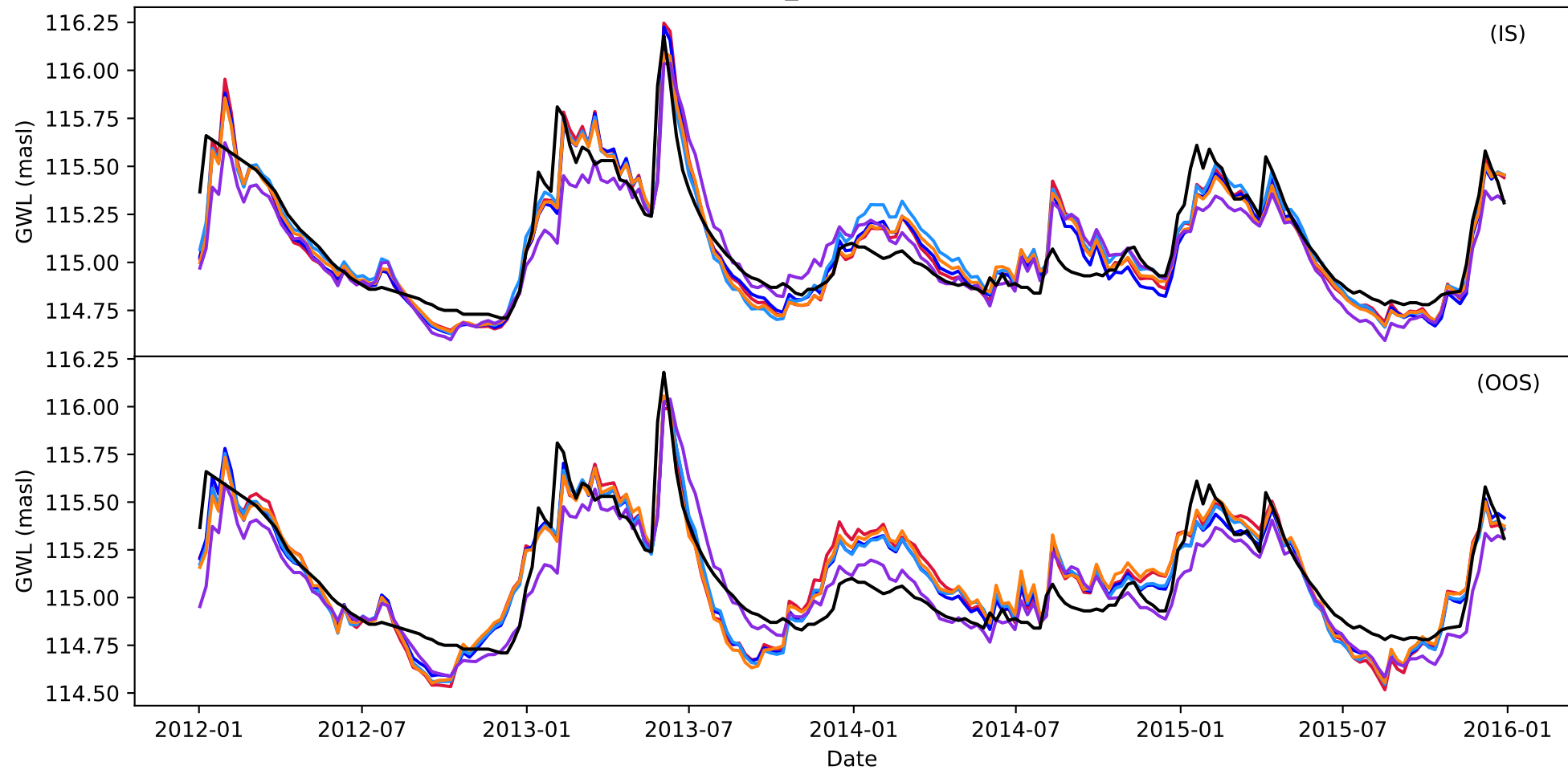


- obs
- ENVfeat (OOS) NSE=0.801
- RNDfeat18 (OOS) NSE=0.795
- TSfeat (OOS) NSE=0.774
- RNDfeat8 (OOS) NSE=0.795
- DYNOnly (OOS) NSE=0.798

2012-01 2012-07 2013-01 2013-07 2014-01 2014-07 2015-01 2015-07 2016-01

Date

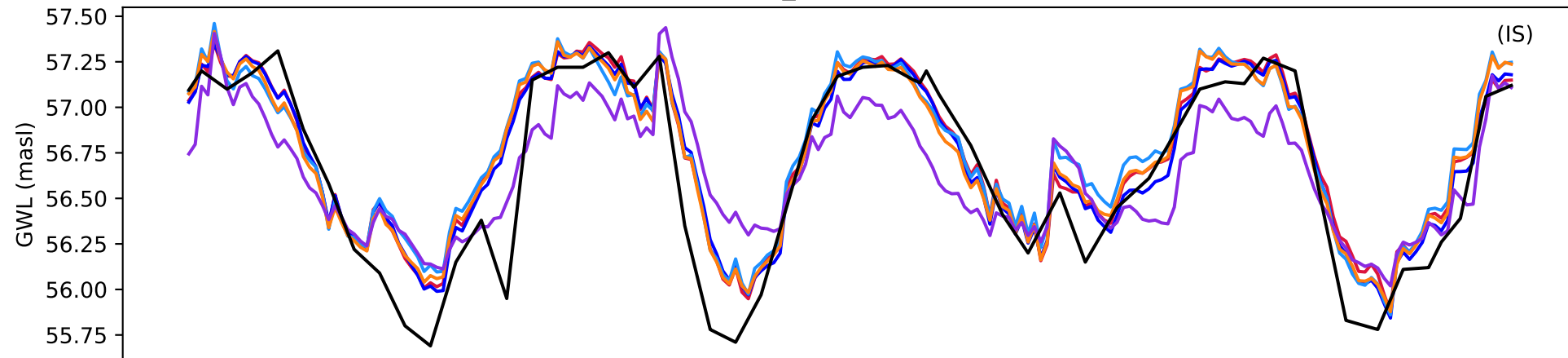
NI_100000926



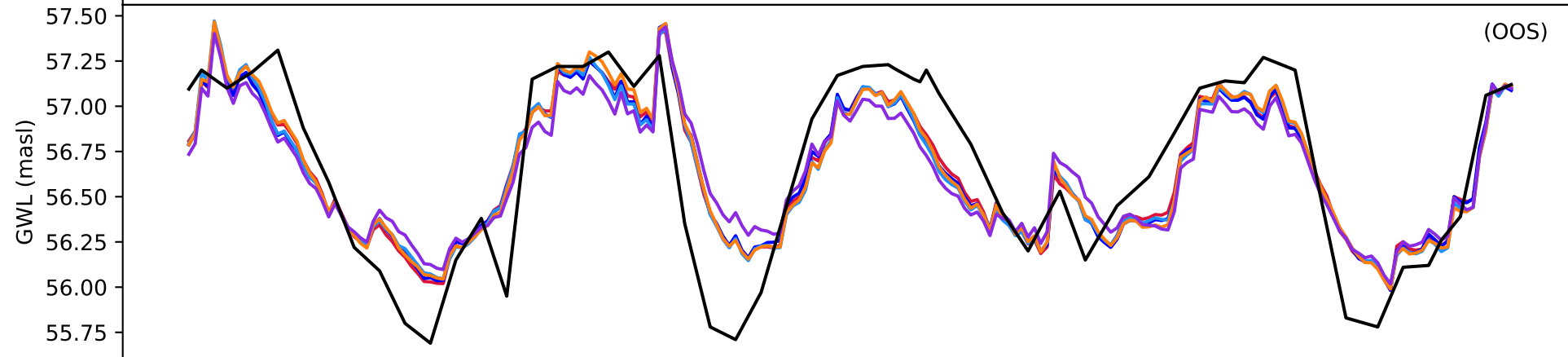
- obs
- ENVfeat (IS) NSE=0.833
- RNDfeat18 (IS) NSE=0.818
- TSfeat (IS) NSE=0.841
- RNDfeat9 (IS) NSE=0.818
- DYNOnly (IS) NSE=0.760

- obs
- ENVfeat (OOS) NSE=0.715
- RNDfeat18 (OOS) NSE=0.740
- TSfeat (OOS) NSE=0.770
- RNDfeat8 (OOS) NSE=0.740
- DYNOnly (OOS) NSE=0.782

NI_129300060



- obs
- ENVfeat (IS) NSE=0.839
- RNDfeat18 (IS) NSE=0.790
- TSfeat (IS) NSE=0.847
- RNDfeat9 (IS) NSE=0.790
- DYNonly (IS) NSE=0.670

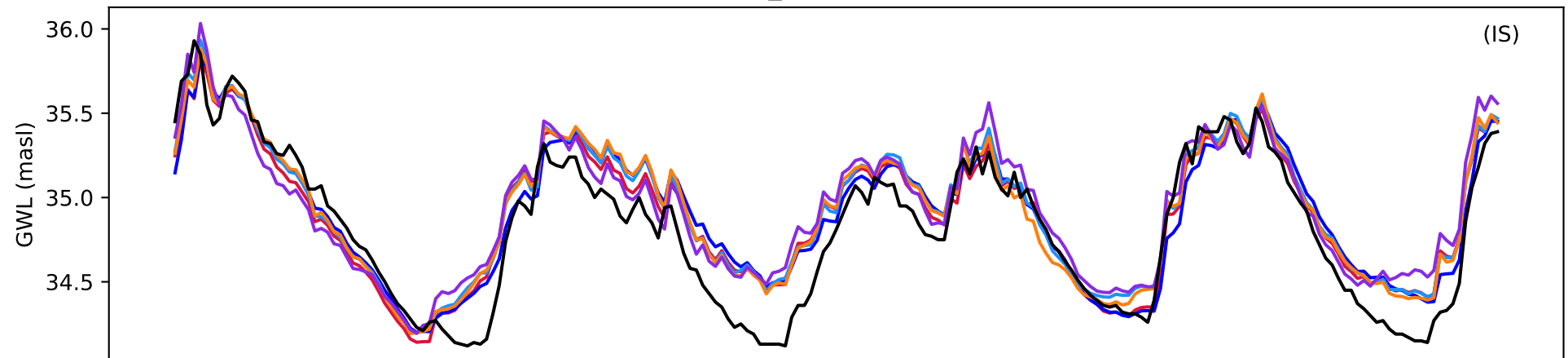


- obs
- ENVfeat (OOS) NSE=0.781
- RNDfeat18 (OOS) NSE=0.740
- TSfeat (OOS) NSE=0.756
- RNDfeat8 (OOS) NSE=0.740
- DYNonly (OOS) NSE=0.675

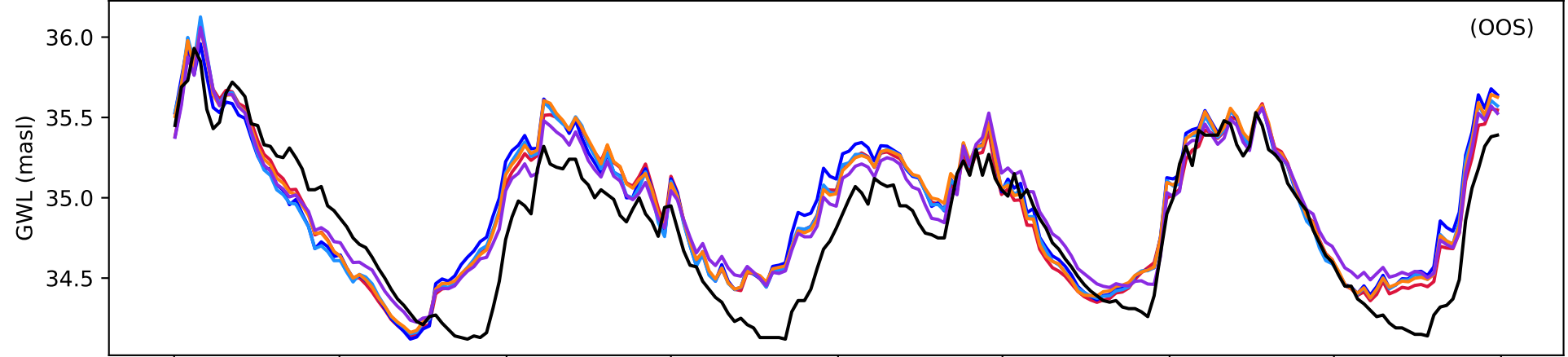
2012-01 2012-07 2013-01 2013-07 2014-01 2014-07 2015-01 2015-07 2016-01

Date

NI_200000620



- obs
- ENVfeat (IS) NSE=0.870
- RNDfeat18 (IS) NSE=0.861
- TSfeat (IS) NSE=0.865
- RNDfeat9 (IS) NSE=0.861
- DYNOnly (IS) NSE=0.823

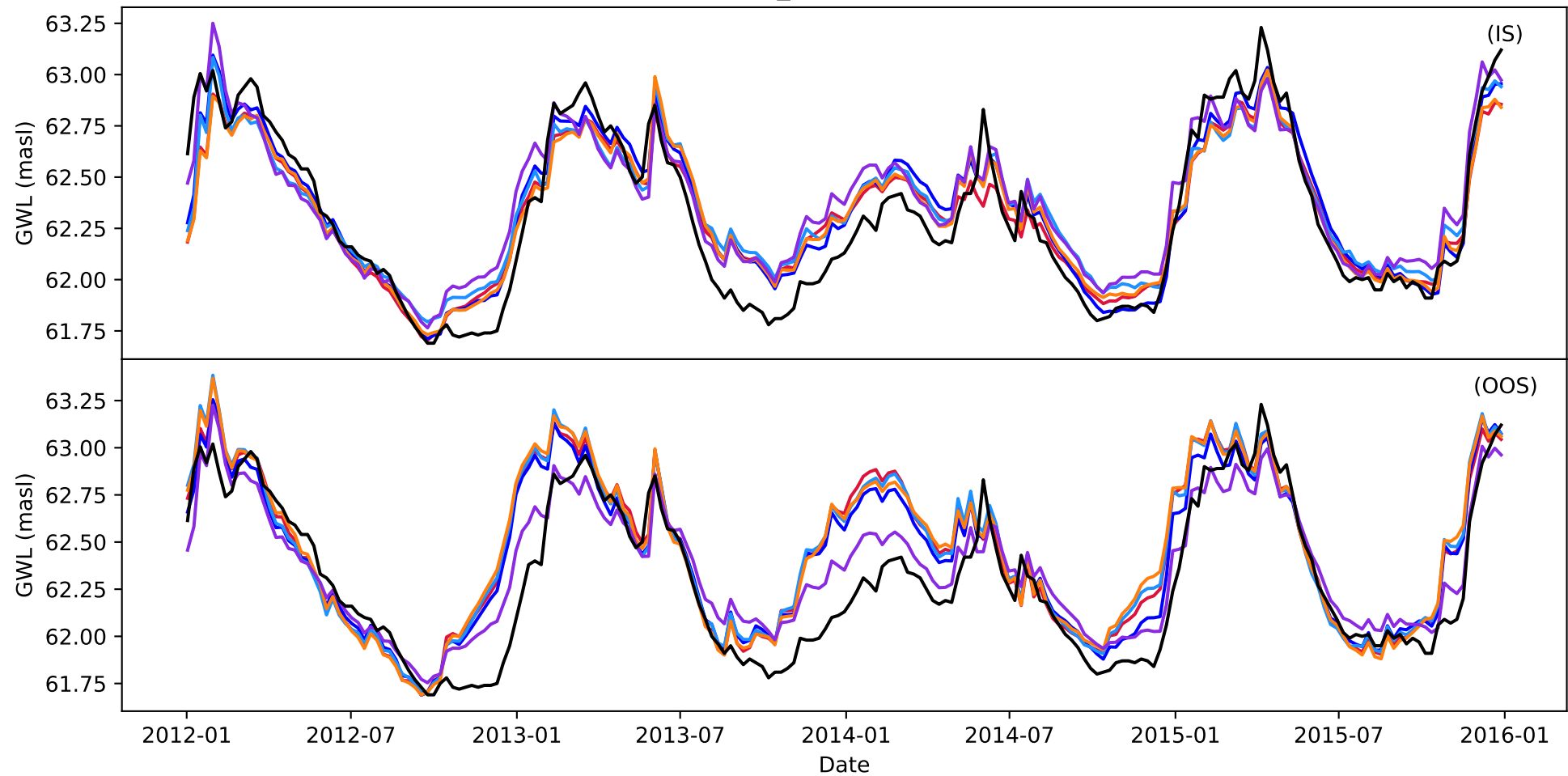


- obs
- ENVfeat (OOS) NSE=0.819
- RNDfeat18 (OOS) NSE=0.794
- TSfeat (OOS) NSE=0.745
- RNDfeat8 (OOS) NSE=0.794
- DYNOnly (OOS) NSE=0.839

2012-01 2012-07 2013-01 2013-07 2014-01 2014-07 2015-01 2015-07 2016-01

Date

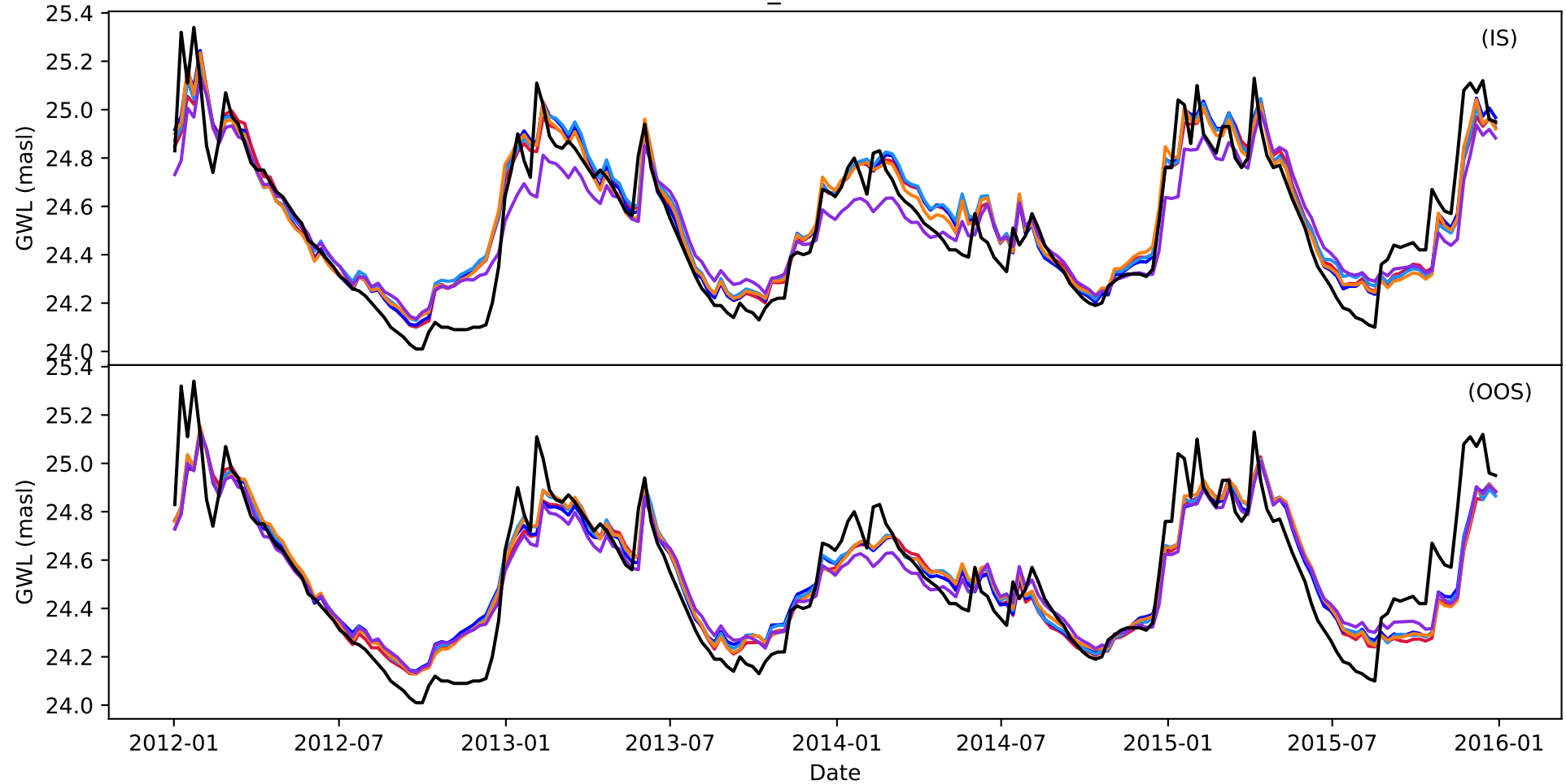
NI_200000788



- obs
- ENVfeat (IS) NSE=0.911
- RNDfeat18 (IS) NSE=0.895
- TSfeat (IS) NSE=0.929
- RNDfeat9 (IS) NSE=0.895
- DYNonly (IS) NSE=0.885

- obs
- ENVfeat (OOS) NSE=0.720
- RNDfeat18 (OOS) NSE=0.681
- TSfeat (OOS) NSE=0.756
- RNDfeat8 (OOS) NSE=0.681
- DYNonly (OOS) NSE=0.901

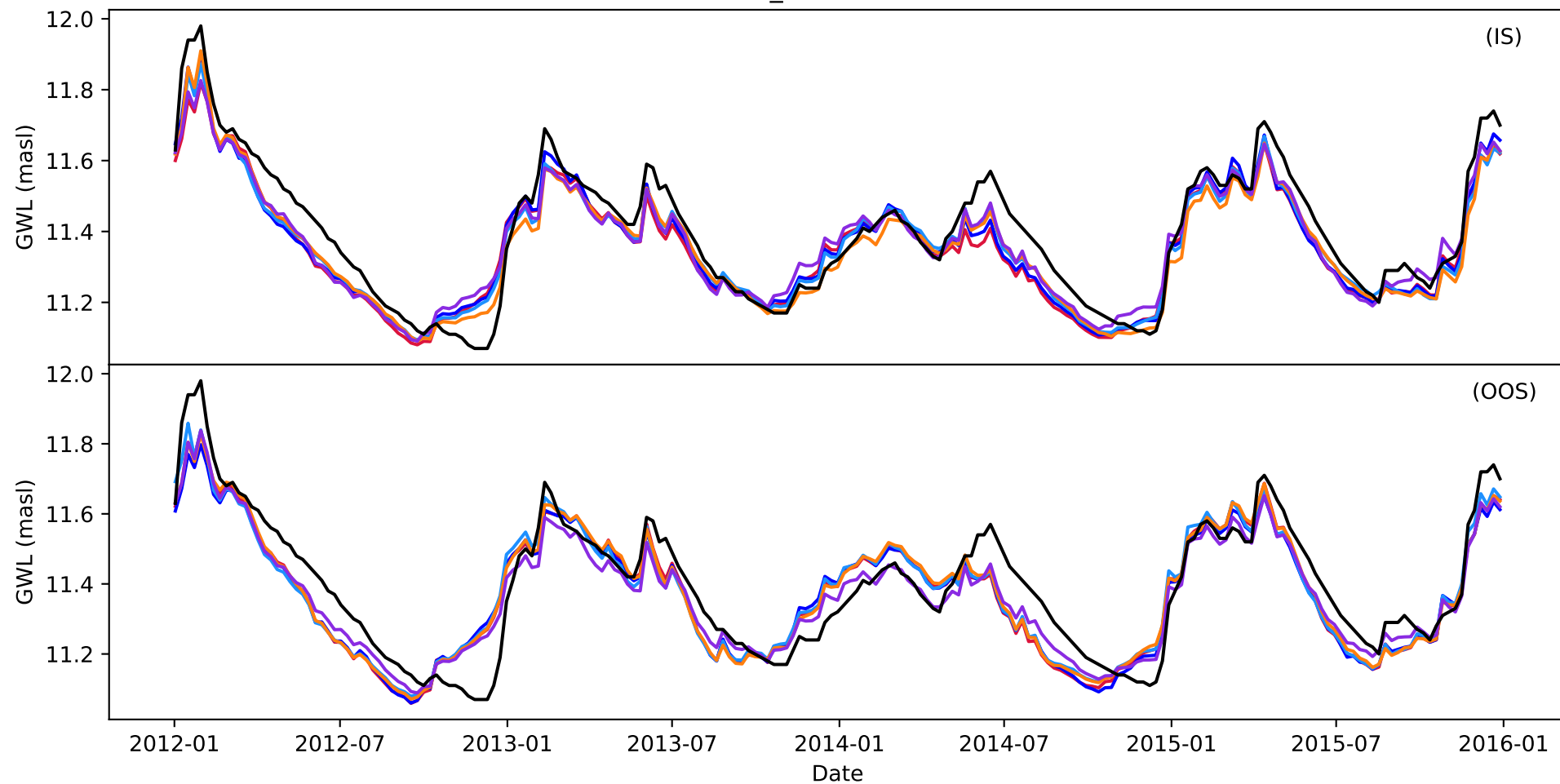
NI_200001068



- obs
- ENVfeat (IS) NSE=0.881
- RNDfeat18 (IS) NSE=0.866
- TSfeat (IS) NSE=0.883
- RNDfeat9 (IS) NSE=0.866
- DYNonly (IS) NSE=0.827

- obs
- ENVfeat (OOS) NSE=0.839
- RNDfeat18 (OOS) NSE=0.843
- TSfeat (OOS) NSE=0.843
- RNDfeat8 (OOS) NSE=0.843
- DYNonly (OOS) NSE=0.825

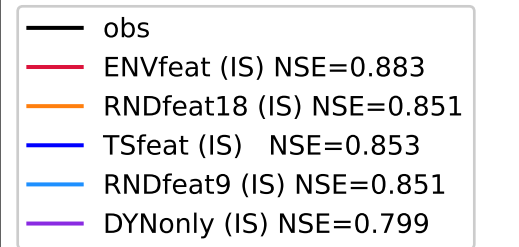
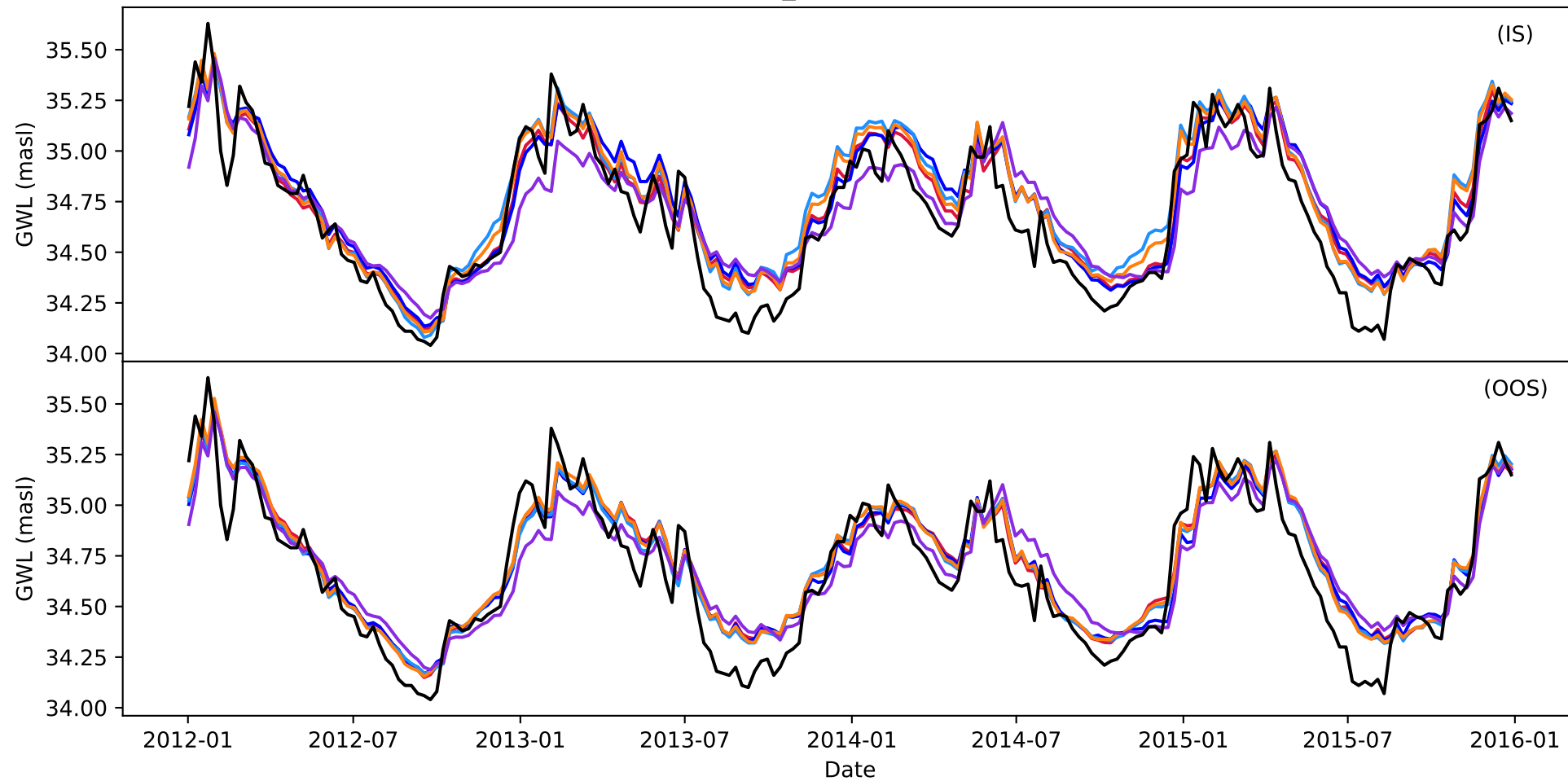
NI_200001722



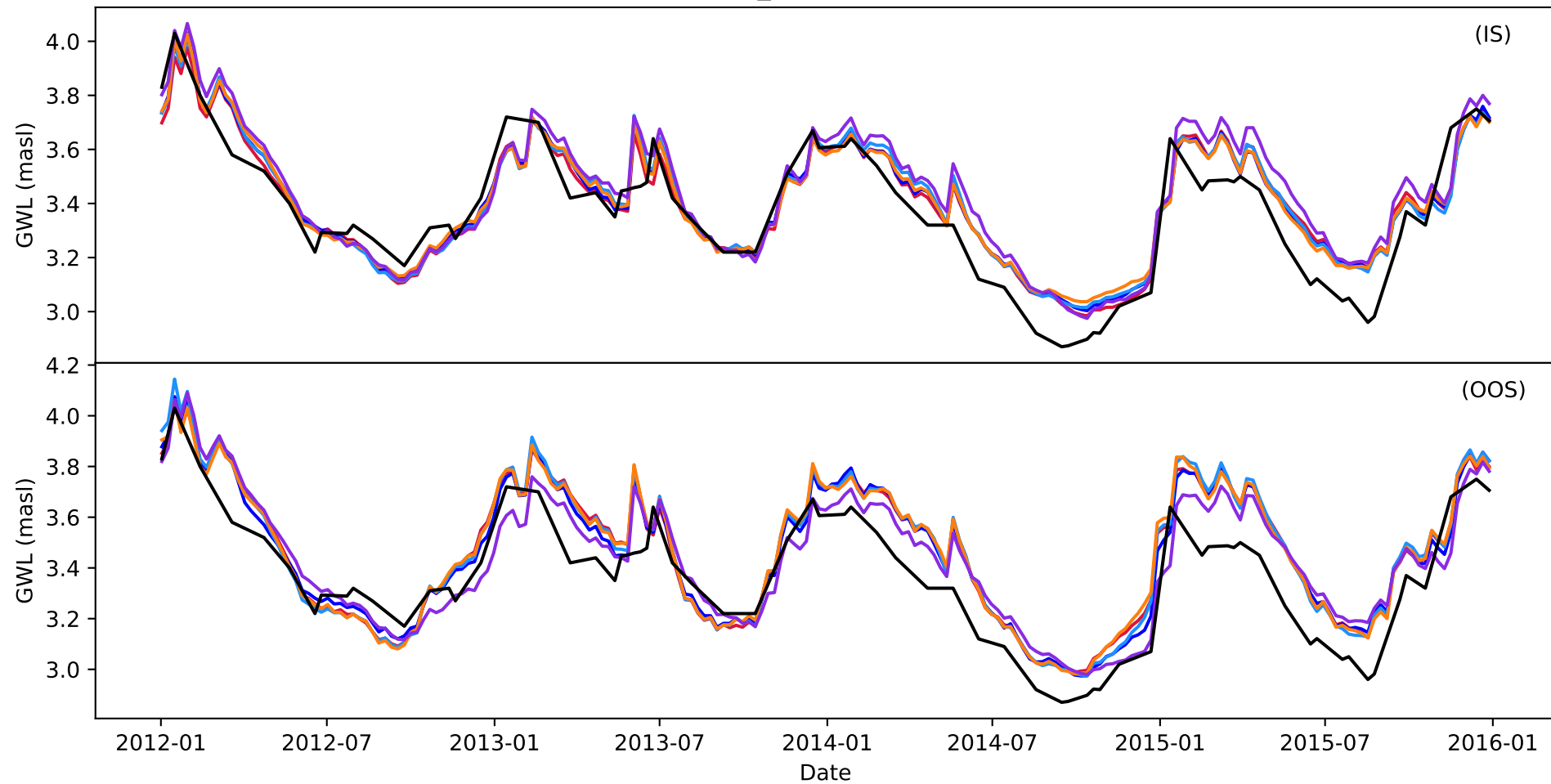
- obs
- ENVfeat (IS) NSE=0.838
- RNDfeat18 (IS) NSE=0.884
- TSfeat (IS) NSE=0.876
- RNDfeat9 (IS) NSE=0.884
- DYNSonly (IS) NSE=0.875

- obs
- ENVfeat (OOS) NSE=0.814
- RNDfeat18 (OOS) NSE=0.823
- TSfeat (OOS) NSE=0.798
- RNDfeat8 (OOS) NSE=0.823
- DYNSonly (OOS) NSE=0.877

NI_200002153



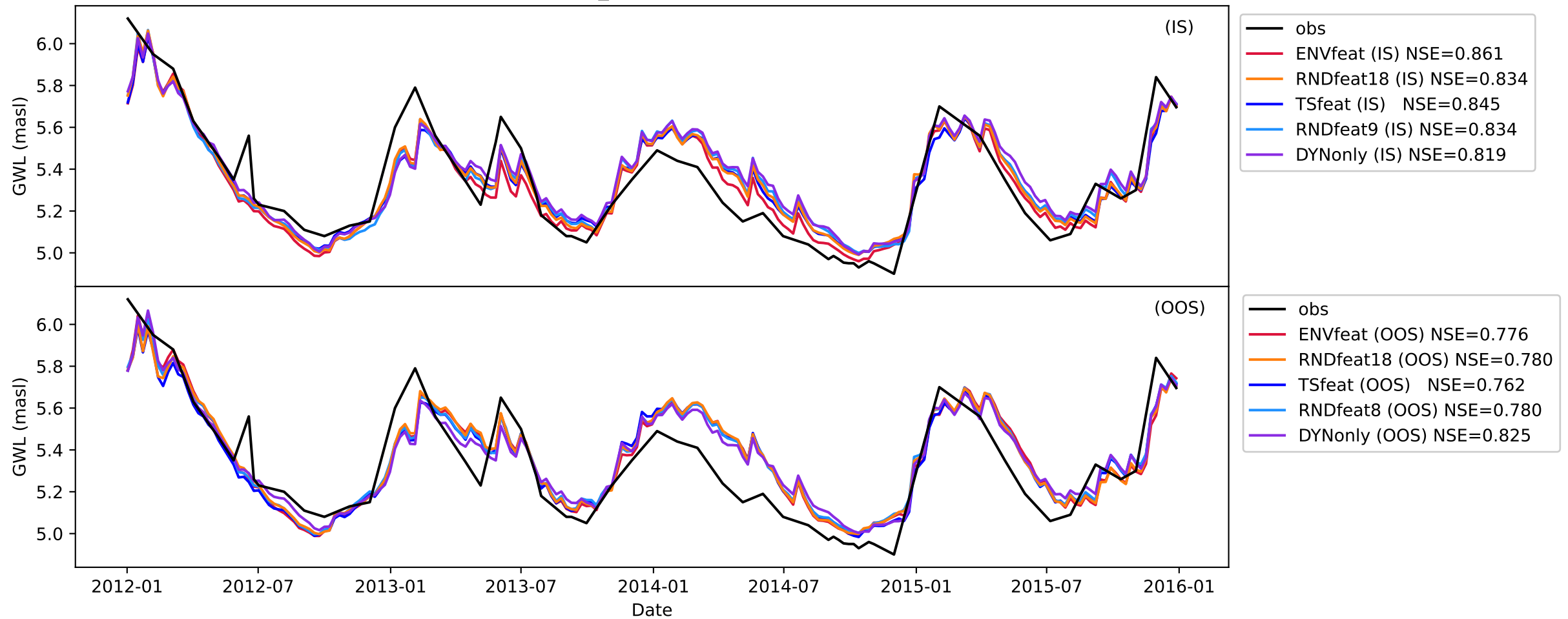
NI_400080190



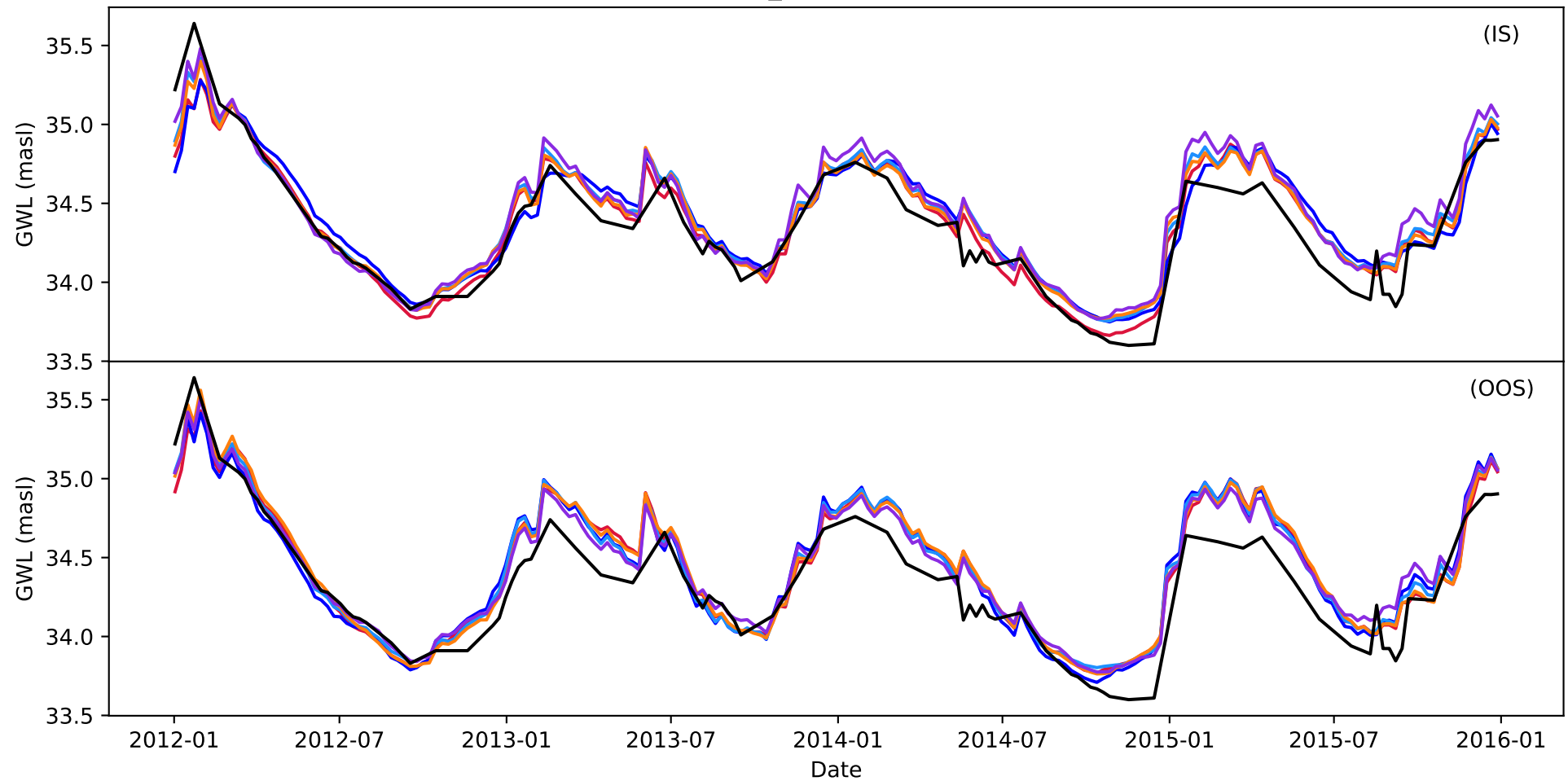
- obs
- ENVfeat (IS) NSE=0.874
- RNDfeat18 (IS) NSE=0.862
- TSfeat (IS) NSE=0.880
- RNDfeat9 (IS) NSE=0.862
- DYNonly (IS) NSE=0.814

- obs
- ENVfeat (OOS) NSE=0.696
- RNDfeat18 (OOS) NSE=0.700
- TSfeat (OOS) NSE=0.767
- RNDfeat8 (OOS) NSE=0.700
- DYNonly (OOS) NSE=0.806

NI_400081660



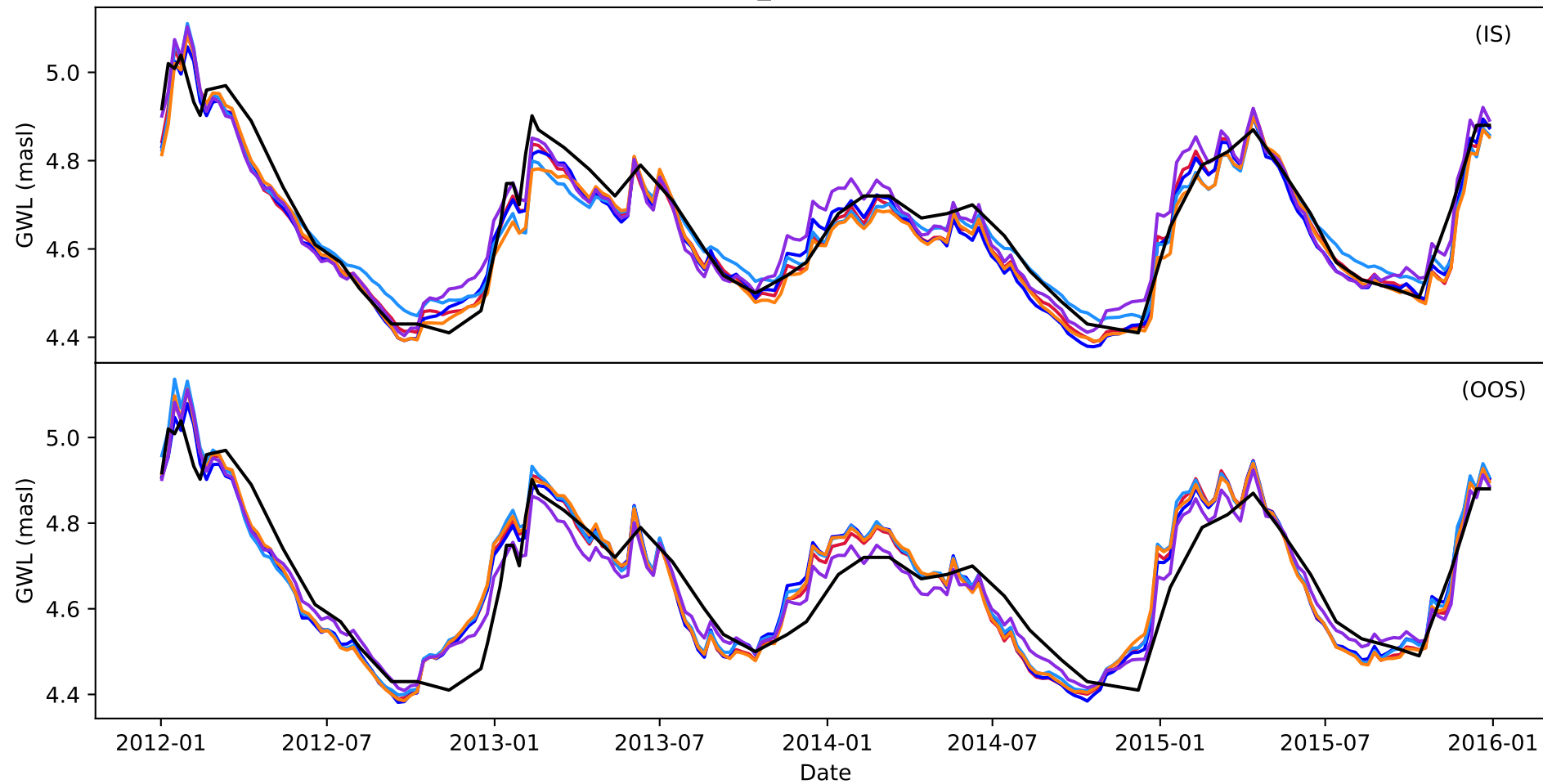
NI_405160331



- obs
- ENVfeat (IS) NSE=0.919
- RNDfeat18 (IS) NSE=0.896
- TSfeat (IS) NSE=0.885
- RNDfeat9 (IS) NSE=0.896
- DYNOnly (IS) NSE=0.878

- obs
- ENVfeat (OOS) NSE=0.823
- RNDfeat18 (OOS) NSE=0.821
- TSfeat (OOS) NSE=0.832
- RNDfeat8 (OOS) NSE=0.821
- DYNOnly (OOS) NSE=0.883

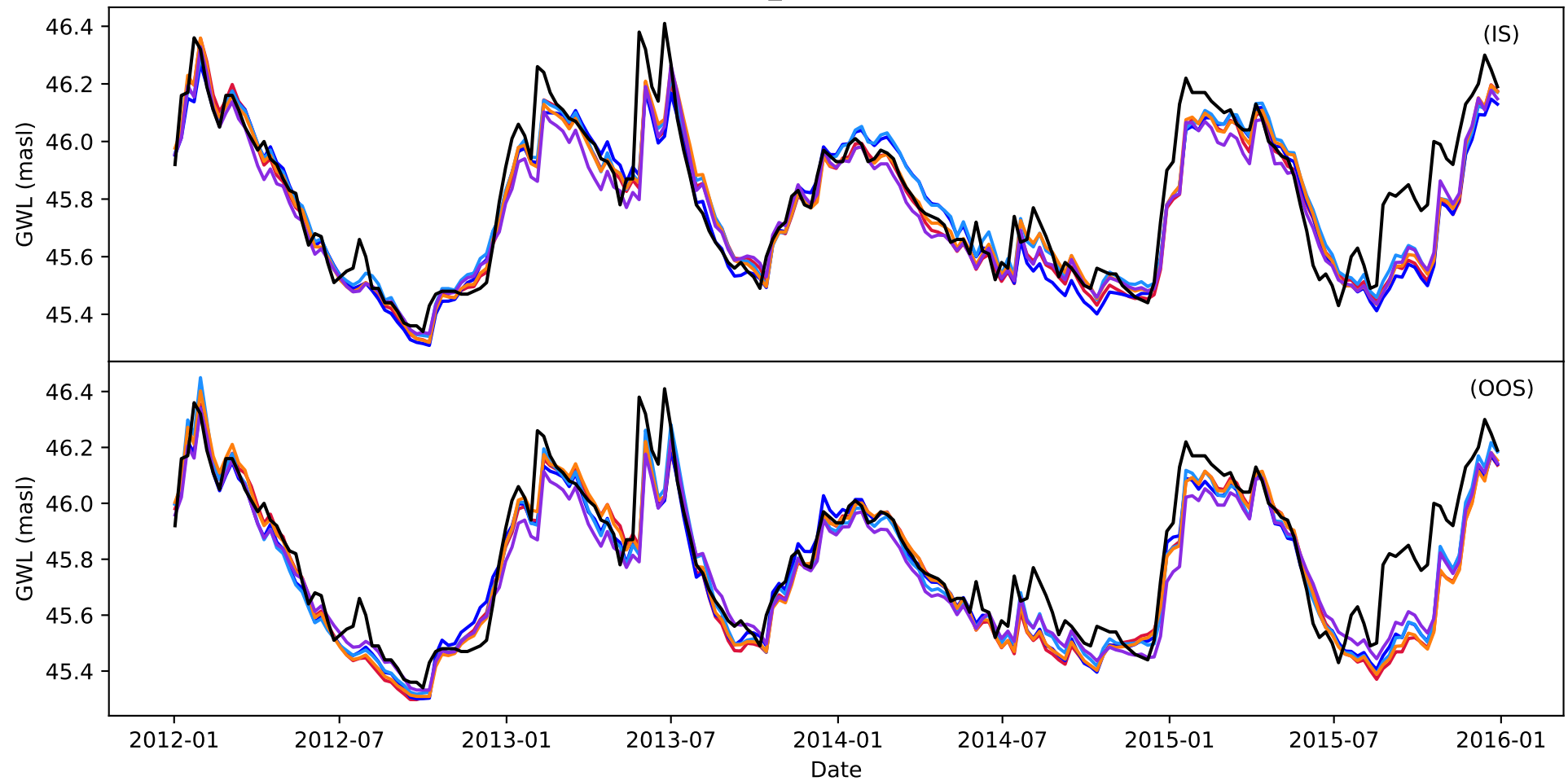
NI_500000592



- obs
- ENVfeat (IS) NSE=0.939
- RNDfeat18 (IS) NSE=0.925
- TSfeat (IS) NSE=0.933
- RNDfeat9 (IS) NSE=0.925
- DYNonly (IS) NSE=0.923

- obs
- ENVfeat (OOS) NSE=0.873
- RNDfeat18 (OOS) NSE=0.851
- TSfeat (OOS) NSE=0.867
- RNDfeat8 (OOS) NSE=0.851
- DYNonly (OOS) NSE=0.924

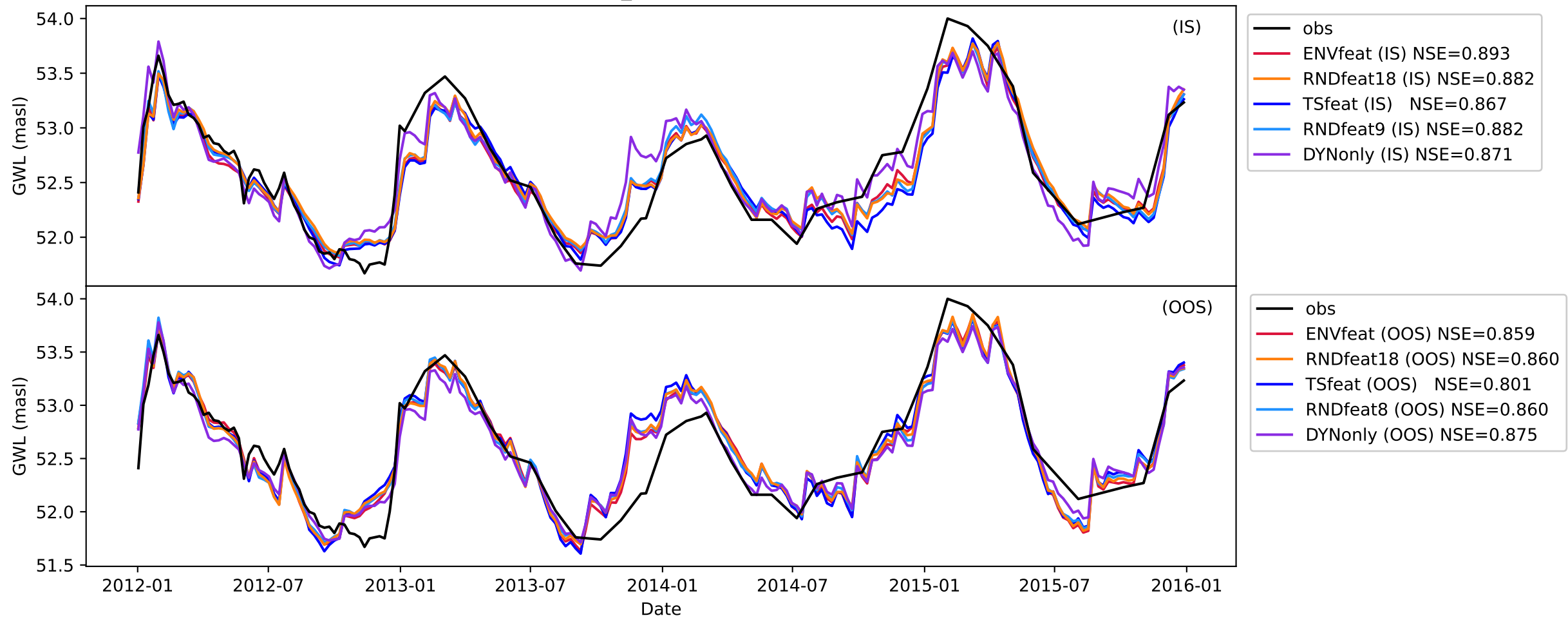
NI_600041871



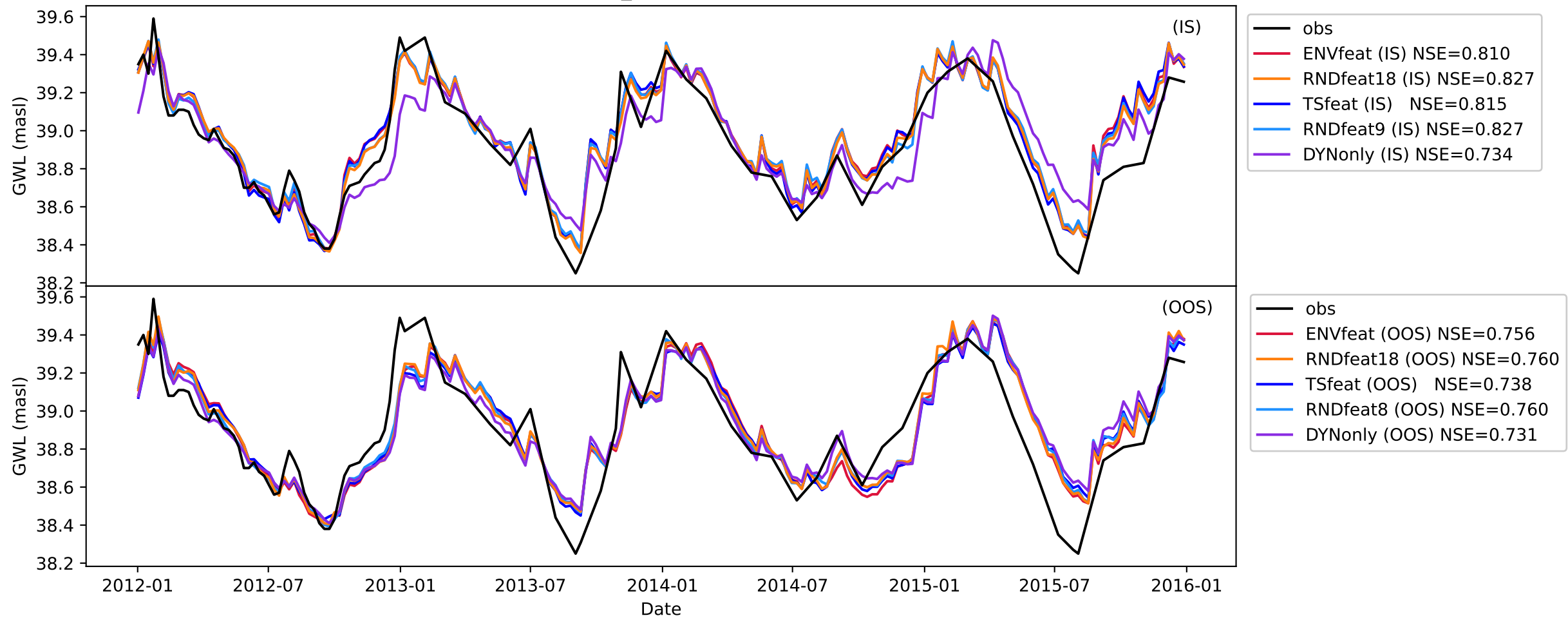
- obs
- ENVfeat (IS) NSE=0.828
- RNDfeat18 (IS) NSE=0.836
- TSfeat (IS) NSE=0.808
- RNDfeat9 (IS) NSE=0.836
- DYNOnly (IS) NSE=0.818

- obs
- ENVfeat (OOS) NSE=0.772
- RNDfeat18 (OOS) NSE=0.794
- TSfeat (OOS) NSE=0.792
- RNDfeat8 (OOS) NSE=0.794
- DYNOnly (OOS) NSE=0.797

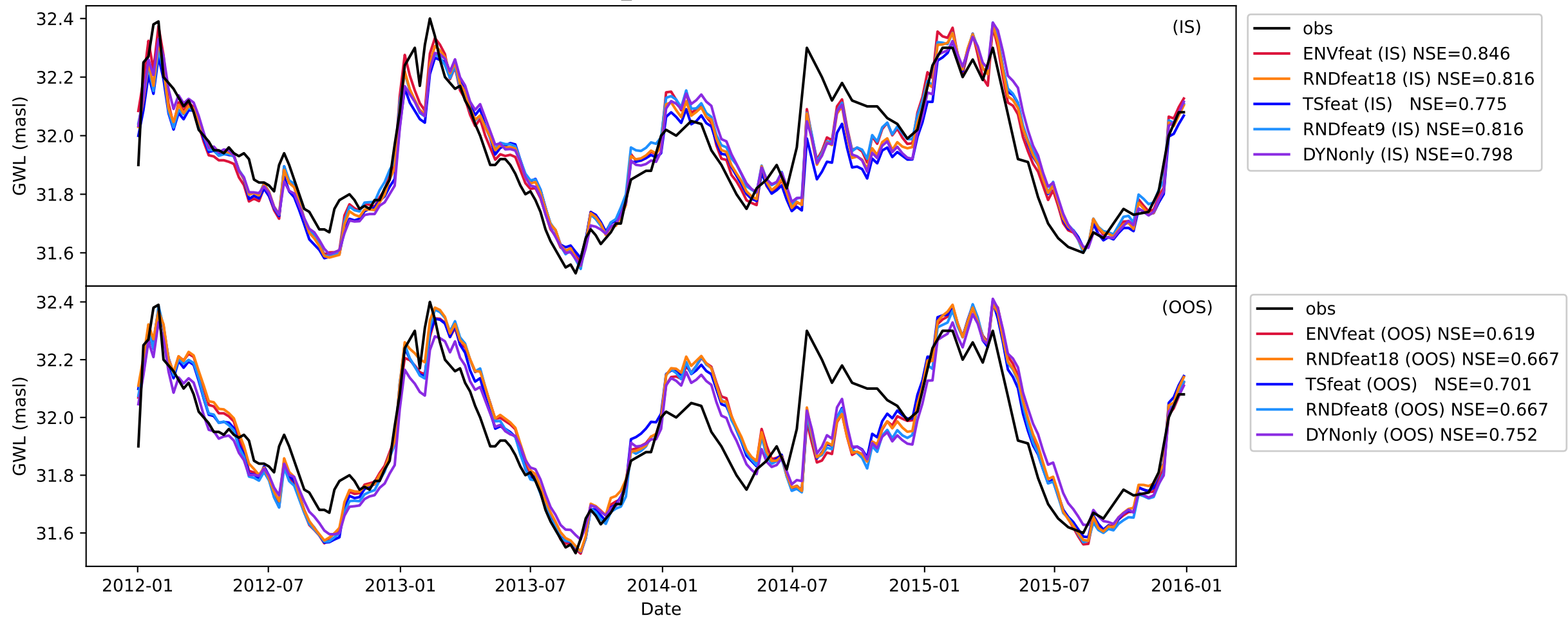
NW_60090169



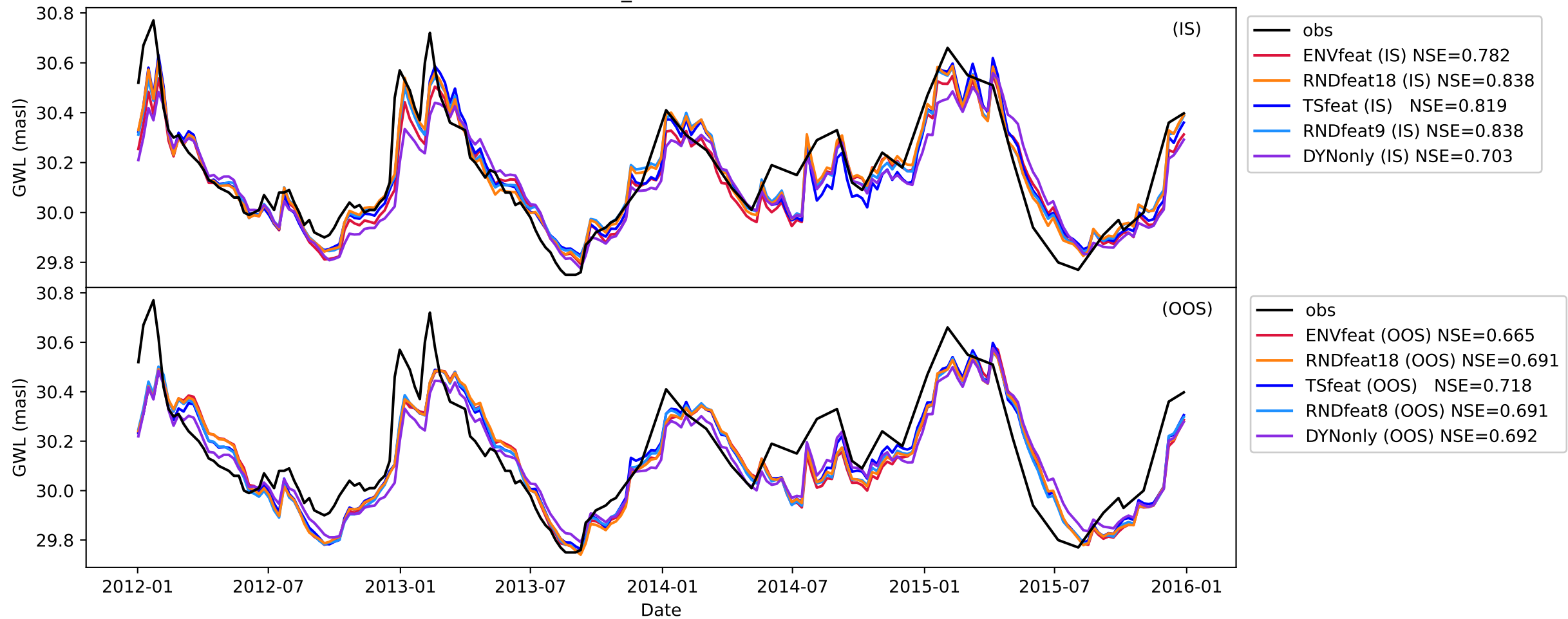
NW_60240258



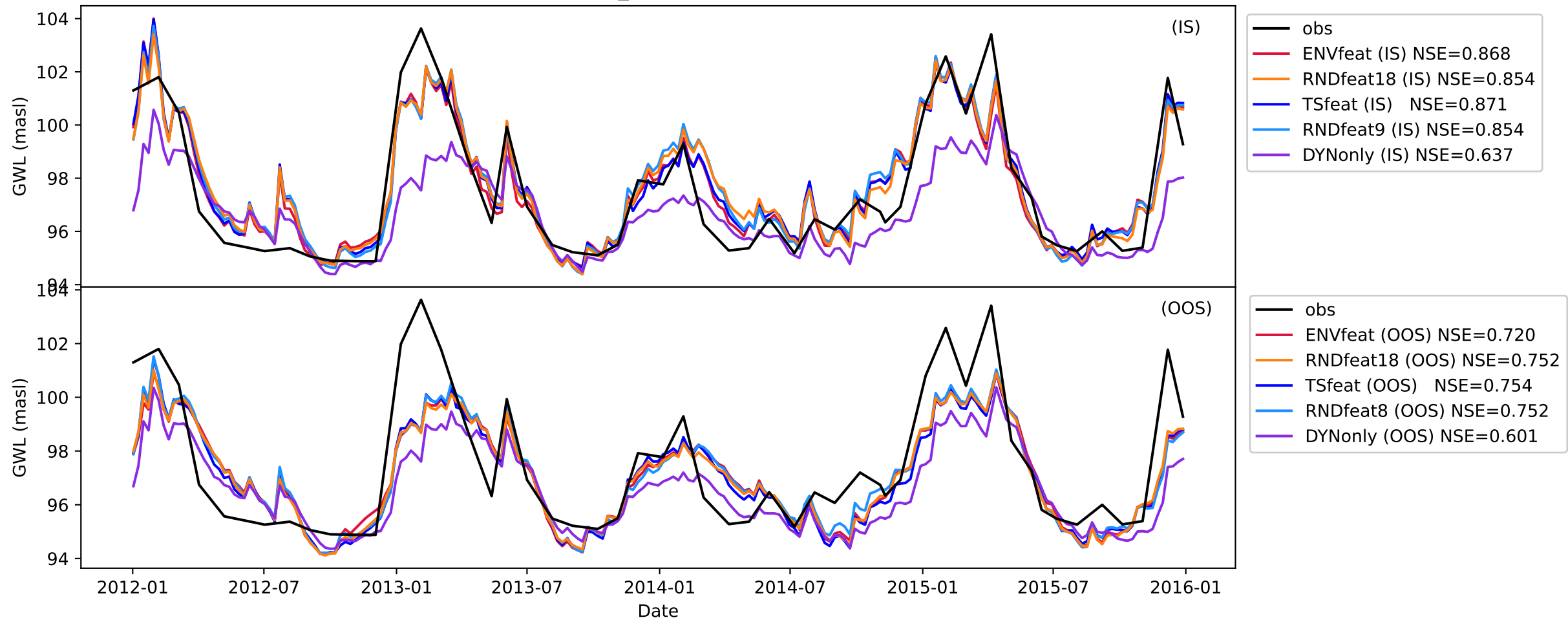
NW_8000186



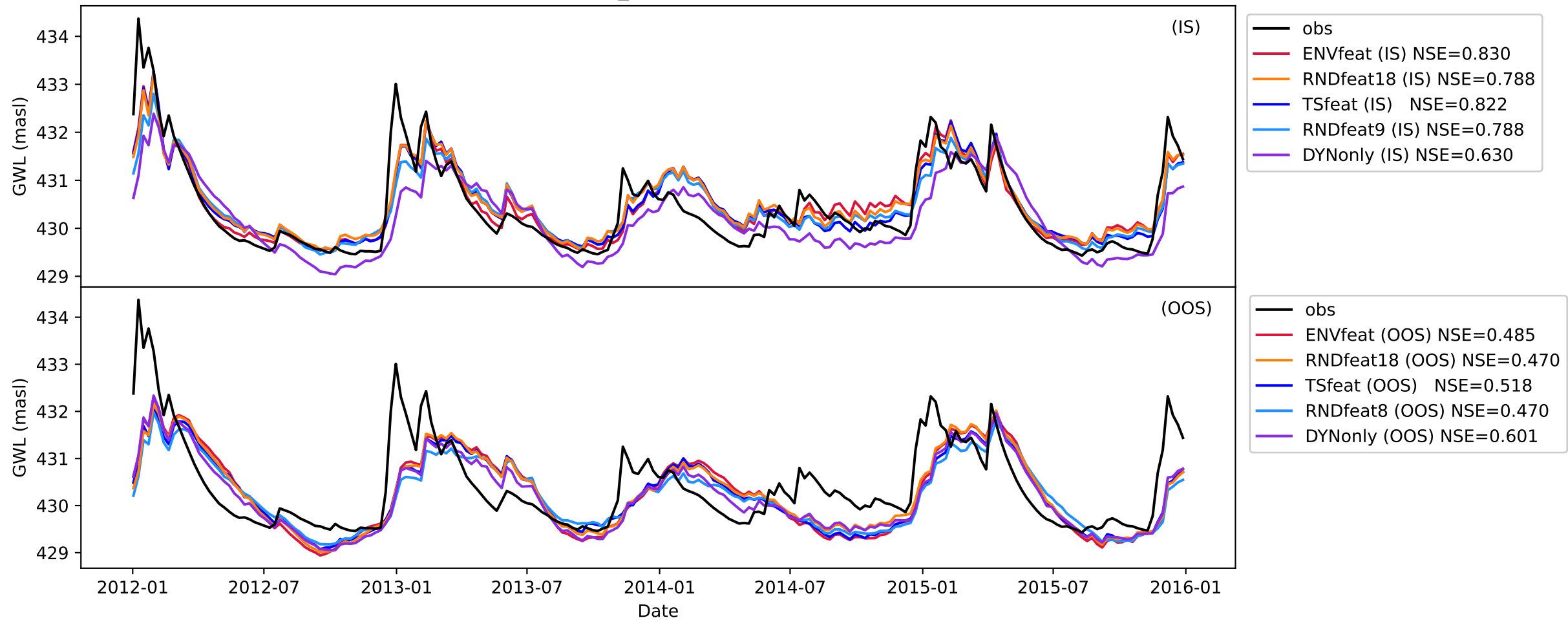
NW_80300376



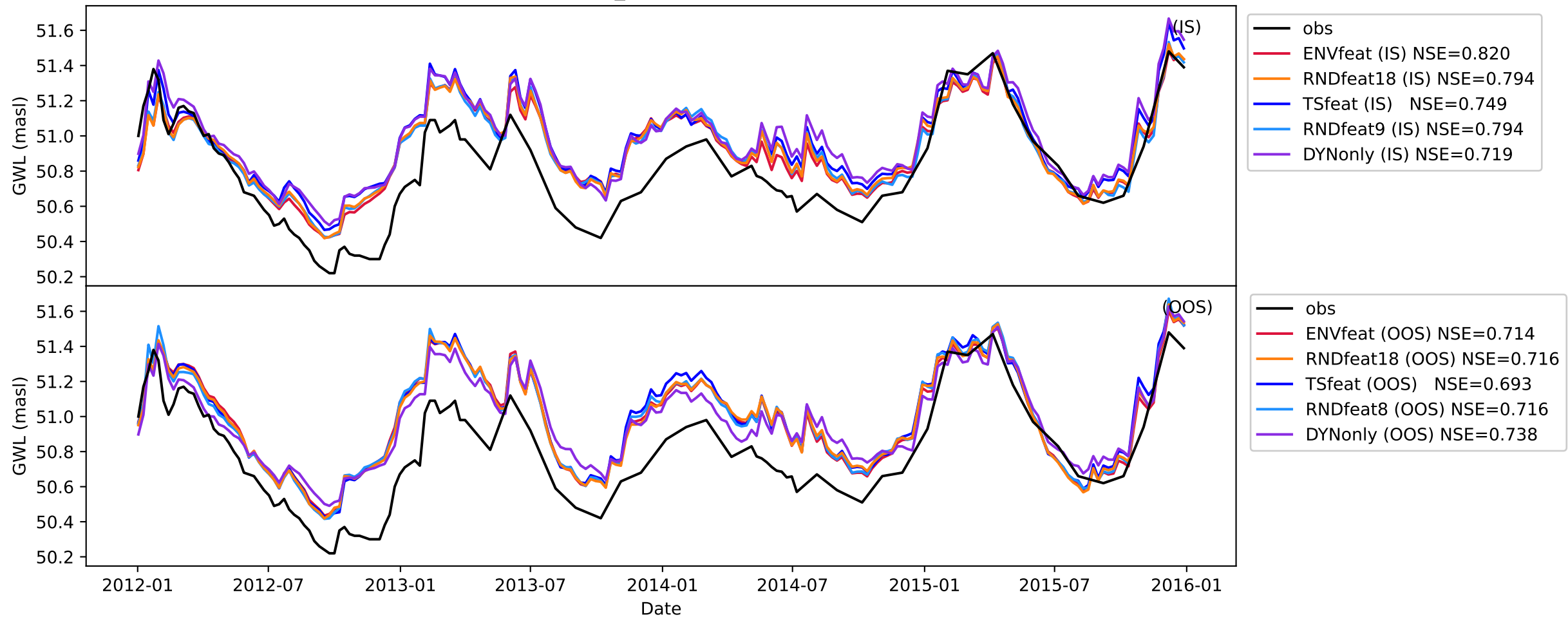
NW_91163705



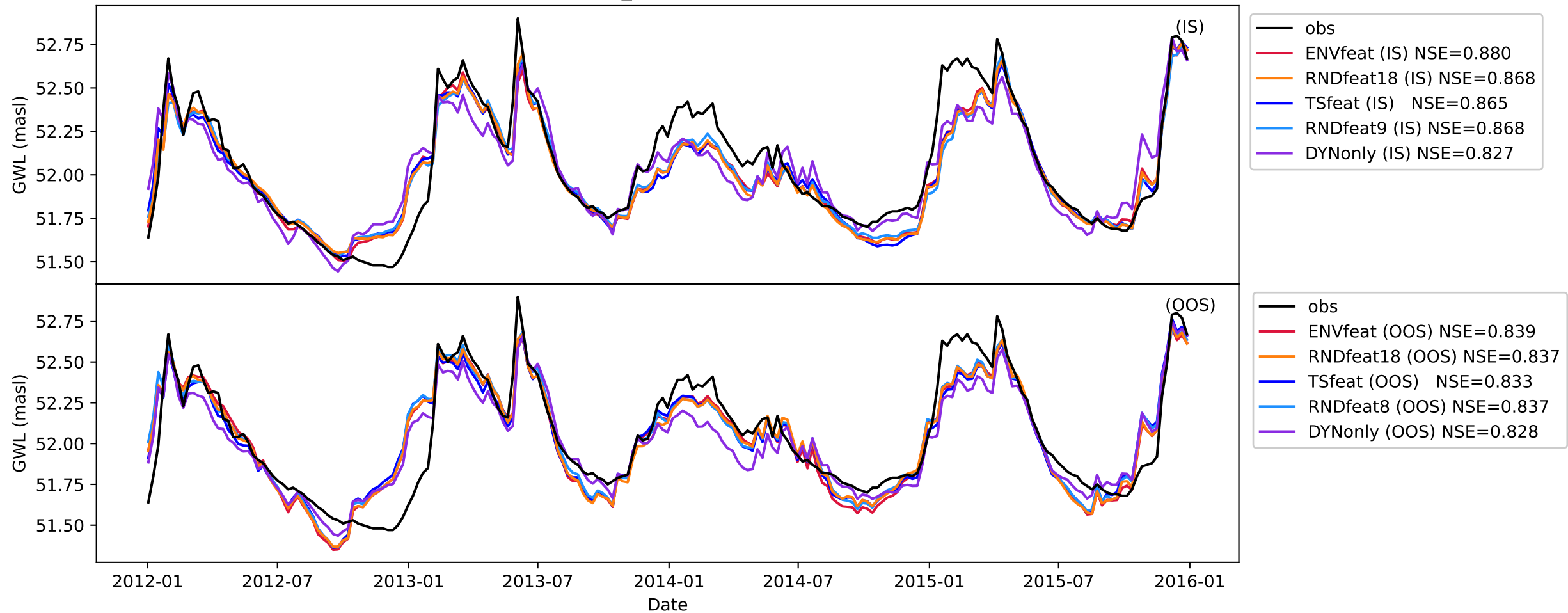
NW_91174909



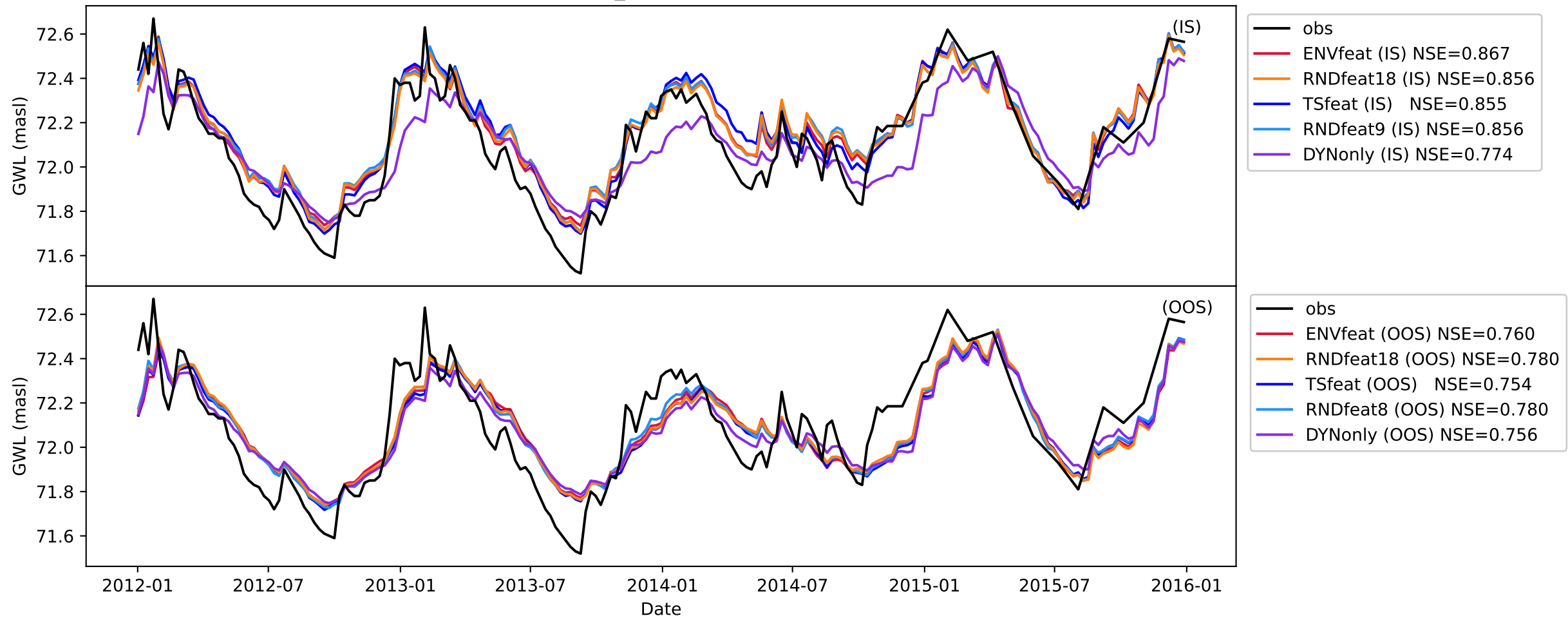
NW_100140142



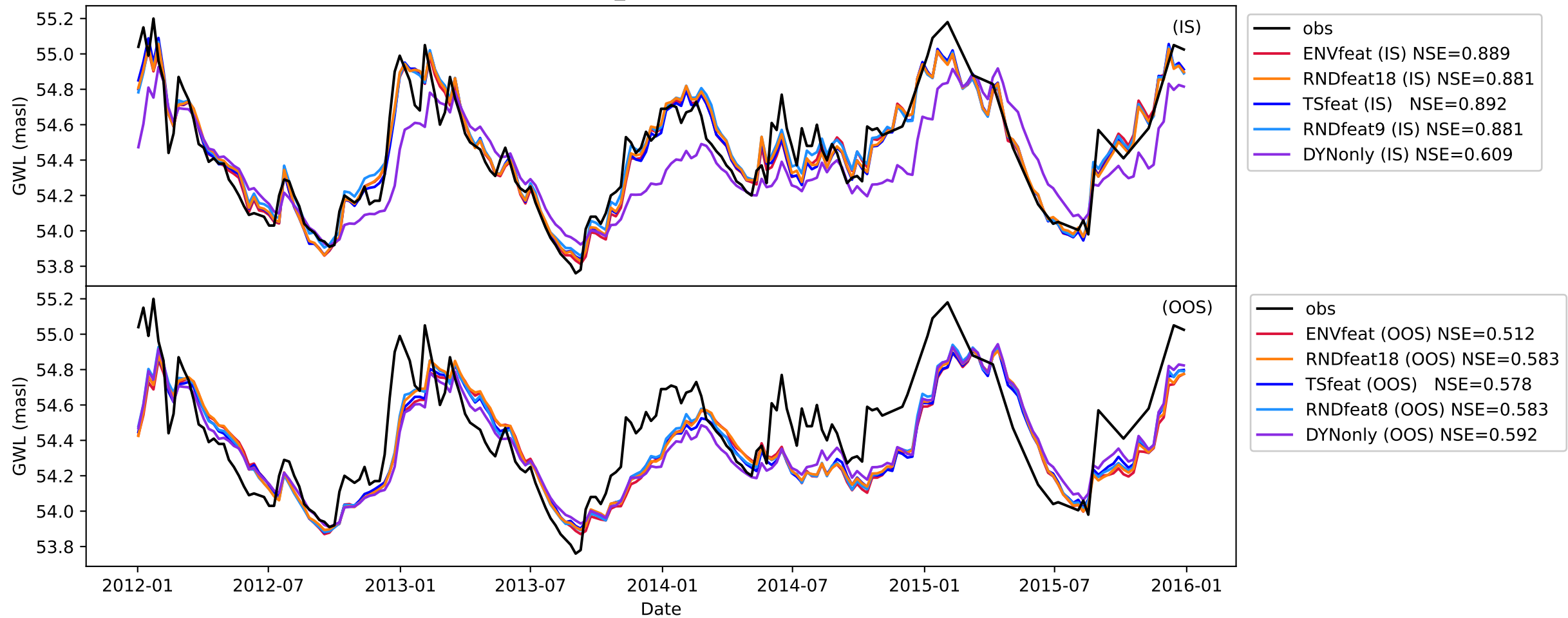
NW_100140762



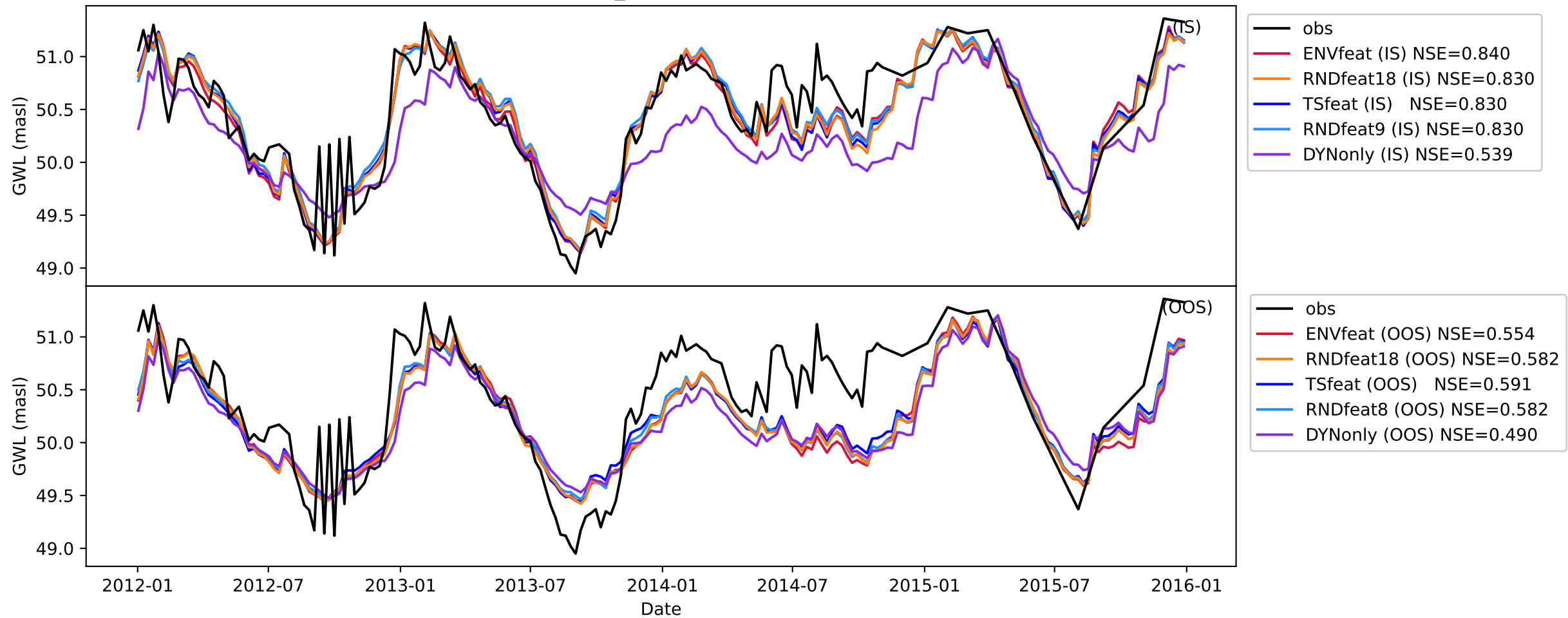
NW_110040028



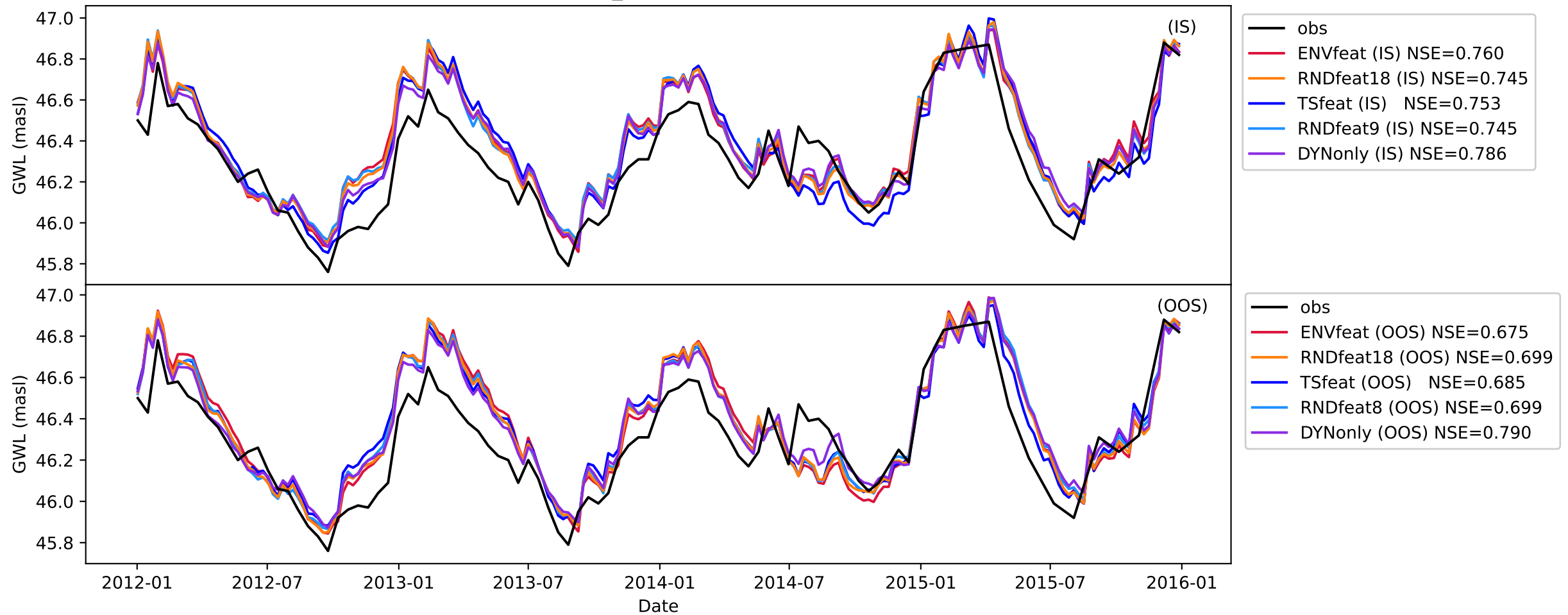
NW_110040041



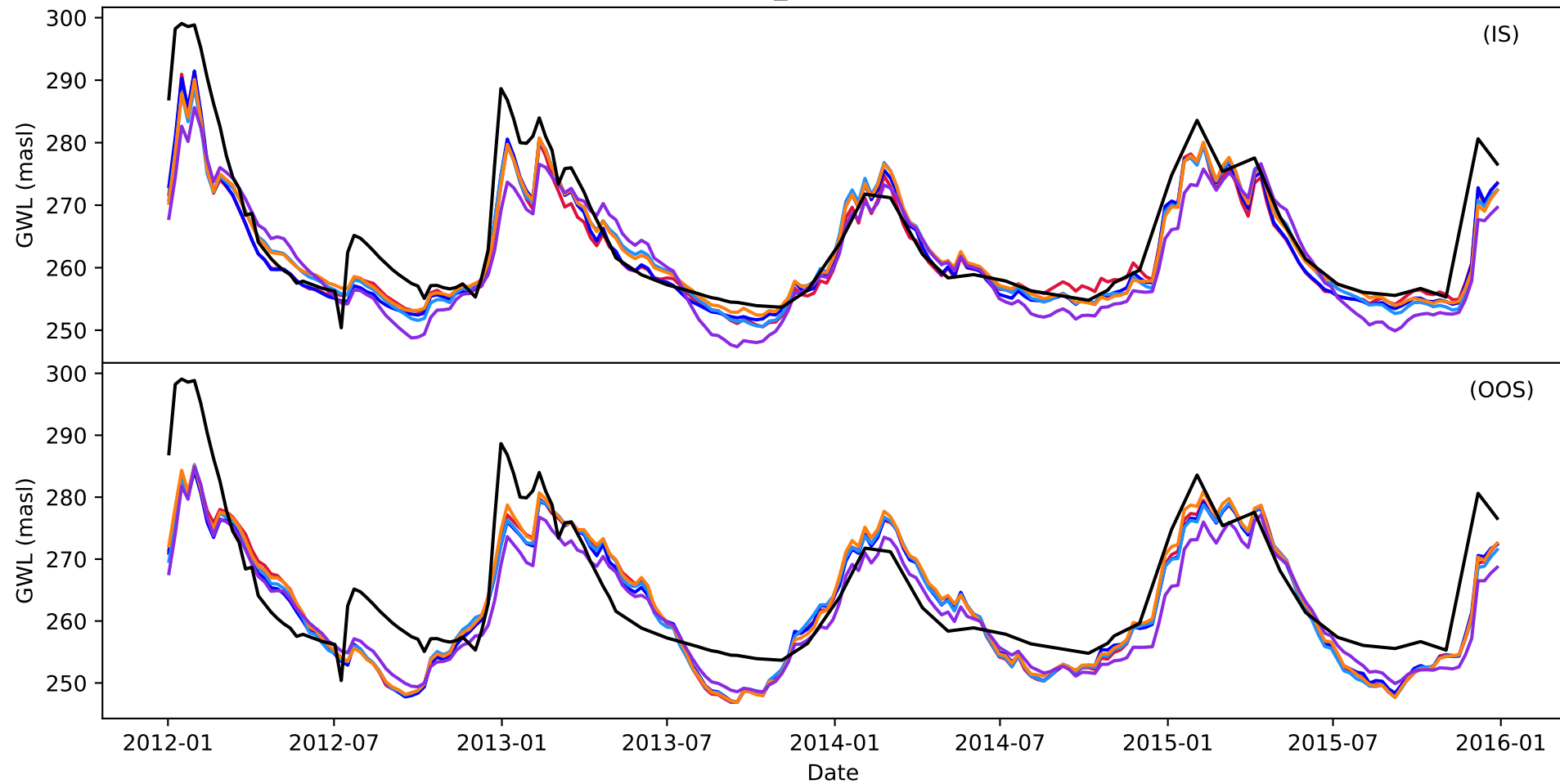
NW_110060143



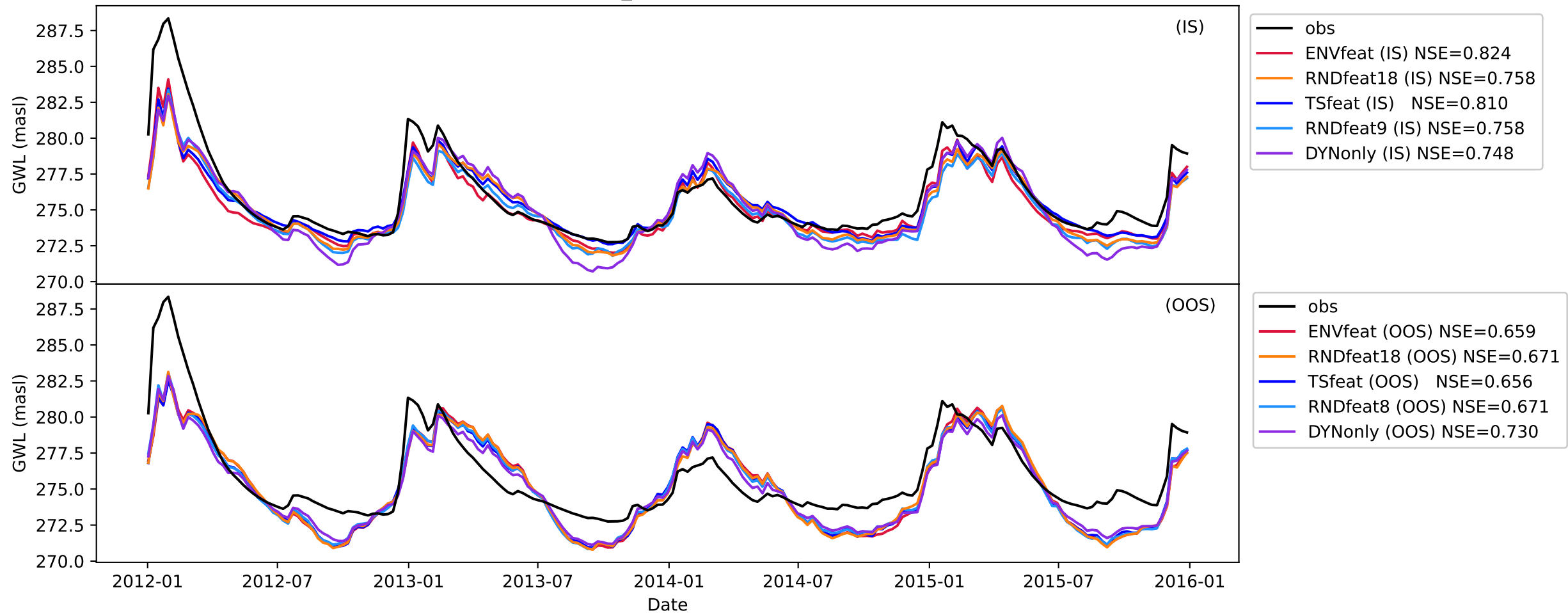
NW_110240017



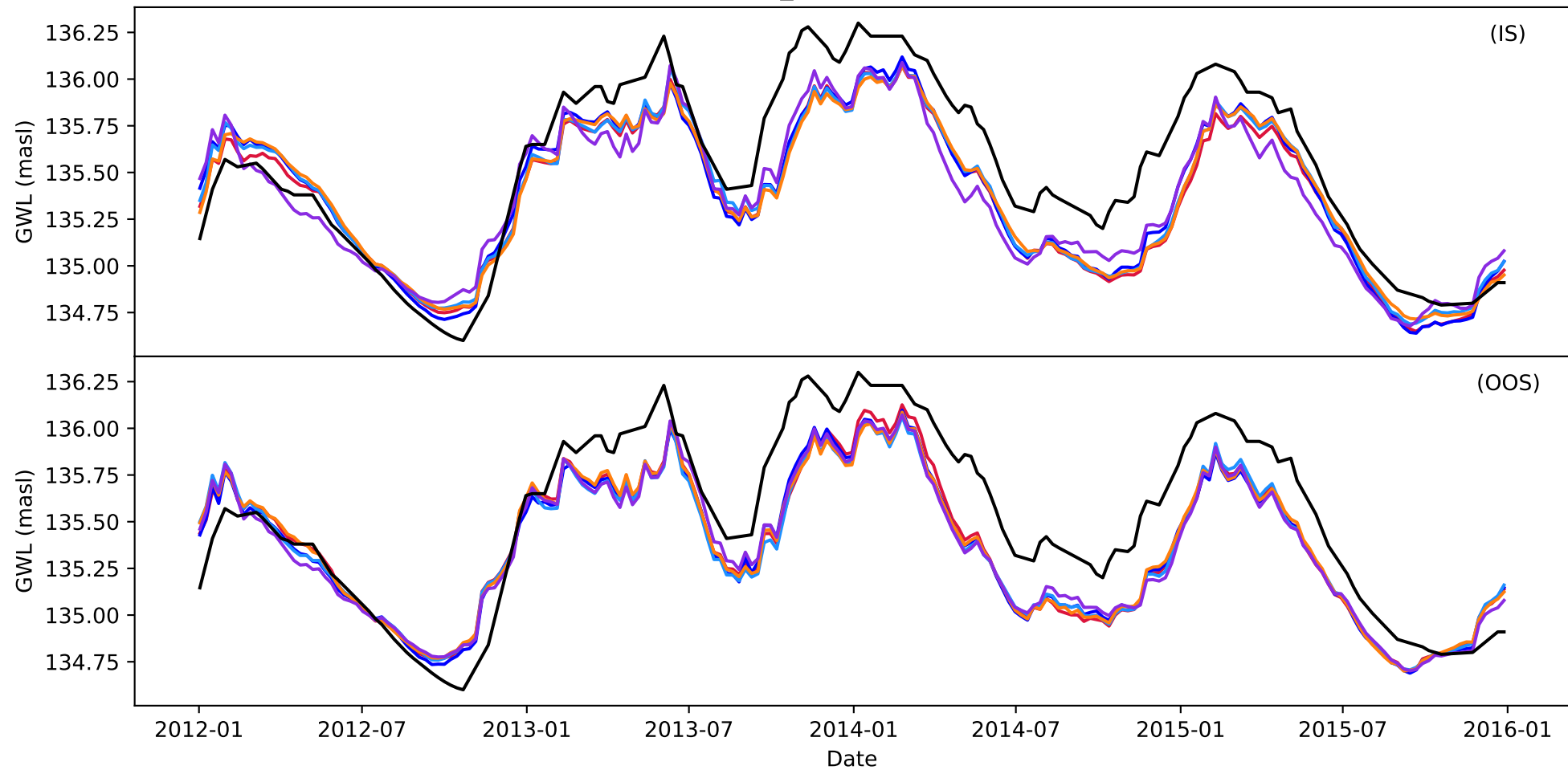
NW_129660176



NW_129660206



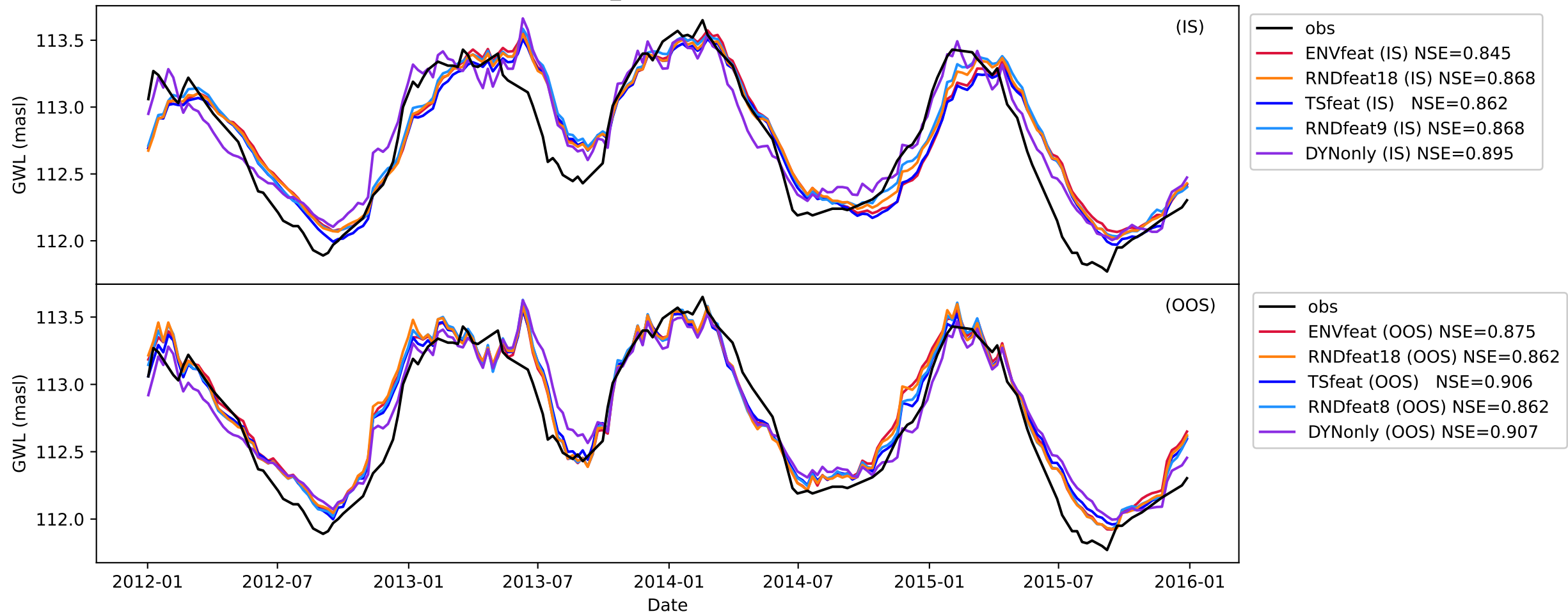
RP_2373131200



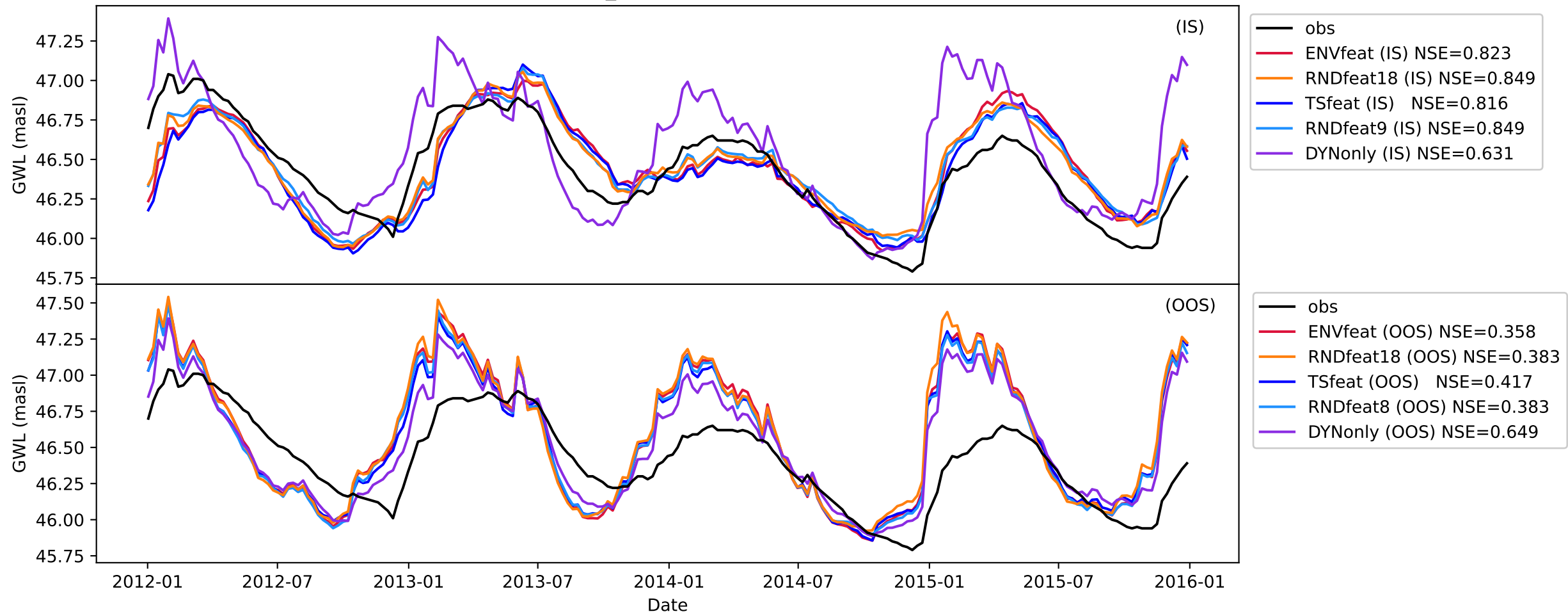
- obs
- ENVfeat (IS) NSE=0.751
- RNDfeat18 (IS) NSE=0.758
- TSfeat (IS) NSE=0.776
- RNDfeat9 (IS) NSE=0.758
- DYNOnly (IS) NSE=0.751

- obs
- ENVfeat (OOS) NSE=0.722
- RNDfeat18 (OOS) NSE=0.706
- TSfeat (OOS) NSE=0.708
- RNDfeat8 (OOS) NSE=0.706
- DYNOnly (OOS) NSE=0.731

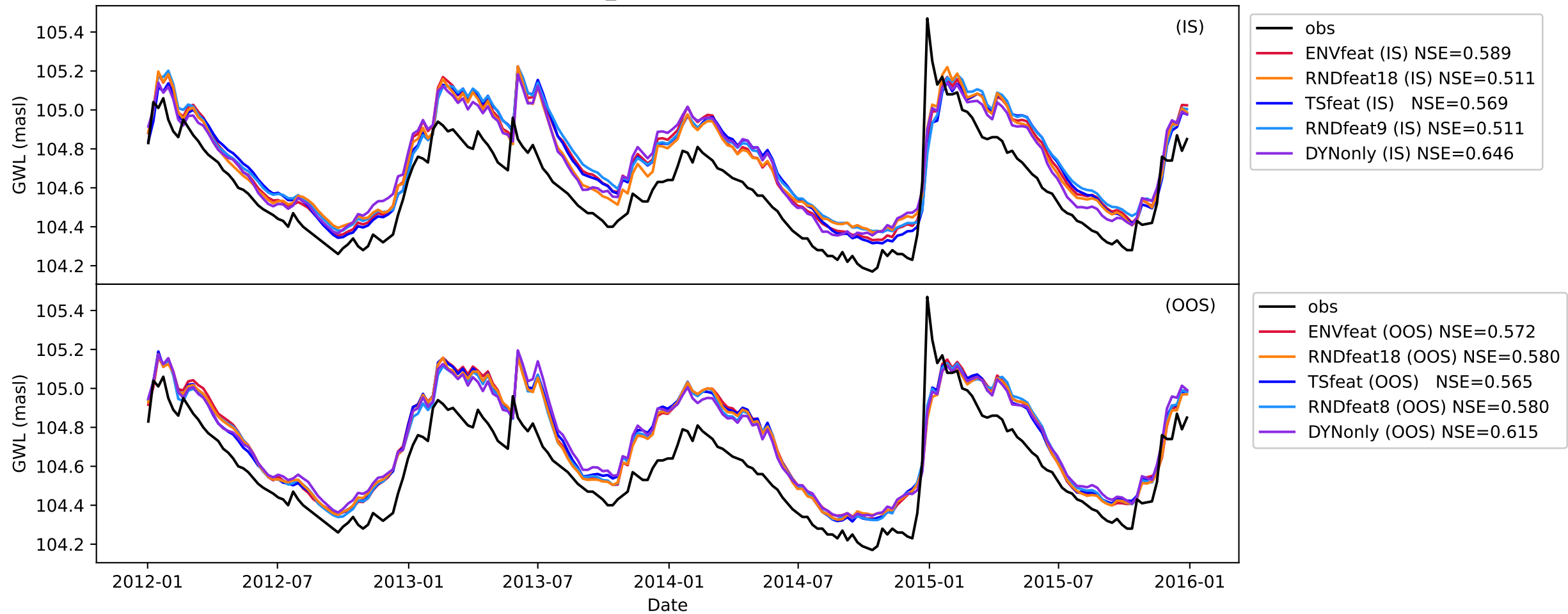
RP_2378140100



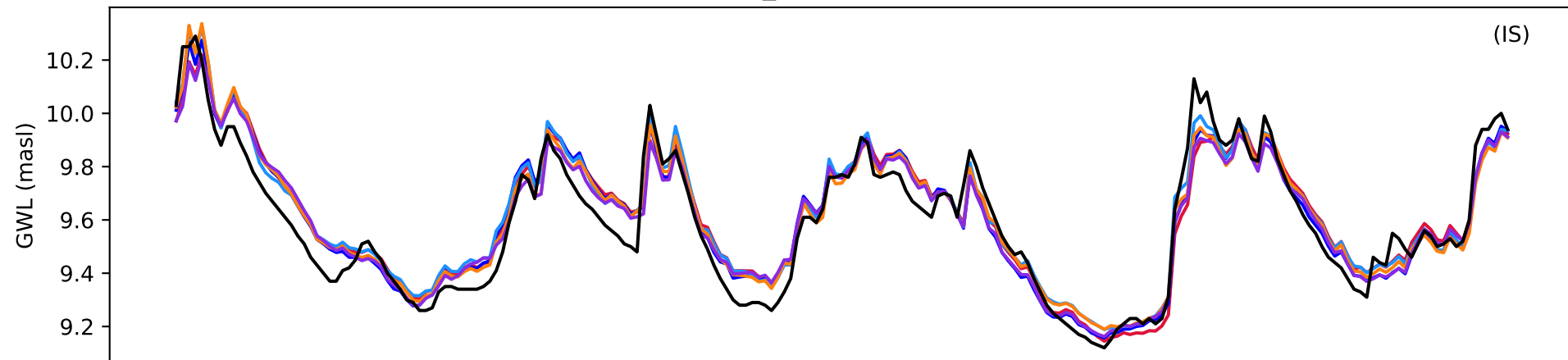
SH_10L53126001



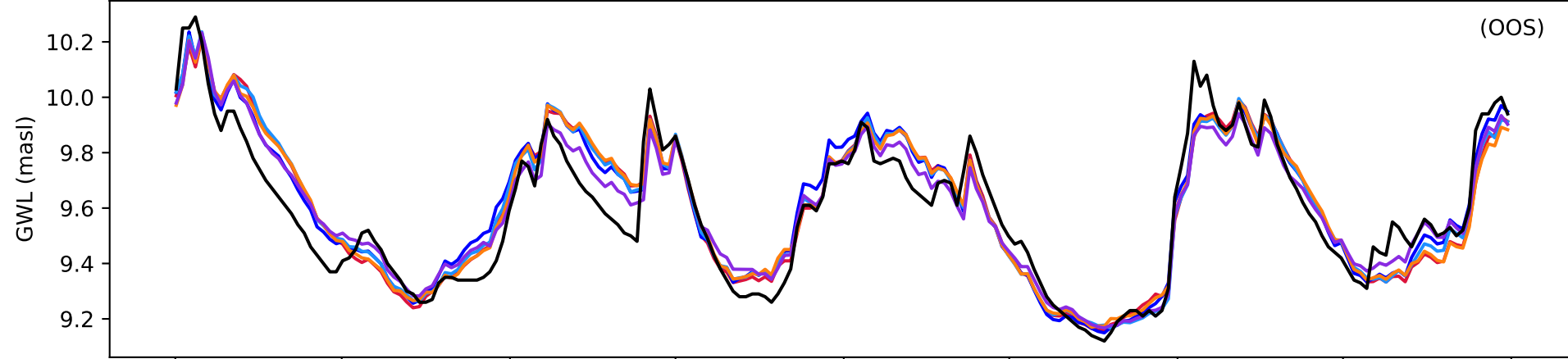
SH_10L55038005



SH_10L56048003



- obs
- ENVfeat (IS) NSE=0.899
- RNDfeat18 (IS) NSE=0.909
- TSfeat (IS) NSE=0.915
- RNDfeat9 (IS) NSE=0.909
- DYNOnly (IS) NSE=0.914

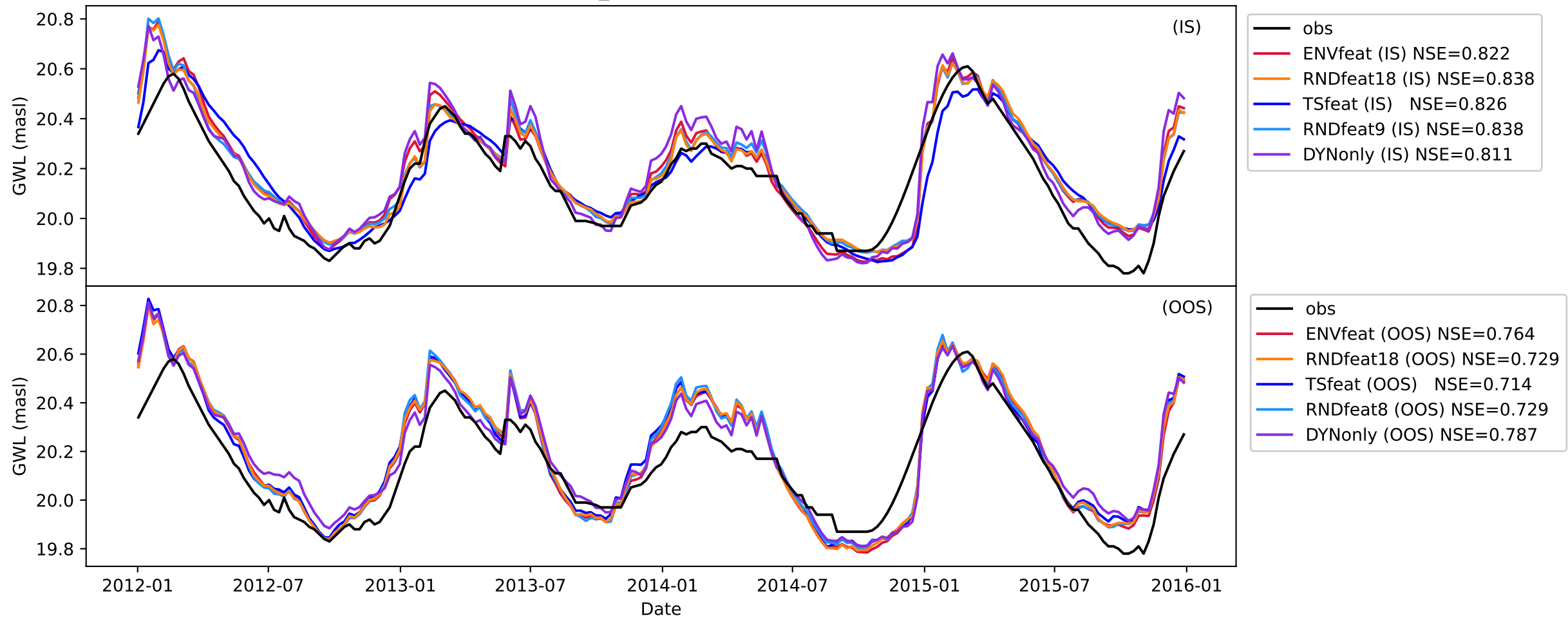


- obs
- ENVfeat (OOS) NSE=0.821
- RNDfeat18 (OOS) NSE=0.811
- TSfeat (OOS) NSE=0.858
- RNDfeat8 (OOS) NSE=0.811
- DYNOnly (OOS) NSE=0.903

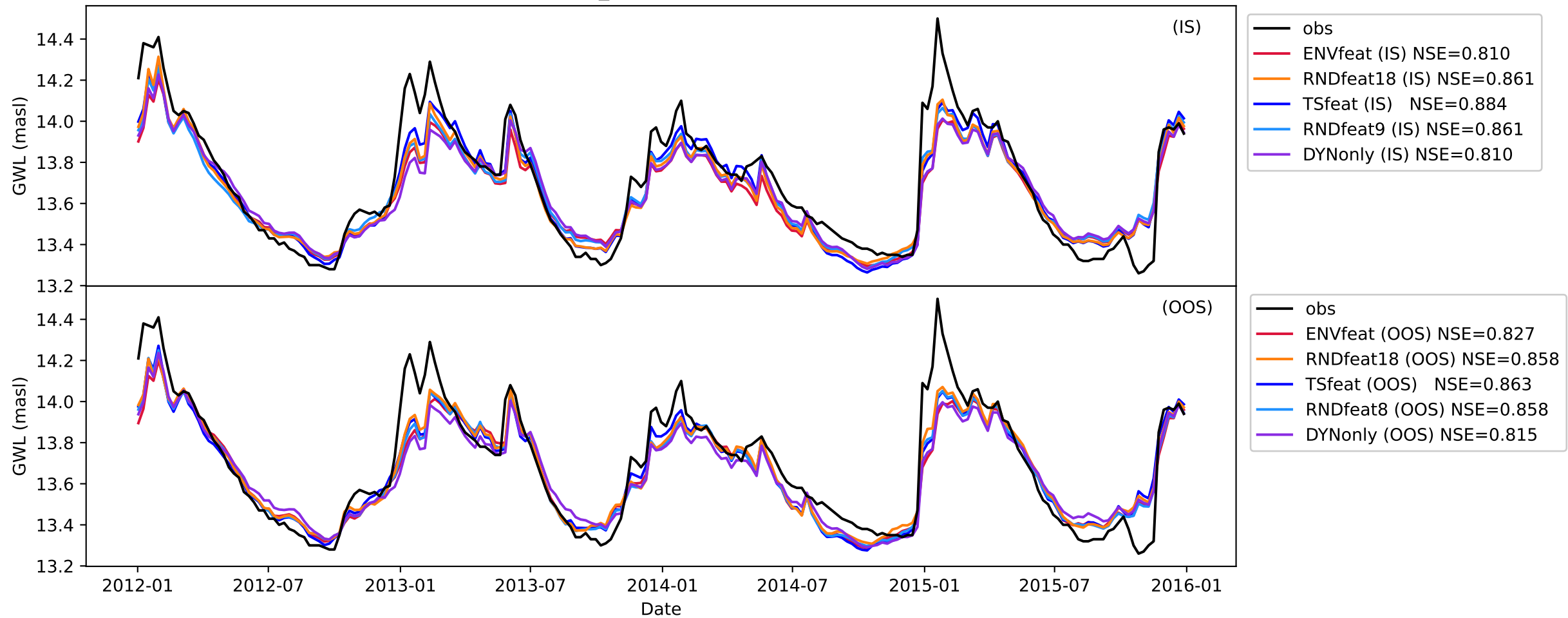
2012-01 2012-07 2013-01 2013-07 2014-01 2014-07 2015-01 2015-07 2016-01

Date

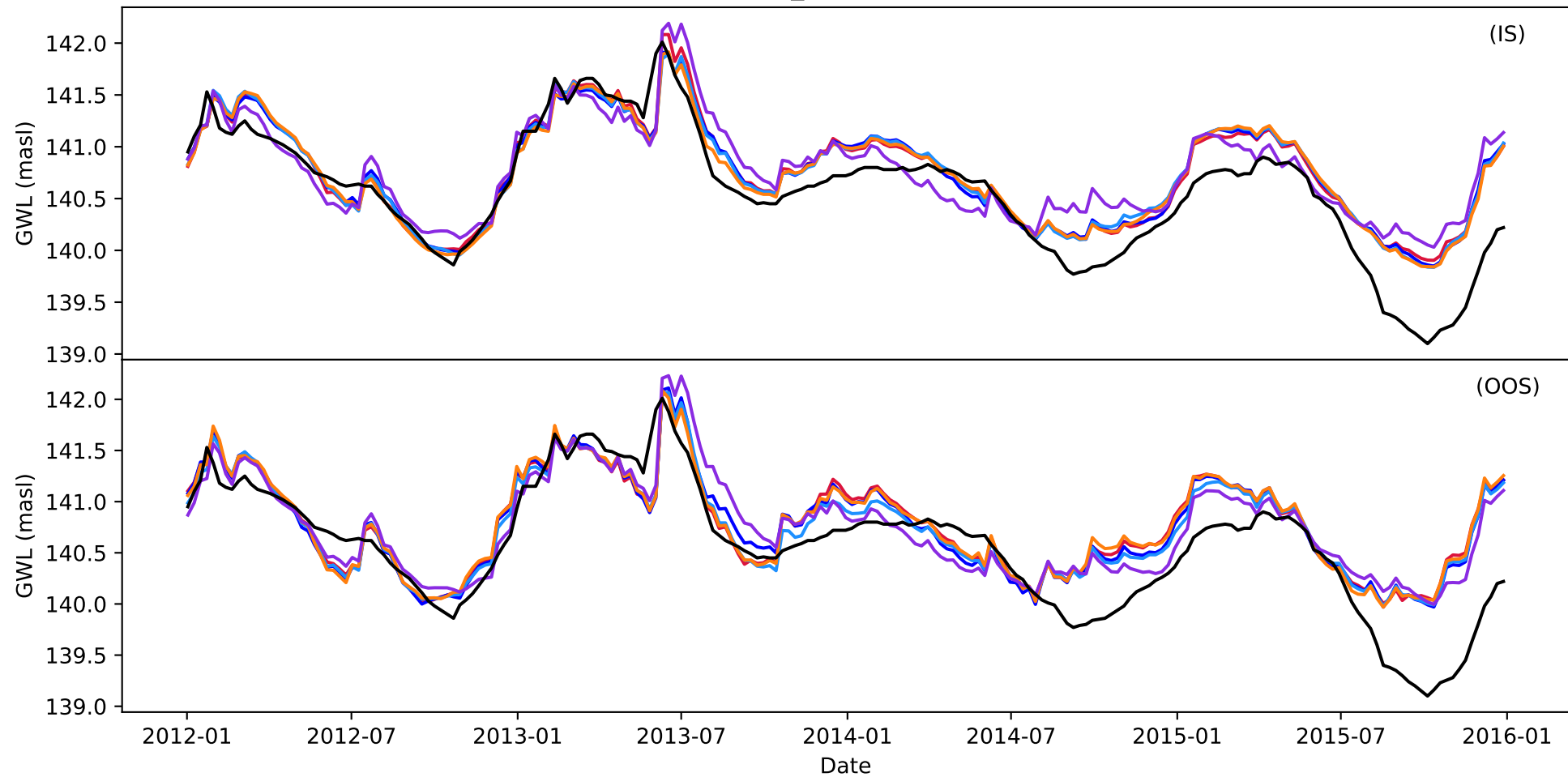
SH_10L57066002



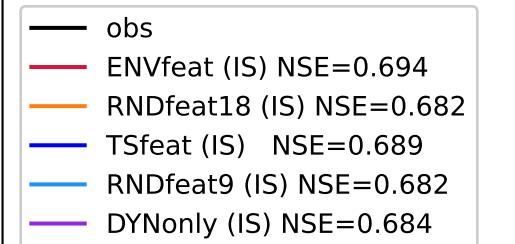
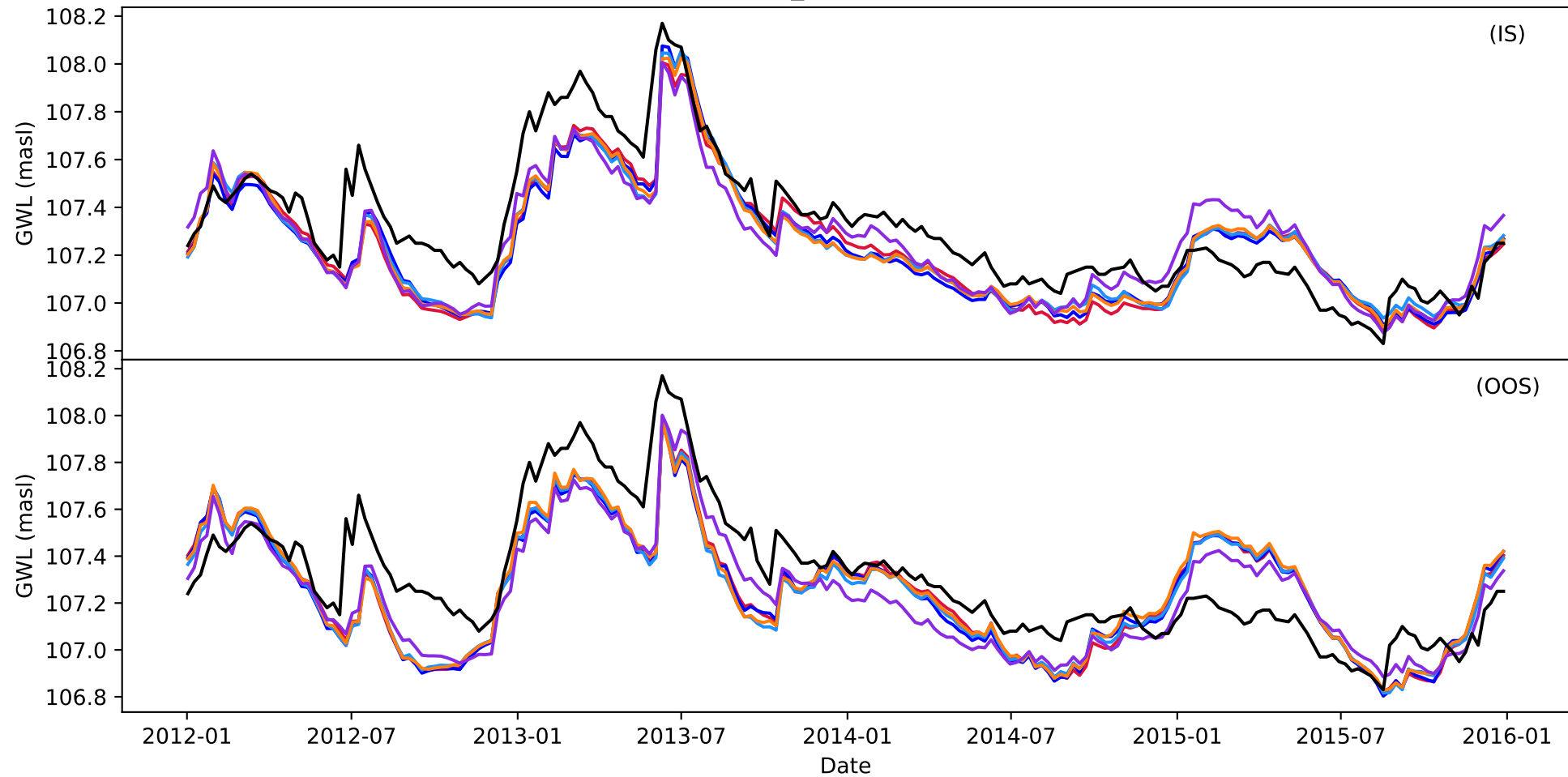
SH_10L62060004



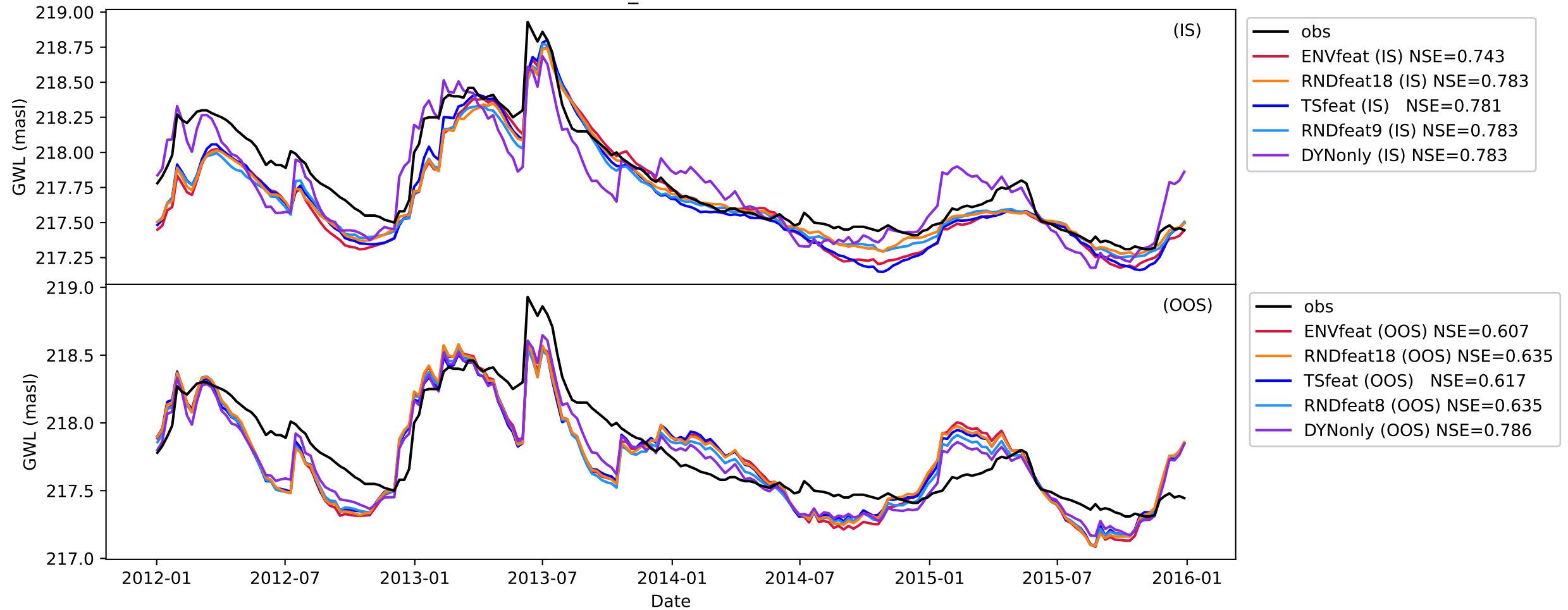
SN_46440927



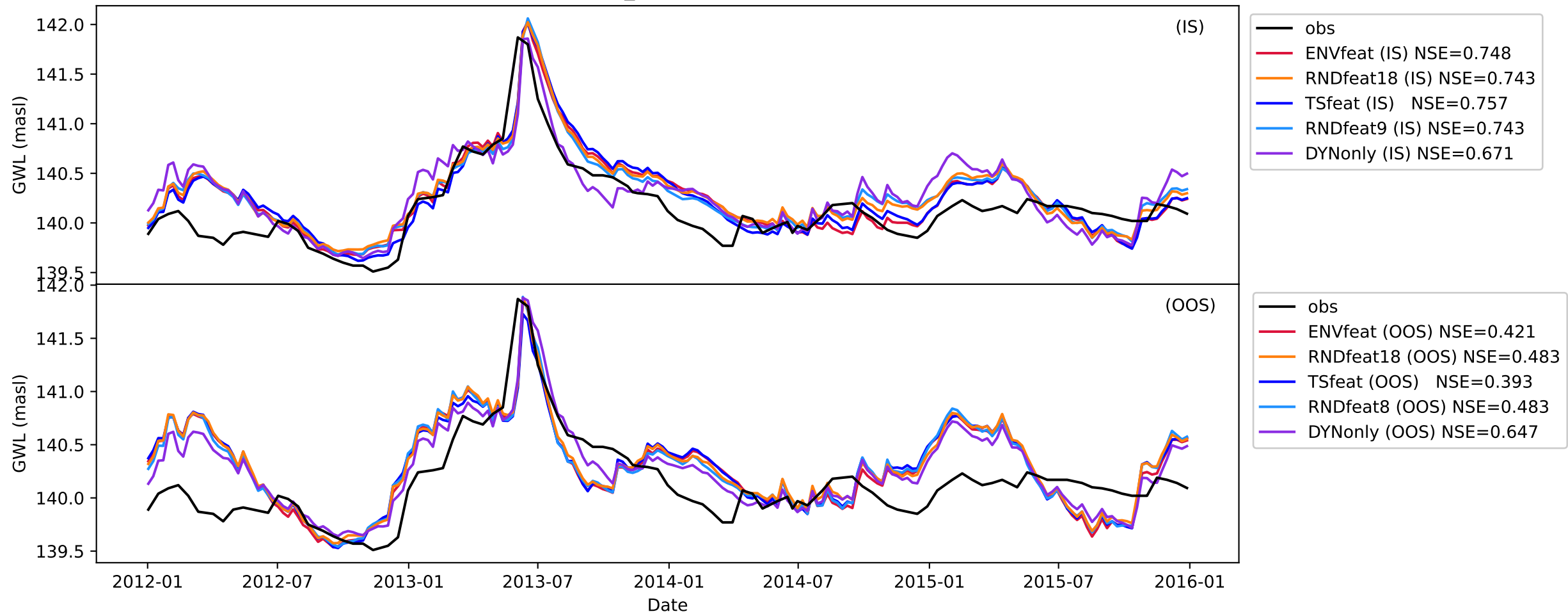
SN_46460564



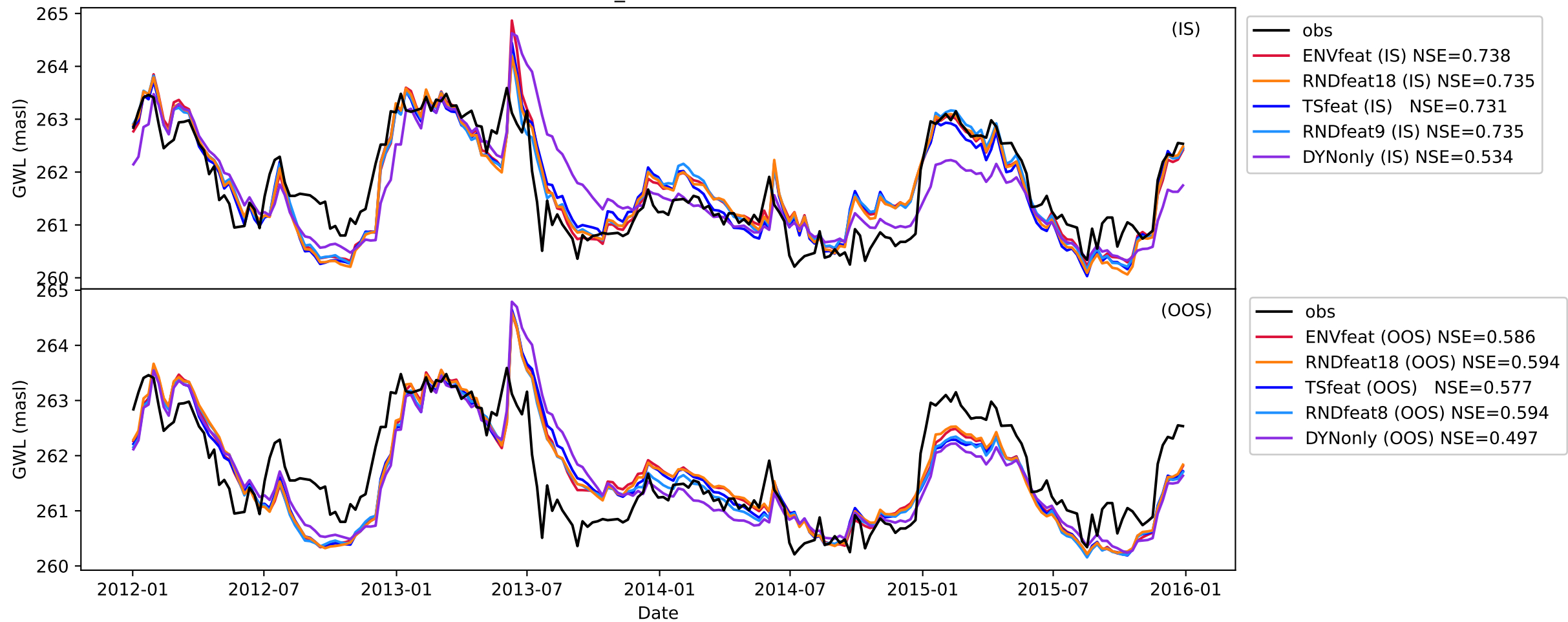
SN_47500596



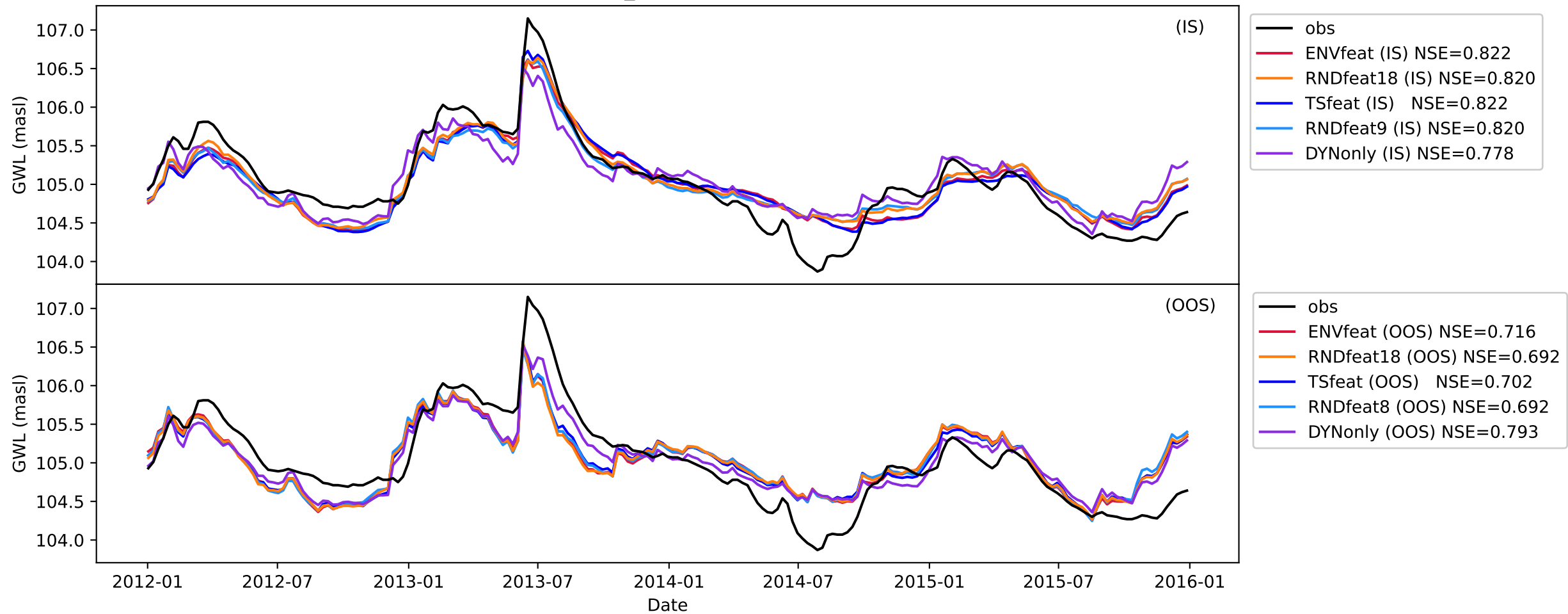
SN_48390509



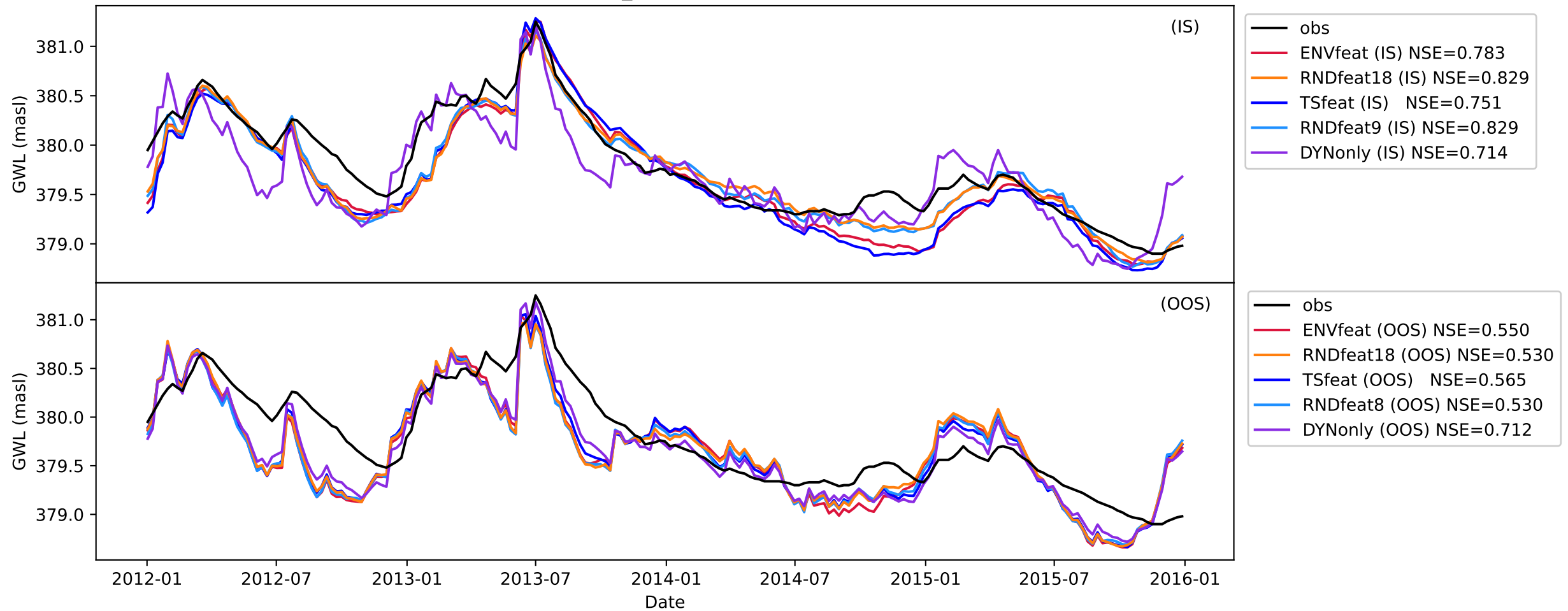
SN_49430964



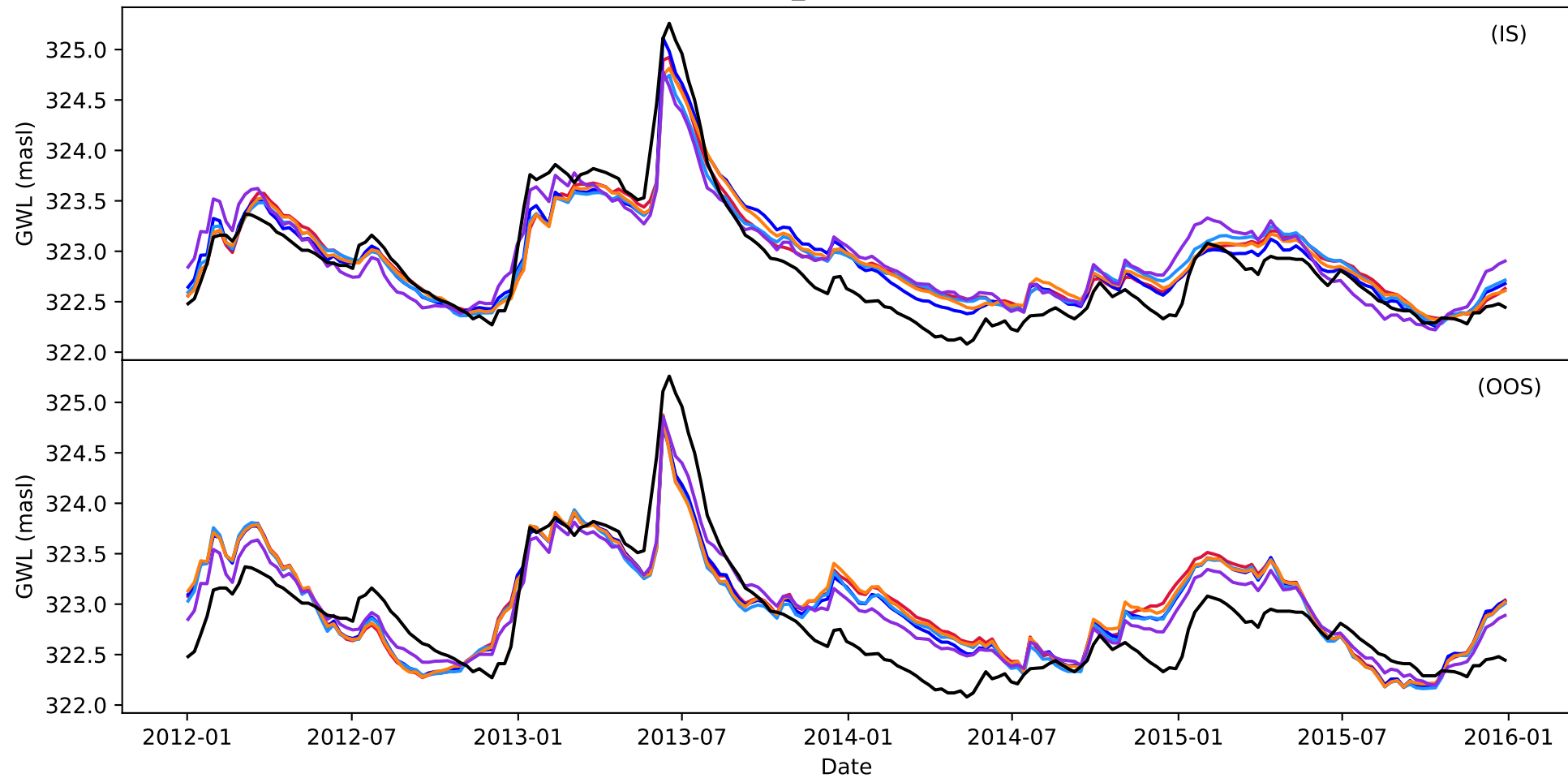
SN_49484004



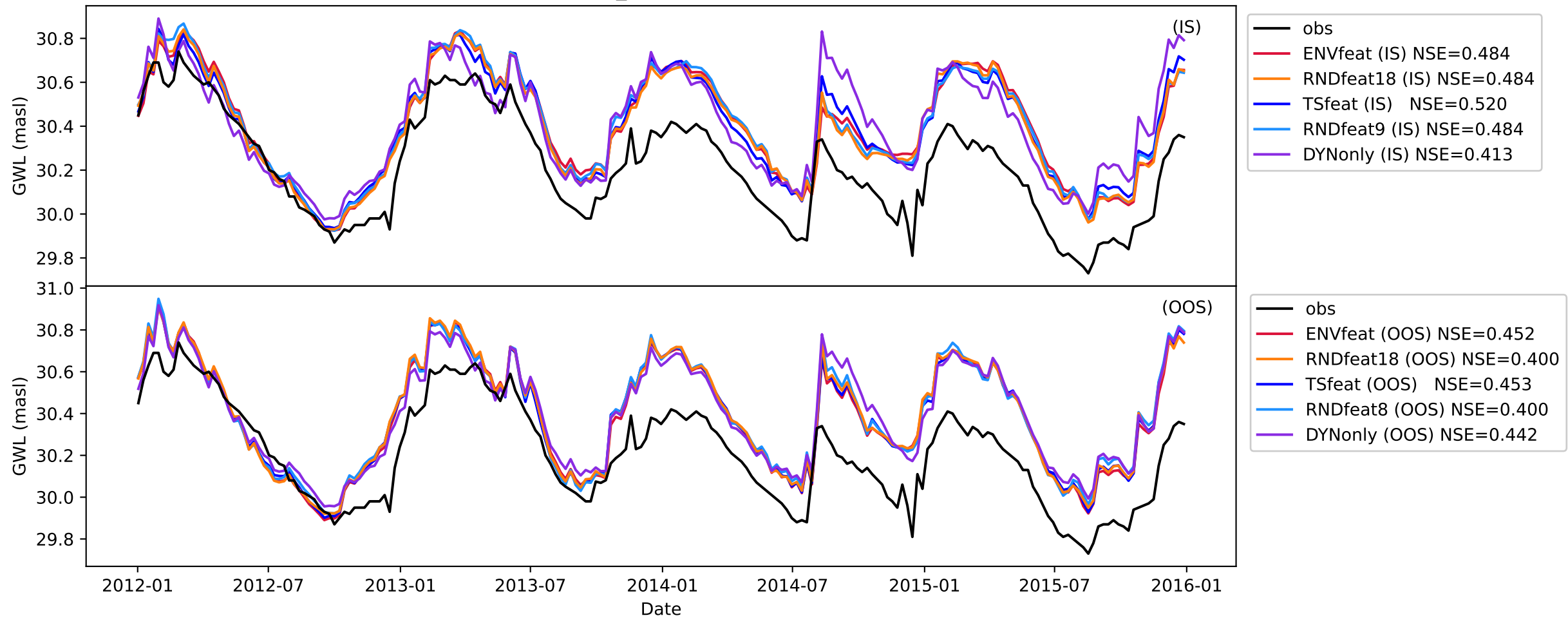
SN_49531740



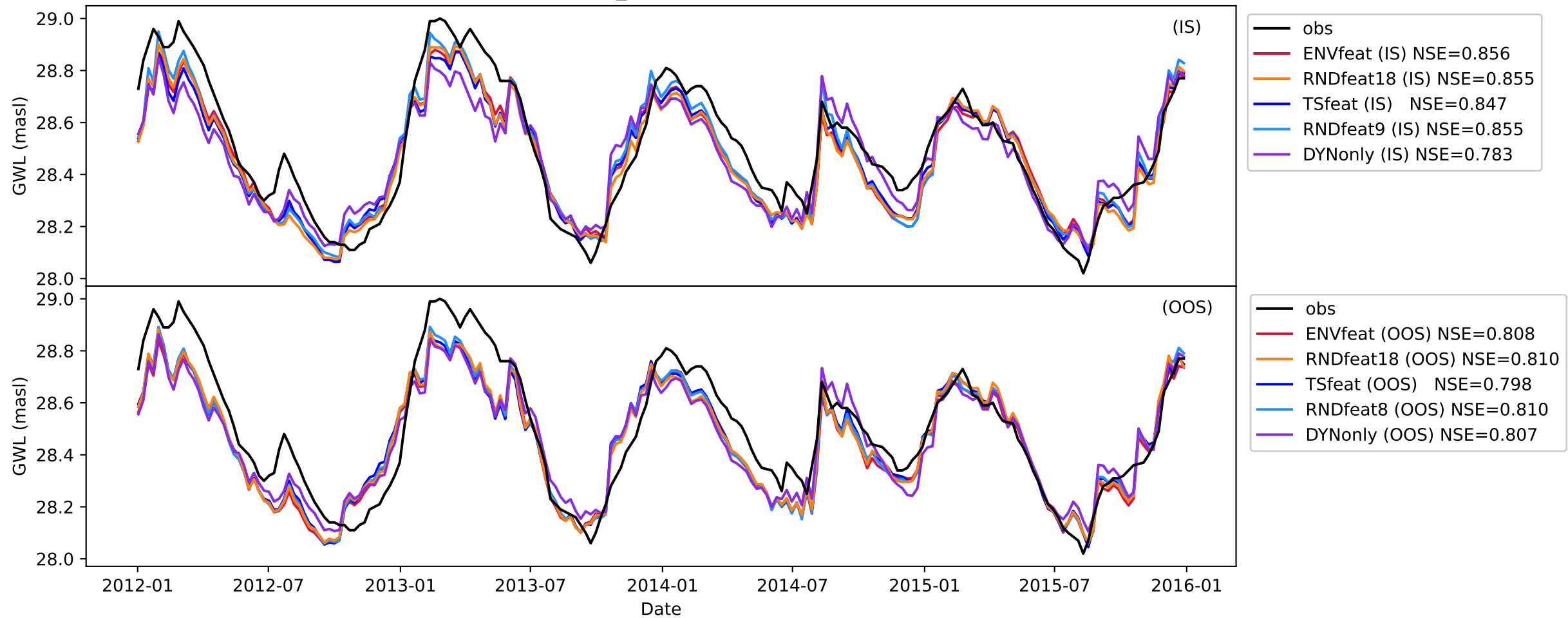
SN_52410759



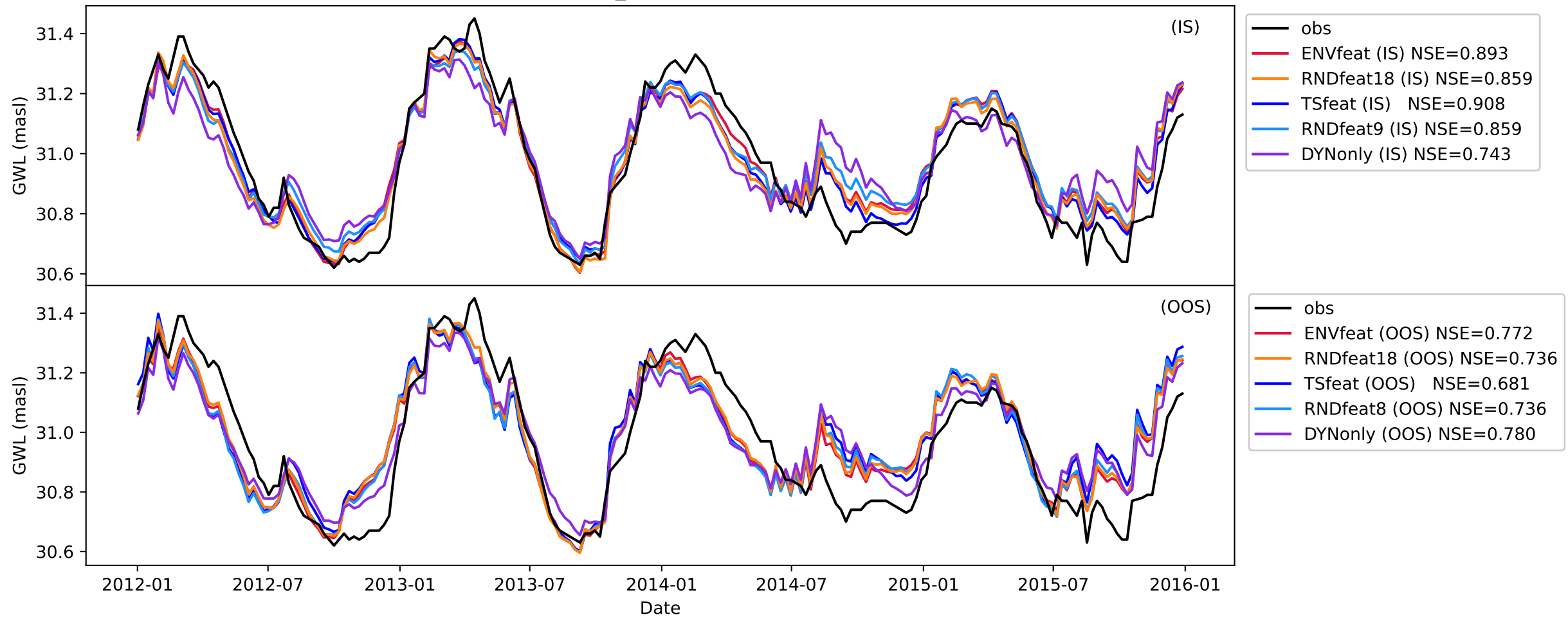
ST_31340028



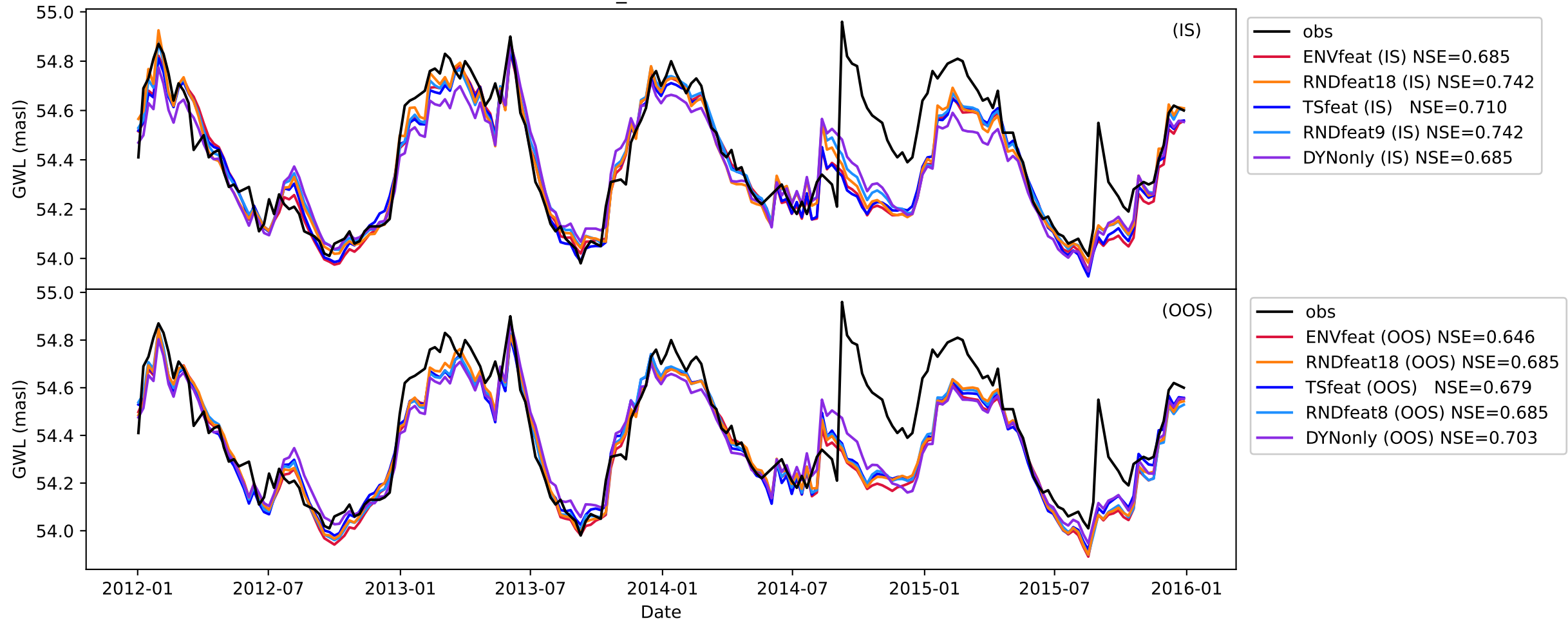
ST_33340002



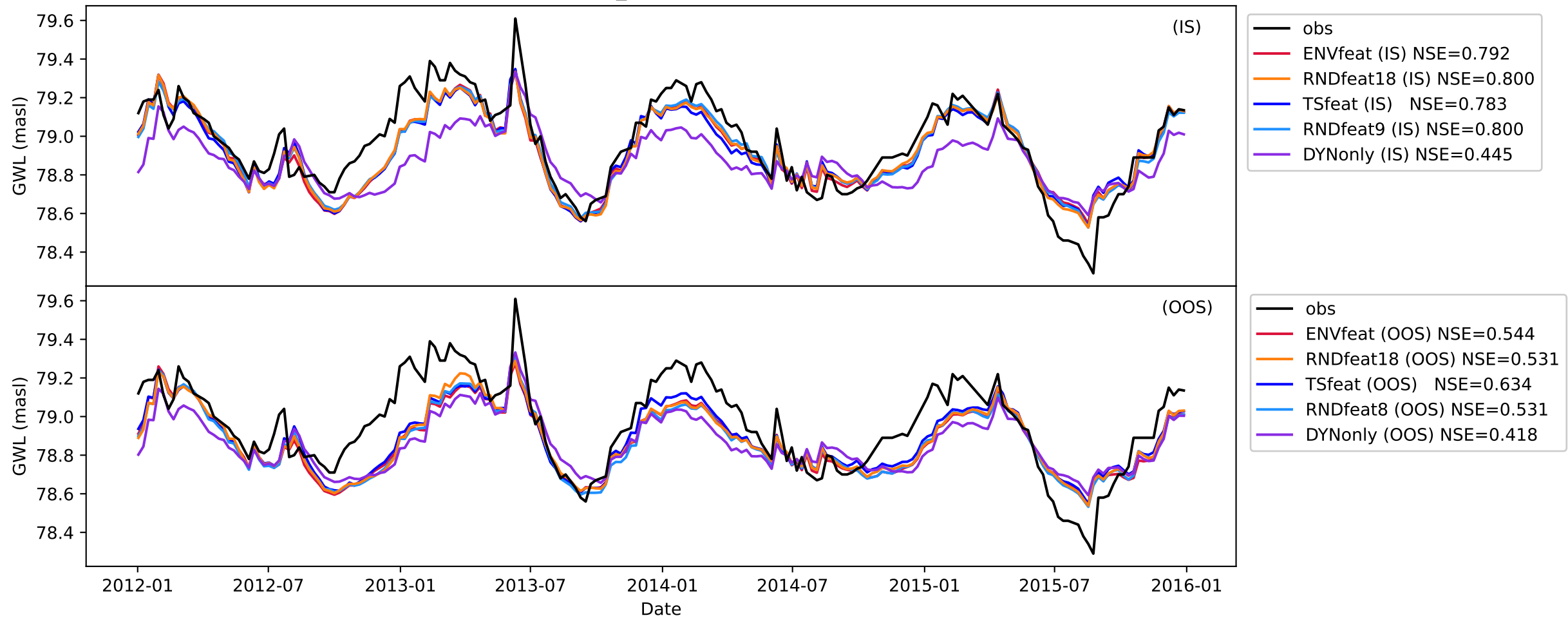
ST_34376608



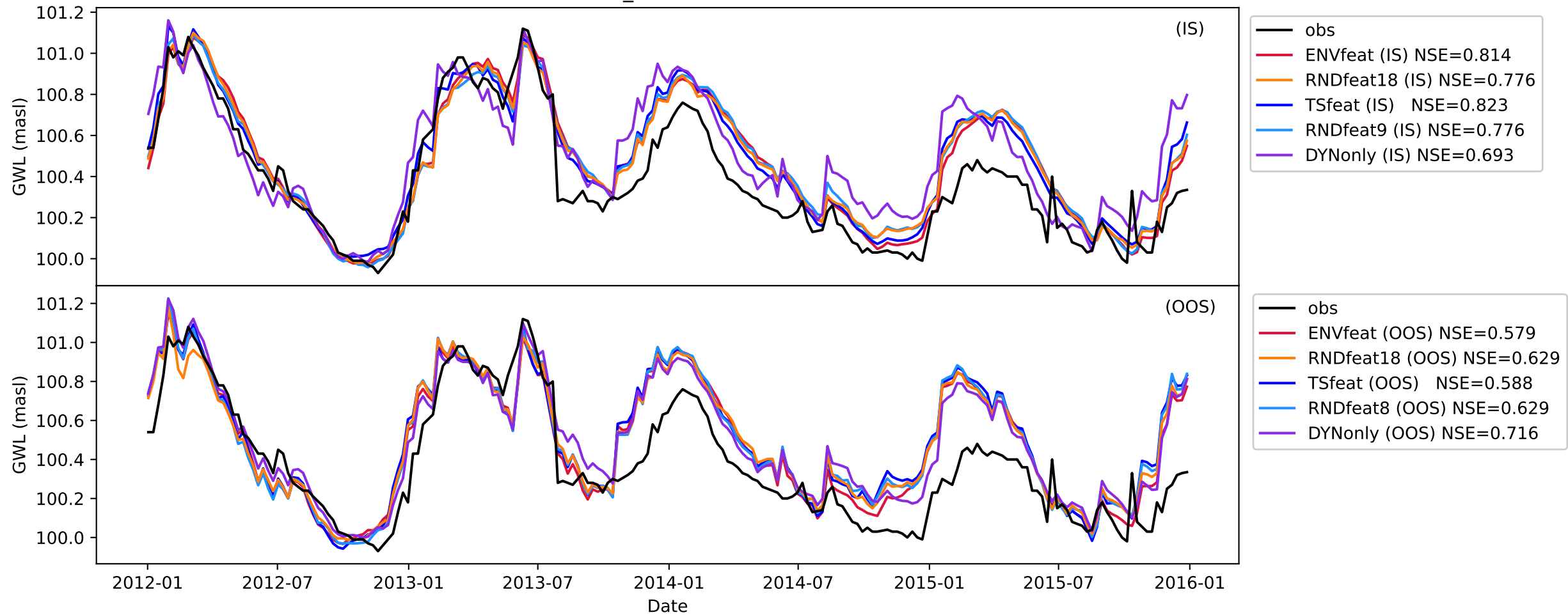
ST_36340007



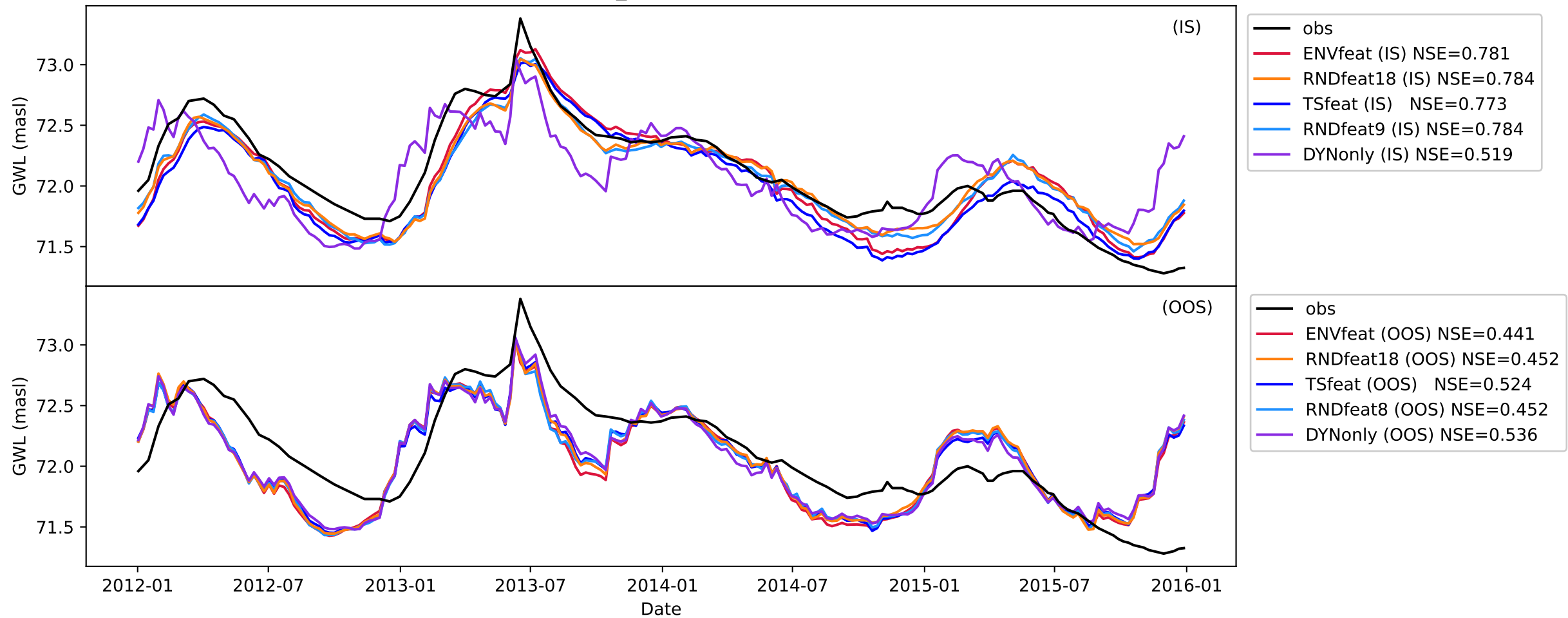
ST_39320023



ST_40415442



ST_43435116



ST_44339213

