

**CLAIMS**

1. A forecasting platform for generating a series of short period wind speed (SPWS)  
5 forecasts for a local area, the platform comprising:
- (a) a scheduling module,
    - (i) wherein the scheduling module is configured to trigger the generation of  
the series of SPWS forecasts according to a forecast schedule with a  
plurality of forecast requests, each SPWS forecast associated with one of  
10 the forecast requests; and
    - (ii) wherein each forecast request includes a forecast identifier, a forecast time  
window, a forecast member selection list, a forecast area identifier, and a  
pre-forecast observation time window;
  - (b) a collection module,
    - 15 (i) wherein the collection module is in data communication through a network  
with:
      - (1) at least one ensemble member server including a plurality of  
ensemble members configured for generation of member outputs; and
      - (2) a wind speed (WS) observation system for the local area configured  
20 to collect a series of observed WS records for the local area, each WS  
record including an observation area identifier, an observation time  
window, and WS observation information;
    - (ii) wherein, for each forecast request, the collection module is configured to  
store or link to a set of selected member outputs of the forecast request,  
25 each selected member output associated with:
      - (1) the forecast time window of the forecast request;
      - (2) one of the ensemble members identified in the forecast member  
selection list of the forecast request; and
      - (3) the forecast area identifier of the forecast request;
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- (iii) wherein computations generating each selected member output from the ensemble member associated with the selected member output:
  - (1) generate WS forecast information for the selected member output;  
and
  - 5 (2) are performed by at least one of the at least one ensemble member server, the platform, and a third party remote computing service; and
- (iv) wherein, for each forecast request, the collection module is configured to store or link to a set of pre-forecast observed WS records,
  - 10 (1) the forecast area identifier of the forecast request and the observation area identifier of the set of pre-forecast observed WS records both identifying a first identical or overlapping geographic area; and
  - (2) the observation time window of each pre-forecast observed WS record overlapping at least partially with the pre-forecast observation time window of the forecast request;
- 15 (c) a pre-processing module configured to:
  - (i) for each forecast request, identify and extract:
    - (1) the WS forecast information from each of the selected member outputs of the forecast request; and
    - (2) the WS observation information of the set of pre-forecast observed  
20 WS records for the forecast request; and
  - (ii) for each forecast request, employ k-means clustering to cluster the WS forecast information from each of the selected member outputs of the forecast request into a plurality of WS clusters of the forecast request;
- (d) a forecast history database,
  - 25 (i) wherein the forecast history database is configured to store a plurality of forecast records memorializing each of the SPWS forecasts outputted from a plurality of prior forecast requests; and
  - (ii) wherein the forecast record associated with each prior forecast request stores or links to:
    - 30 (1) the forecast identifier of the prior forecast request;
    - (2) the forecast area identifier of the prior forecast request;
    - (3) the forecast member selection list of the prior forecast request;

- (4) the set of selected member outputs for the prior forecast request;
- (5) the WS forecast information from each of the selected member outputs of the prior forecast request;
- (6) the WS observation information of the set of pre-forecast observed  
5 WS records of the prior forecast request; and
- (7) the WS clusters for the prior forecast request;
- (e) a ranking module comprising a clustering module configured, for each forecast request, to:
  - (i) select and access at least one sample forecast record from the plurality of  
10 forecast records of the prior forecast requests stored in the forecast history database, wherein the forecast area identifier of at least one sample forecast record and the forecast area identifier of the forecast request both identify a second identical or overlapping geographic area;
  - (ii) create cluster comparison information for the forecast request from analysis  
15 of:
    - (1) the WS clusters clustered for the forecast request by the pre-processing module;
    - (2) the WS observation information extracted for the forecast request by the pre-processing module from the set of pre-forecast observed WS  
20 records; and
    - (3) the WS clusters of one or more of the prior forecast requests, as memorialized in the forecast history database for each forecast record associated with the at least one sample forecast records of the prior forecast requests; and
  - (iii) for each of the WS clusters generated by the pre-processing module for the  
25 forecast request, apply cluster feature engineering to generate a set of cluster statistics and cluster error calculations from the cluster comparison information of the forecast request;

- (f) a forecasting module comprising a stacking module including a set of first machine learning (ML) models and a second ML model,
- (i) wherein, for each forecast request, each first ML model is configured to:
- (1) receive as inputs one of the WS clusters of the forecast request; and
  - (2) generate one of a plurality of first ML model outputs from the WS cluster received by the first ML model for the forecast request; and
- (ii) wherein, for each forecast request, the second ML model is configured to:
- (1) receive the first ML model output for the forecast request from each of the first ML models; and
  - (2) generate the SPWS forecast for the forecast request based on a weighted average of the first ML model outputs of the forecast request, wherein the weighted average is calculated from the set of cluster statistics and cluster error calculations for each WS cluster of the forecast request; and
- (g) an output module configured, for each forecast request, to:
- (i) output the SPWS forecast of the forecast request to a user interface; and
  - (ii) augment the forecast history database with a new forecast record detailing the SPWS forecast generated for the forecast request.
2. The platform of claim 1, wherein, for each forecast request, the plurality of WS clusters include:
- (a) a low WS cluster;
  - (b) a medium WS cluster;
  - (c) a high WS cluster; and
  - (d) an average WS cluster.
3. The platform of claim 1,
- (a) wherein each of the ensemble members are exchangeable; and
  - (b) wherein the plurality of ensemble members include at least one of:
- (i) a plurality of ECMWF EPS ensemble members; and
  - (ii) a plurality of down-scaled NWP ensemble members.

4. The platform of claim 1,
- (a) wherein the forecast duration of the forecast time window is in the range of 1 to 6 hours and ends at the forecast start time; and
- (b) wherein the pre-forecast observation time window of the forecast request has a pre-forecast observation duration that is in the range of 1 to 6 hours and ends at the forecast start time.
5. The platform of claim 1, wherein the set of cluster statistics and cluster error calculations include at least one of a root mean square error, a mean bias error, a standard deviation, a mean, a maximum, and a minimum.
6. The platform of claim 1,
- (a) wherein the output module is in data communication through the network with a utility company server receiving generated wind power from the local area; and
- (b) wherein the output module is configured to deliver the SPWS forecast to the utility company server through the network.
7. The platform of claim 1, wherein the forecast time window of the prior forecast request of the at least one sample forecast record overlaps at least partially with at least one of:
- (a) a previous calendar day from the forecast time window of the forecast request; and
- (b) a previous time of calendar day as the forecast time window of the forecast request.

8. A computer-implemented forecasting method for generating a series of short period wind speed (SPWS) forecasts for a local area, the method comprising the steps of:
- (a) maintaining a scheduling module,
    - 5 (i) wherein the scheduling module is configured to trigger the generation of the series of SPWS forecasts according to a forecast schedule with a plurality of forecast requests, each SPWS forecast associated with one of the forecast requests; and
    - (ii) wherein each forecast request includes a forecast identifier, a forecast time  
10 window, a forecast member selection list, a forecast area identifier, and a pre-forecast observation time window;
  - (b) maintaining a collection module,
    - (i) wherein the collection module is in data communication through a network  
15 with:
      - (1) at least one ensemble member server including a plurality of ensemble members configured for generation of member outputs; and
      - (2) a wind speed (WS) observation system for the local area configured to collect a series of observed WS records for the local area, each WS  
20 record including an observation area identifier, an observation time window, and WS observation information;
    - (ii) wherein, for each forecast request, the collection module is configured to store or link to a set of selected member outputs of the forecast request, each selected member output associated with:
      - (1) the forecast time window of the forecast request;
      - 25 (2) one of the ensemble members identified in the forecast member selection list of the forecast request; and
      - (3) the forecast area identifier of the forecast request;

- (iii) wherein computations generating each selected member output from the ensemble member associated with the selected member output:
  - (1) generate WS forecast information for the selected member output;  
and
  - 5 (2) are performed by at least one of the at least one ensemble member server, the platform, and a third party remote computing service; and
- (iv) wherein, for each forecast request, the collection module is configured to store or link to a set of pre-forecast observed WS records,
  - 10 (1) the forecast area identifier of the forecast request and the observation area identifier of the set of pre-forecast observed WS records both identifying a first identical or overlapping geographic area; and
  - (2) the observation time window of each pre-forecast observed WS record overlapping at least partially with the pre-forecast observation time window of the forecast request;
- 15 (c) maintaining a pre-processing module configured to:
  - (i) for each forecast request, identify and extract:
    - (1) the WS forecast information from each of the selected member outputs of the forecast request; and
    - (2) the WS observation information of the set of pre-forecast observed  
20 WS records for the forecast request; and
  - (ii) for each forecast request, employ k-means clustering to cluster the WS forecast information from each of the selected member outputs of the forecast request into a plurality of WS clusters of the forecast request;
- (d) maintaining a forecast history database,
  - 25 (i) wherein the forecast history database is configured to store a plurality of forecast records memorializing each of the SPWS forecasts outputted from a plurality of prior forecast requests; and
  - (ii) wherein the forecast record associated with each prior forecast request stores or links to:
    - 30 (1) the forecast identifier of the prior forecast request;
    - (2) the forecast area identifier of the prior forecast request;
    - (3) the forecast member selection list of the prior forecast request;

- (4) the set of selected member outputs for the prior forecast request;
  - (5) the WS forecast information from each of the selected member outputs of the prior forecast request;
  - (6) the WS observation information of the set of pre-forecast observed  
5 WS records of the prior forecast request; and
  - (7) the WS clusters for the prior forecast request;
- (e) for each forecast request, selecting and accessing at least one sample forecast record from the plurality of forecast records of the prior forecast requests stored in the forecast history database, wherein the forecast area identifier of at least one  
10 sample forecast record and the forecast area identifier of the forecast request both identify a second identical or overlapping geographic area;
- (f) for each forecast request, creating cluster comparison information for the forecast request from analysis of:
  - (i) the WS clusters clustered for the forecast request by the pre-processing  
15 module;
  - (ii) the WS observation information extracted for the forecast request by the pre-processing module from the set of pre-forecast observed WS records; and
  - (iii) the WS clusters of one or more of the prior forecast requests, as  
20 memorialized in the forecast history database for each forecast record associated with the at least one sample forecast records of the prior forecast requests; and
- (g) for each of the WS clusters generated by the pre-processing module for the forecast request, applying cluster feature engineering to generate a set of cluster  
25 statistics and cluster error calculations from the cluster comparison information of the forecast request;
- (h) maintaining a forecasting module comprising a stacking module including a set of first machine learning (ML) models and a second ML model,
  - (i) wherein, for each forecast request, each first ML model is configured to:  
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    - (1) receive as inputs one of the WS clusters of the forecast request; and
    - (2) generate one of a plurality of first ML model outputs from the WS cluster received by the first ML model for the forecast request; and

- (ii) wherein, for each forecast request, the second ML model is configured to:
    - (1) receive the first ML model output for the forecast request from each of the first ML models; and
    - (2) generate the SPWS forecast for the forecast request based on a weighted average of the first ML model outputs of the forecast request, wherein the weighted average is calculated from the set of cluster statistics and cluster error calculations for each WS cluster of the forecast request;
  - (i) for each forecast request, outputting the SPWS forecast of the forecast request to a user interface; and
  - (j) for each forecast request, augmenting the forecast history database with a new forecast record detailing the SPWS forecast generated for the forecast request.
- 9. The method of claim 8, wherein, for each forecast request, the plurality of WS clusters include:
  - (a) a low WS cluster;
  - (b) a medium WS cluster;
  - (c) a high WS cluster; and
  - (d) an average WS cluster.
- 10. The method of claim 8,
  - (a) wherein each of the ensemble members are exchangeable; and
  - (b) wherein the plurality of ensemble members include at least one of:
    - (i) a plurality of ECMWF EPS ensemble members; and
    - (ii) a plurality of down-scaled NWP ensemble members.
- 11. The method of claim 8,
  - (a) wherein the forecast duration of the forecast time window is in the range of 1 to 6 hours and ends at the forecast start time; and
  - (b) wherein the pre-forecast observation time window of the forecast request has a pre-forecast observation duration that is in the range of 1 to 6 hours and ends at the forecast start time.

12. The method of claim 8, wherein the set of cluster statistics and cluster error calculations include at least one of a root mean square error, a mean bias error, a standard deviation, a mean, a maximum, and a minimum.

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13. The method of claim 8, the method further comprising the steps of:

- (a) establishing a data communication link through the network with a utility company server receiving generated wind power from the local area; and
- (b) delivering the SPWS forecast to the utility company server through the network.

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14. The method of claim 8, wherein the forecast time window of the prior forecast request of the at least one sample forecast record overlaps at least partially with at least one of:

- (a) a previous calendar day from the forecast time window of the forecast request;

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and

- (b) a previous time of calendar day as the forecast time window of the forecast request.

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