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**1. Baseline Data:**

**Location WRF:**

G:/WRF/20001234\_00WRF.txt

F:/CV62015Cast/CEELab20/WRFnew/20001234\_00WRF.txt

Are the two styles of reference to the same database both folders are referenced depending on when the codes were written

**Location MADIS:**

MADIS data came in the form of by hourly station information with additional information such as elevation. The data was broken into hourly wind data, using the code below. Scraped MADIS data comes in the form of 20001234\_00mad.txt. This is converted to a set of txt’s in a better format for further analysis:

* Azula/home/alex/Documents/RF/KFRF/MADpullWRF.m

wfnFFST/20001234\_00ffMA.txt: all hourly MADIS Wind speeds

wfnFFST/20001234\_00 staMA.txt: station names corresponding to wind data above

wfnFFST/20001234\_00 timeMA.txt: blank txt (not used)

wfnFFST/20001234\_00 latMA.txt: Latitude corresponding to wind data above

wfnFFST/20001234\_00 lonMA.txt: Longitude corresponding to wind data above

Files were copied/recreated under the Folder “Madis/” as well

**Location METAR:**

METAR data came in the form of by storm txt’s 20001234.csv. Looping based on the UTC time information transformed METAR Data into hourly individual txt’s using the codes below

* Azula/home/alex/Documents/RF/KFRF/METpullV2.m
* F:/CV62015Cast/CEELab20/Metar/pull.m

wfMFFST/200001234\_00FF.txt: all hourly METAR Wind speeds

wfMFFST/200001234\_00ST.txt: station names corresponding to wind speed data above

Files were copied/recreated under the folder Metar as well

**2. LOOCV UK Wind**

**Note about procedure**: Codes are designed to be run through the whole procedure on one computer (per storm) in order to allow for transition back to one machine by copying all cross validation outputs for large scale analysis. Storm to undergo cross validation listed as a number 1-107 in the first sectioned area after the clear and clc commands as the variable “RN” and “STstring

**2.1 METAR PROCEDURE**

a) Hourly wind data is transformed into a storm matrix in order to evaluate for missing data based on the output data from the (1. Baseline Data). Metar/200001234\_00ST.txt and Metar/200001234\_00FF.txt. Additionally a list of non-oceanic stations and domain location is provided with MetCRno.csv

* F:/CV62015Cast/CEELab20/WindTSMet2.m

The output of this code is a txt with the matrix organized to include all the hours (rows) and stations (columns) of one storm in WindMetOut/F24.txt

b) WindMetOut/F24.txt information was analyzed by storm. Stations without 5 hour gaps were grouped by filename with the prefix H as well as their Grid Column and Grid Row (WRF grid). Column row and station information comes from MetCRno.csv (needed to redesign to use next storm rather than a 5 fill at beginning and end.

* F:/CV62015Cast/CEELab20/zWindMet2.m

Stations with the appropriate amount of data are grouped together to conserve the order station relationship for CV

WindMetOut#/20001234\_00HCn0.txt: complete availability stations, grid column information

WindMetOut#/20001234\_00HRn0.txt: complete availability grid row information

WindMetOut#/20001234\_00HSTn0.txt: complete availability station information

WindMetOut#/20001234\_00HFFn0.txt: complete availability wind speed information

Stations without enough data for CV but are still used in the Kriging

WindMetOut#/20001234\_00TCn0.txt: Remaining station grid column information

WindMetOut#/20001234\_00TRn0.txt: Remaining station grid row information

WindMetOut#/20001234\_00TSTn0.txt: Remaining station name information

WindMetOut#/20001234\_00TFFn0.txt: Remaining station wind speed information

**2.2 MADIS PROCEDURE**

a) Hourly wind data is transformed into a storm matrix in order to evaluate for missing data based on the output data from the (1. Baseline Data). MadisCRno.csv, Madis/200001234\_00ST.txt, Madis/200001234\_00FF.txt

* F:/CV62015Cast/CEELab20/WindTSMad2.m

The output of this code is a txt with the matrix organized to include all the hours (rows) and stations (columns), WindMadOut/20001234F24.txt

b) WindMadOut/F24.txt information was analyzed by storm. Stations without 5 hour gaps were grouped by filename with the prefix H as well as their Grid Column and Grid Row (WRF grid). Column row and station information comes from the station information of non-oceanic data (MadisCRno.csv) (needed to redesign to use next storm rather than a 5 fill at beginning and end.

* F:/CV62015Cast/CEELab20/zWindMad2.m

Stations with the appropriate amount of data are grouped together to conserve the order station relationship

WindMadOut#/20001234\_00HRn0.txt: complete availability grid row information

WindMadOut#/20001234\_00HSTn0.txt: complete availability station information

WindMadOut#/20001234\_00HFFn0.txt: complete availability wind speed information

Stations without enough data for CV but are still used in the Kriging

WindMadOut#/20001234\_00TCn0.txt: Remaining station grid column information

WindMadOut#/20001234\_00TRn0.txt: Remaining station grid row information

WindMadOut#/20001234\_00TSTn0.txt: Remaining station name information

WindMadOut#/20001234\_00TFFn0.txt: Remaining station wind speed information

**2.3 Combination, Kriging and Analysis**

**Figure 5: Scatter Plots of (a)WRF forecast (b)LOOCV UK Wind**

a) Outputs from the METAR procedure and MADIS procedure: WindMadout/ and WindMetout/ are analyzed for proximity. This allows for the removal of duplicates and stations that are too close for the Kriging to differentiate. Furthermore the results provide a method of combining databases, giving one acceptable set of inputs to the model

* F:/CV62015Cast/CEELab20/WindTCSTm2.m

Stations with the appropriate amount of data are grouped together to conserve the order station relationship for CV

WindCombOut#/HtrC20001234 \_00.txt: complete availability stations, combined grid column information

WindCombOut#/HtrR20001234 \_00.txt: complete availability stations, combined grid row information

WindCombOut#/HtrFF20001234 \_00.txt complete availability stations, combined wind speed information

WindCombOut#/HtrST20001234 \_00.txt: complete availability stations, combined station name information

Stations with incomplete histories are compared to each other and then back to the complete histories to provide hourly data to be concatenated:

WindCombOut#/TTtrC20001234 \_00.txt: Remaining stations, combined grid column

WindCombOut#/TTtrR20001234 \_00.txt: Remaining stations, combined grid row

WindCombOut#/TTtrFFF20001234 \_00.txt: Remaining stations, combined wind speed

WindCombOut#/TTtrST20001234 \_00.txt: Remaining stations, combined station name information

Information of which stations are combined (complete history) is listed in:

WindBStat#/HElim20001234 \_00.csv: Stations with combined station as second column

This becomes important when running the final analysis statistics

b) LOOCV input files are created by removing every station, once each hour of the WindCombOut#/Htr files. Any additional station information (WindCombOut#/TTtr files) were concatenated to the end of the hourly information to preserve the order of the removed stations

* F:/CV62015Cast/CEELab20/ByStatCV.m (part 1)

Final Kriging inputs for the cross validation are

ZfKrig#/20001234\_00(field#)trC.txt: LOO input data Column with missing station/hour as field #

ZfKrig#/20001234\_00(field#)trR.txt: LOO input data Row with missing station/hour as field #

ZfKrig#/20001234\_00(field#)trFF.txt: LOO input data Wind with missing station/hour as field #

c) This data is used to produce the Kriging fields for all possible hour station combinations. The code below creates fields for every missing station/hour combination

* F:/CV62015Cast/CEELab20/BiasKrig.m

Information about the output fields are stored in the folder ZfKrig, the files are as follows:

ZfKrig#/(field#)yx.txt, Full 88110 gridded output (extra values are because the domain must encompass a larger square representation of the field

ZfKrig#/(field#)mse.txt Accompanying prediction error field

ZfKrig#/(field#)CR.txt Input file locations (just for bookkeeping)

ZfKrig#/(field#)ff.txt Input file wind (just for bookkeeping)

d) Second part of the code matches the LOO interpolation (ZfKrig#/(field#)ff.txt) to the original data by hour and station from the proximity analysis WindTCSTm2.m:

WindCombOut/HtrC20001234 \_00.txt:

WindCombOut/HtrR20001234 \_00.txt

WindCombOut/HtrFF20001234 \_00.txt

And WRF data (WRFnew/20001234\_00WRF.txt)

* F:/CV62015Cast/CEELab20/ByStatCV.m (part 2)

WindBStat#/RMSEK123.csv: UK RMSE of station (K123) and Storm (#)

WindBStat#/RMSEWRFK123.csv: WRF RMSE of station (K123) and Storm (#)

WindBStat#/FFK123.csv: Average Observed Wind of station (K123) and Storm (#)

WindBStat#/FFUKK123.csv: Average UK Wind of station (K123) and Storm (#)

WindBStat#/FFWRFK123.csv: Average WRF Wind of station (K123) and Storm (#)

e) Final plotting code reads all the txt outputs and compiles

* C:/Users/alex/Desktop/Storm3Test/RMSEukValNT.m

Array compilation and workspace save for fast graphing

NewUKwrfPlot.mat

**3. LOOCV BK from baseline**

**Note about procedure**: Codes are designed to be run through the whole procedure on one computer (per storm) in order to allow for transition back to one machine by copying all cross validation outputs for large scale analysis. Storm to undergo cross validation listed as a number 1-107 in the first sectioned area after the clear and clc commands as the variable “RN” and “STstring

**3.1 METAR PROCEDURE**

a) Hourly wind data is transformed into a storm matrix in order to evaluate for missing data based on the output data from the (1. Baseline Data). Metar/200001234\_00ST.txt and Metar/200001234\_00FF.txt. Additionally a list of non-oceanic stations and domain location is provided with MetCRno.csv

Additional WRF data is required to calculate the bias (WRFnew/20001234\_00WRF.txt)

* F:/CV62015Cast/ CEELab20/BiasTSMet2.m

The output of this code is a txt with the matrix organized to include all the hours (rows) and stations (columns) of one storm BiasMetOut/20001234F24.txt

Additionally a matrix of the same format containing corresponding WRF ouputs is created BiasMetOut/20001234WRF24.txt

b) txt information above was analyzed by storm. Stations without 5 hour gaps were grouped by filename with the prefix H as well as their Grid Column and Grid Row (WRF grid). Column row and station information comes from MetCRno.csv (needed to redesign to use next storm rather than a 5 fill at beginning and end.

* F:/CV62015Cast/ CEELab20/zBiasMet2.m

Stations with the appropriate amount of data are grouped together to conserve the order station relationship for CV

BiasMetOut#/20001234\_00HCn0.txt: complete availability stations, grid column information

BiasMetOut#/20001234\_00HRn0.txt: complete availability grid row information

BiasMetOut#/20001234\_00HSTn0.txt: complete availability station information

BiasMetOut#/20001234\_00HFFn0.txt: complete availability bias information

Stations without enough data for CV but are still used in the Kriging

BiasMetOut#/20001234\_00TCn0.txt: Remaining station grid column information

BiasMetOut#/20001234\_00TRn0.txt: Remaining station grid row information

BiasMetOut#/20001234\_00TSTn0.txt: Remaining station name information

BiasMetOut#/20001234\_00TFFn0.txt: Remaining station bias information

**3.2 MADIS PROCEDURE**

a) Hourly wind data is transformed into a storm matrix in order to evaluate for missing data based on the output data from the (1. Baseline Data). MadisCRno.csv, Madis/200001234\_00ST.txt, Madis/200001234\_00FF.txt

Additional WRF data is required to calculate the bias (WRFnew/20001234\_00WRF.txt)

* F:/CV62015Cast/ CEELab20/BiasTSMad2.m

The output of this code is a txt with the matrix organized to include all the hours (rows) and stations (columns) of one storm (#) BiasMadOut#/20001234F24.txt

Additionally a matrix of the same format containing corresponding WRF ouputs is created BiasMadOut#/20001234WRF24.txt

b) txt information above was analyzed by storm. Stations without 5 hour gaps were grouped by filename with the prefix H as well as their Grid Column and Grid Row (WRF grid). Column row and station information comes from MadisCRno.csv (needed to redesign to use next storm rather than a 5 fill at beginning and end.

* F:/CV62015Cast/ CEELab20/zBiasTSMad2.m

Stations with the appropriate amount of data are grouped together to conserve the order station relationship for CV

BiasMetOut#/20001234\_00HCn0.txt: complete availability stations, grid column information

BiasMetOut#/20001234\_00HRn0.txt: complete availability grid row information

BiasMetOut#/20001234\_00HSTn0.txt: complete availability station information

BiasMetOut#/20001234\_00HFFn0.txt: complete availability bias information

Stations without enough data for CV but are still used in the Kriging

BiasMetOut#/20001234\_00TCn0.txt: Remaining station grid column information

BiasMetOut#/20001234\_00TRn0.txt: Remaining station grid row information

BiasMetOut#/20001234\_00TSTn0.txt: Remaining station name information

BiasMetOut#/20001234\_00TFFn0.txt: Remaining station bias information

**3.3 Combination, Kriging and Analysis PROCEDURE**

**Figure 5: Scatter Plots of (d)LOOCV BK**

a) Outputs from the Metar Procedure and Madis Procedure: BiasMadOut#/ and BiasMetOut#/ are analyzed for proximity. This allows for the removal of duplicates and stations that are too close for the Kriging to differentiate. Furthermore the results provide a method of combining databases, giving one acceptable set of inputs to the model

* F:/CV62015Cast/CEELab20/BiasTCSTm2.m

Stations with the appropriate amount of data are grouped together to conserve the order station relationship for CV

BiasCombOut/HtrC20001234 \_00.txt: complete availability stations, combined grid column information

BiasCombOut/HtrR20001234 \_00.txt: complete availability stations, combined grid row information

BiasCombOut/HtrFF20001234 \_00.txt: complete availability stations, combined wind speed information

BiasCombOut/HtrST20001234 \_00.txt: complete availability stations, combined station name information

Stations with incomplete histories are compared to each other and then back to the complete histories to provide hourly data to be concatenated:

BiasCombOut#/TTtrC20001234 \_00.txt: Remaining stations, combined grid column

BiasCombOut#/TTtrR20001234 \_00.txt: Remaining stations, combined grid row

BiasCombOut#/TTtrFFF20001234 \_00.txt: Remaining stations, combined bias

BiasCombOut#/TTtrST20001234 \_00.txt: Remaining stations, combined station name information

Information of which stations are combined (complete history) is listed in:

BiasBStat#/HElim20001234 \_00.csv: Stations with combined station as second column

This becomes important when running the final analysis statistics

b) LOOCV input files are created by removing every station, once each hour of the BiasCombOut#/Htr files. Any additional station information (BiasCombOut#/TTtr files) were concatenated to the end of the hourly information to preserve the order of the removed stations

* F:/CV62015Cast/CEELab20/BiasByStatCV.m (part 1)

Final Kriging inputs before the cross validation are

BiasZfKrig#/20001234\_00(field#)trC.txt: LOO input Columns, station/hour as field #

BiasZfKrig#/20001234\_00(field#)trR.txt: LOO input Rows, station/hour as field #

BiasZfKrig#/20001234\_00(field#)trFF.txt: LOO input Bias, station/hour as field #

c) This data is used to produce the Kriging fields for all possible hour station combinations. The code below creates fields for every missing station/hour combination

* F:/CV62015Cast/CEELab20/BiasKrig.m

Information about the output fields are stored in the folder BiasZfKrig, the files are as follows:

BiasZfKrig#/(field#)yx.txt: Full 88110 gridded output (extra values are because the domain must encompass a larger square representation of the field

BiasZfKrig#/(field#)mse.txt: corresponding interpolation error

BiasZfKrig#/(field#)CR.txt: Input location information (for book keeping)

BiasZfKrig#/(field#)ff.txt: Input Bias information (for book keeping)

d) Second part of the code matches the LOO interpolation (ZfKrig#/(field#)ff.txt) to the original data by hour and station from the proximity analysis outputs in the folder BiasCombOut/ (BiasTCSTm2.m)

And WRF data (WRFnew/20001234\_00WRF.txt)

* F:/CV62015Cast/CEELab20/BiasByStatCV.m (part 2)

BiasBStat#/ BiasRMSEK123.csv: BK RMSE of station (K123) and Storm (#)

BiasBStat#/ BiasK123.csv: Average Observed Wind of station (K123) and Storm (#)

BiasBStat#/ BiasUKK123.csv: Average UK Wind of station (K123) and Storm (#)

e) Final plotting code reads all the txt outputs and compiles

* C:/Users/alex/Desktop/Storm3Test/RMSEBiasPWRF2.m

PlotBPWRF.mat

**4. IS UK from baseline Figure 5: Scatter Plots of (c)In Sample Wind**

a) Input files come from WindCombOut#/ (3. LOOCV BK- WindTCSTm2). Kriging is performed with these files with no other preprocessing other than concatenation

* F:/CV62015Cast/ISKrigW.m

The corresponding output fields are:

ZfKrig#/(field#)loiyx.txt: Full 88110 gridded output (extra values are because the domain must encompass a larger square representation of the field

ZfKrig#/(field#)loimse.txt: Accompanying prediction error field

ZfKrig#/(field#)loiCR.txt: Input file locations (just for bookkeeping)

ZfKrig#/(field#)loiff.txt: Input file wind (just for bookkeeping)

b) The same field to observation comparisons are made using the station information produced by WindCombOut#/ and WindBStat#/ (3. LOOCV BK- WindTCSTm2)

As well as the In Sample Field information

ZfKrig#/(field#)loiyx.txt

ZfKrig#/(field#)loiCR.txt

* F:/CV62015Cast/BSCVARfixloi.m

WindBStat#/loiRMSEK123.csv: IS UK RMSE of station (K123) and Storm (#)

WindBStat#/loiFFK123.csv: Average Observed Wind of station (K123) and Storm (#)

WindBStat#/loiUKK123.csv: Average IS UK Wind of station (K123) and Storm (#)

WindBStat#/loiWRFK123.csv: Average WRF Wind of station (K123) and Storm (#)

c) Txt reassembly and boxplot

* F:/CV62015Cast/LOIRMSE.m

**5. M1 Kriging -> KF**

**5.1 METAR Procedure**

a) Hourly wind data is transformed into a storm matrix in order to evaluate for missing data based on the output data from the (1. Baseline Data). Metar/200001234\_00ST.txt and Metar/200001234\_00FF.txt. Additionally a list of non-oceanic stations and domain location is provided with MetCRno.csv. Differs from other versions because looped to cover all storms in one run

* Azula/home/alex/Documents/RF/KFRF/TSMet4369.m

The output of this code is a txt (per storm) with the matrix organized to include all the hours (rows) and stations (columns), wfMffST/20001234F24.txt

b) txt information was analyzed by storm. Stations without 5 hour gaps were filled with no other organization required (Kalman reads Kriged inputs). Grid Column and Grid Row (WRF grid) and station information comes from MetCRno.csv (needed to redesign to use next storm rather than a 5 fill at beginning and end.

* Azula/home/alex/Documents/RF/KFRF/zremKalMet.m

WfMCR/20001234\_00HCn0.txt: complete availability stations, grid column information

WfMCR /20001234\_00HRn0.txt: complete availability grid row information

wfMffST/20001234\_00HSTn0.txt: complete availability station information

wfMffST/20001234\_00HFFn0.txt: complete availability wind speed information

**5.2 MADIS Procedure**

a) Hourly wind data is transformed into a storm matrix in order to evaluate for missing data based on the output data from the (1. Baseline Data). MadisCRno.csv, Madis/200001234\_00ST.txt, Madis/200001234\_00FF.txt. Additionally a list of non-oceanic stations and domain location is provided with MadisCRno.csv. Differs from other versions because looped to cover all storms in one run

* Azula/home/alex/Documents/RF/KFRF/TSMad369.m

The output of this code is a txt (per storm) with the matrix organized to include all the hours (rows) and stations (columns), wfnFFST/20001234F24.txt

b) txt information was analyzed by storm. Stations without 5 hour gaps were filled with no other organization required (Kalman reads Kriged inputs). Grid Column and Grid Row (WRF grid) and station information comes from MadisCRno.csv (needed to redesign to use next storm rather than a 5 fill at beginning and end.

* Azula/home/alex/Documents/RF/KFRF/zremKalMad.m

WfNCR/20001234\_00HCn0.txt: complete availability stations, grid column information

WfNCR /20001234\_00HRn0.txt: complete availability grid row information

wfnFFST/20001234\_00HSTn0.txt: complete availability station information

wfnFFST/20001234\_00HFFn0.txt: complete availability wind speed information

**5.3 Combining Data Krining and Kalman Filtering Procedure**

a) Outputs from the Metar Procedure (wfMffST/ and WfMCR/) and Madis Procedure (WfNCR/ and wfnFFST/) are analyzed for proximity. This allows for the removal of duplicates and stations that are too close for the Kriging to differentiate. Furthermore the results provide a method of combining databases, giving one acceptable set of inputs to the model

* Azula/home/alex/Documents/RF/KFRF/toocloseWRF.m (wrong folder?)

wNMtr /20001234\_00trC.txt: Kriging input Column Location

wNMtr /20001234\_00trR: Kriging input Row Location

wNMtr /20001234\_00trFF: Kriging input Wind Location

b) Kriging is performed hourly

* Azula/home/alex/Documents/RF/KFRF/tcsHorizWRF.m

Output fields are stored in the workspace:

wfNMIn/20001234\_00Krig.mat

c) hours are referenced using a sequential list of times (FC24JS.txt) to read the hourly workspaces above, and WRF files (WRFnew/20001234\_00WRF.txt)

* Azula/home/alex/Documents/RF/KFRF/TITLEWRF.m

Outputs the Kalman Filter input files.

KalWRF/RFO2/Obs#.txt: Full history of one grid cell (#) Kriged Observed Wind

KalWRF/RFO2/modeltom\_filt#.txt: Initialized filtered outputs to be overwritten by the filter

KalWRF/RFO2/ ModYes#.txt: Full history of one grid cell WRF corresponding to Observed

KalWRF/RFO2/ ModTom#.txt: Full history of one grid cell WRF 24 hours ahead

KalWRF/RFO2/ yV#.txt: Initialization

KalWRF/RFO2/ x\_matrix#.txt: Initialization

KalWRF/RFO2/ P\_matrix#.txt: Initialization

KalWRF/RFO2/ P#.txt: Initialization

KalWRF/RFO2/ x#.txt: Initialization

d) When creating maps of the wind speeds all 1:88110 sets need to be accounted for. After maps were made a more precise version was run over locations that are to be evaluated (provided by GClist.txt)

* Azula/home/alex/Documents/RF/KFRF/KalWRF/RFO2/KalmanP10.f90

Filter outputs are overwritten versions of the initialization files including

KalWRF/RFO2/modeltom\_filt#.txt

**6. Method 2 KF**

**6.1 METAR PROCEDURE**

a) Hourly wind data is transformed into a storm matrix in order to evaluate for missing data based on the output data from the (1. Baseline Data). Metar/200001234\_00ST.txt and Metar/200001234\_00FF.txt. Additionally a list of non-oceanic stations and domain location is provided with MetCRno.csv. Differs from other versions because looped to cover all storms in one run

* **Azula/Documents/RF/KFRF/zWindMet2.m (Edit out 72 stuff)**

The output of this code is one txt with the matrix organized to include all the hours (rows) and stations (columns) of the entire history, Meth3Met/KalinMet.txt

b) Because individual storm histories overlap other storms, edits needed to be made to the txt above in order to get a 1:1 relationship with the history txt (FC24JS.txt). Hours going sequentially through each storm history (TotalTime.txt) were compared. The first set of the repeated data was deleted (in order to match the Method 1 data)

* **Laptop/ Desktop/Storm3Test/MatMAnip.m**

Meth3Met/KalinMetFin.txt

c) One of the largest challenges of this procedure is creating unique histories for each station (and eventually referencing all data related to a storm). The code below produces an ID field for the temporal history associated with each value using station information from MetCRno.csv, wind speeds from Meth3Met/KalinMetFin.txt, history time strings from FC24JS.txt, and WRF data from(G:/WRF/20001234\_00WRF.txt)

* **Laptop/ Desktop/Storm3Test/Meth3Met/Method34n.m**

**Note:** # Indicates the column number within MetCRno.csv

M03d2Met/Obs#.txt: Full history of one station (#) Kriged Observed Wind

M03d2MetLocOut#.txt: ID of row number within temporal history

M03d2Met/ModYes#.txt: Full history of station (#) WRF corresponding to Observed

M03d2Met/ModTom#.txt: Full history of station (#) WRF 24 hours ahead

d) These are valuable inputs to the Kalman Filter, however, additional initializations are required, the following code produces the rest of the inputs to the M2KF Using: M03d2Met/GClistMet32.txt

* **Azula/Documents/Meth34nBase/TitleM3Met.m**

M03d2Met/yV#.txt: Initialization

M03d2Met/x\_matrix#.txt: Initialization

M03d2Met/P\_matrix#.txt: Initialization

M03d2Met/X#.txt: Initialization

M03d2Met/P#.txt: Initialization

M03d2Met/modeltom\_filt#.txt: Initialized filtered outputs to be overwritten by the filter

d) Kalman filter reads outputs of the two codes looped by independent locations provided by GClistMet32.txt

* **Azula/Documents/Meth34nBase/M03d2Met/KalmanCV.f90**

Filter outputs are overwritten versions of the initialization files including M03d2Met/modeltom\_filt#.txt

**6.2 MADIS PROCEDURE**

a) Hourly wind data is transformed into a storm matrix in order to evaluate for missing data based on the output data from the (1. Baseline Data). wfMFFST/200001234\_00ST and wfMFFST/200001234\_00FF. Additionally a list of non-oceanic stations and domain location is provided with MadisCRno.csv. Differs from other versions because looped to cover all storms in one run

* **Azula/Documents/RF/KFRF/zWindMad2.m**

The output of this code is a txt with the matrix organized to include all the hours (rows) and stations (columns), Meth3/Kalin.txt

b) Because individual storm histories overlap other storms, edits needed to be made to the txt above in order to get a 1:1 relationship with the history txt (FC24JS.txt). Hours going sequentially through each storm history (TotalTime.txt) were compared. The first set of the repeated data was deleted (in order to match the Method 1 data)

* **Laptop/ Desktop/Storm3Test/MatMAnip.m**

Meth3Met /KalinFin.txt

c) One of the largest challenges of this procedure is creating unique histories for each station (and eventually referencing all data related to a storm). The code below produces an ID field for the temporal history associated with each value using station information from MadisCRno.csv, wind speeds from Meth3Met /KalinFin.txt, history time strings from FC24JS.txt, and WRF data from (G:/WRF/20001234\_00WRF.txt)

* **Laptop/ Desktop/Storm3Test/Meth3/Method34n.m (Came from just storm3test)**

**Note:** # Indicates the column number within MadisCRno.csv

M03d2/Obs#.txt: Full history of one station (#) Kriged Observed Wind

M03d2/LocOut#.txt: ID of row number within temporal history

M03d2/ModYes#.txt: Full history of station (#) WRF corresponding to Observed

M03d2/ModTom#.txt: Full history of station (#) WRF 24 hours ahead

d) These are valuable inputs to the Kalman Filter, however, additional initializations are required, the following code produces the rest of the inputs to the M2KF Using: M03d2/GClistMet32.txt

* **Azula/Documents/Meth34nBase/TitleM3v2.m**

M03d2/yV#.txt: Initialization

M03d2/x\_matrix#.txt: Initialization

M03d2/P\_matrix#.txt: Initialization

M03d2/X#.txt: Initialization

M03d2/P#.txt: Initialization

M03d2/modeltom\_filt#.txt: Initialization

d) Kalman filter reads outputs of the two codes looped by independent locations provided by GClistMet32.txt

* **Azula/Documents/Meth34nBase/M03d2/KalmanCV.f90 (KalmanCV independent by folder…)**

Filter outputs are overwritten versions of the initialization files including

M03d2/modeltom\_filt#.txt

**7. LOOCV RK from Baseline (Figure 8)**

**7.1 Metar Procedure**

a) Outputs from 6. Method 2 KF- Meth3Met/Method34n.m (M03d2Met/: LocOut#.txt, ModTom#.txt, and modeltom\_filt#.txt) are organized into a matrix based on of ID#’s (GClistMet32.txt) of MetCRno.csv stations.

* F:/Meth34Diff/KrInMetHTDiff.m (Part1)

The output Matrix (KalMetDiff.txt) using FC24JS.txt as time and MetCRno.csv as stations denotes missing values 10^6

b) There is a vestigial aspect from previous procedures where outputs are analyzed for threshold minimum and maximum values

* C:/Users/alex/Desktop/Storm3Test/KalOutDiff.R \*

The code above does not change values. It does move the file locations to OutTrimDiff and changes the names of the locations and values to OutTrimDiff/RemMaxMet.csv and OutTrimDiff/RemEdMet.csv

c) The files (OutTrimDiff/RemMaxMet.csv, OutTrimDiff/RemEdMet.csv) are then read hourly (FC24JS.txt)

* F:/Meth34Diff/KrInMetHTDiff.m (Part2)

KrInMetDiff/HMetC20001234\_00.txt: Kalman Filter output grid column information

HMetR20001234\_00.txt: Kalman Filter output grid row information

HMetffC20001234\_00.txt: Kalman Filter outputs

HMetSTC20001234\_00.txt: Kalman Filter output grid station name information

**7.2 MADIS Procedure**

a) Outputs from 6. Method 2 KF- Meth3/Method34n.m (M03d2/ LocOut#.txt, ModTom#.txt, and modeltom\_filt#.txt) are organized into a matrix based on of ID#’s (GClist32.txt) of MadisCRno.csv stations

* F:/Meth34Diff/KrInMadHTDiff.m(Part1)

The output matrix (KalMadisDiff.txt) uses FC24JS.txt as time and MadisCRno.csv as stations to organize Kalman outputs and create a matrix with missing values denoted 10^6

b) There is a vestigial aspect from previous procedures where outputs are analyzed for threshold minimum and maximum values

* C:/Users/alex/Desktop/Storm3Test/KalOutDiff.R \*

The code above does not change values. It does move the file locations to OutTrimDiff and changes the names of the locations and values to OutTrimDiff/RemMaxMad.csv and OutTrimDiff/RemEdMad.csv

c) The files (OutTrimDiff/ RemMaxMad.csv, OutTrimDiff/ RemEdMad.csv) are then read hourly (FC24JS.txt)

* F:/Meth34Diff/KrInMadHTDiff.m (Part2)

KrInMadDiff/HMadC20001234\_00.txt: Kalman Filter output grid column information

KrInMadDiff/HMadR20001234\_00.txt: Kalman Filter output grid row information

KrInMadDiff/HMadffC20001234\_00.txt: Kalman Filter outputs

KrInMadDiff/HMadSTC20001234\_00.txt: Kalman Filter output grid station name information

**7.3 Formatting Sidenote to METAR & MADIS Procedure**

\*) The original procedure for extracting the Kalman Filter outputs was performed before the bounds were set, so an external code was designed to perform bounds of a user defined size. The current parameters are set to outside what the internal Kalman Filter bounds are so this process is unnecessary but outputs are used as inputs to Part 2 of Krin Files,

The Kalman expected residual matrices (KalMetDiff.txt and KalMadisDiff.txt) are analyzed by station (MadisCRno.csv and MetCRno.csv) and reassembled in R

* C:/Users/alex/Desktop/Storm3Test/KalOutDiff.R

The output files from the code are as follows and are all located in a folder labled OutTrimDiff: RemEdMad.csv, RemEdMet.csv, OutMadis.csv, OutMetar.csv, OutMaxMet.csv, OutMaxMad.csv, RemMaxMad.csv, RemMaxMet.csv

**7.4 METAR & MADIS Combination->Graph**

a) Kalman Filter outputs from the Metar Procedure (KrInMetHTDiff.m (Part2)) and Madis Procedure (KrInMadHTDiff.m (Part2)) are located in KrInMetDiff#/ and KrInMadDiff #/. Kalman filter outputs are analyzed for proximity. This allows for the removal of duplicates and stations that are too close for the Kriging to differentiate. Furthermore the results provide a method of combining databases, giving one acceptable set of inputs to the model

* F:/Meth34Diff/BiasTC13Diff.m

Stations with the appropriate amount of data are grouped together to conserve the order station relationship for CV (stations can have 24 hours of a full 48 hour storm history)

BiasCombOutDiff#/GCHtrC20001234\_00.txt: complete availability stations, combined grid column information

BiasCombOutDiff#/GCHtrR20001234\_00.txt: complete availability stations, combined grid row information

BiasCombOutDiff#/GCHtrFF20001234\_00.txt: complete availability stations, combined KF correction information

BiasCombOutDiff#/ GCHtrST20001234\_00.txt: complete availability stations, combined station name information

Stations with incomplete histories are compared to each other and then back to the complete histories to provide hourly data to be concatenated

BiasCombOutDiff#/TTtrC20001234\_00.txt: Remaining stations, combined grid column

BiasCombOutDiff#/TTtrR20001234\_00.txt: Remaining stations, combined grid row

BiasCombOutDiff#/TTtrFFF20001234\_00.txt: Remaining stations, combined KF corrections

BiasCombOutDiff#/TTtrST20001234\_00.txt: Remaining stations, combined station name information

Information of which stations are combined (complete history) is listed in:

BiasBStDiff#/GCHElim20001234\_00.csv, Stations with combined station as second column

b) **Note about procedure**: Codes are designed to be run through the whole procedure on one computer (per storm) in order to allow for transition back to one machine by copying all cross validation outputs for large scale analysis. Storm to undergo cross validation listed as a number 1-107 in the first sectioned area after the clear and clc commands as the variable “RN” and “STstring

LOOCV input files are created by removing every station, once each hour of the BiasCombOut#/GCHtr files. Any additional station information (BiasCombOut#/TTtr files) were concatenated to the end of the hourly information to preserve the order of the removed stations

* F:/Meth34nBase/BiasBSCVDiff.m (part 1)

BiasZfKrigDiff/trC(LOO#).txt: LOO input Columns, station/hour as field #

BiasZfKrigDiff/trR(LOO#).txt: LOO input Rows, station/hour as field #

BiasZfKrigDiff/trFF(LOO#).txt: LOO input Bias, station/hour as field #

c) Storm and number of fields (ile) manually inserted and

* F:/Meth34nBase/BiasKriDiffr.m

BiasZfKrigDiff#/(field#)yx.txt: Full 88110 gridded output (extra values are because the domain must encompass a larger square representation of the field

BiasZfKrigDiff#/(field#)mse.txt: corresponding interpolation error

BiasZfKrigDiff#/(field#)CR.txt: Input location information (for book keeping)

BiasZfKrigDiff#/(field#)ff.txt: Input Bias information (for book keeping)

d) Information about the fields (listed above) is compared to the original Kalman Filter outputs located in the BiasCombOutDiff# folder

* F:/Meth34Diff/ByStatCVGC.m

Outputs are arrays by hour with storm denoted by the folder BiasCombOutDiff#: and station information stored in KalFFK123.csv for Kalman Filter outputs and KPFFK123.csv for CV UK outputs

e) Points are reassembled to form the scatter…

* F:/Meth34Diff/GCKM3Scatter.m

**8. Geographic Maps**

**8.1 Figure 6: Geographic distribution of Bias from (a)WRF forecast (b)LOOCV UK Wind (d)LOOCV UK Bias**

**AND Figure 7: Geographic distribution of RMSE from (a)WRF forecast (b)LOOCV UK Wind (d)LOOCV UK Bias**

a) Output workspaces NewUKwrfPlot.mat (2. LOOCV UK Wind-RMSEukValNT.m) and PlotBPWRF.mat (3. LOOCV BK-RMSEBiasPWRF2.m ) are used in a very simple txt write

* C:/Users/alex/Desktop/Storm3Test/MesoMap.m

MesoMapRMSEWRF.txt: Matrix of each calculated WRF RMSE per station (row) storm (column)

MesoMapRMSEmatUK.txt: Matrix of each calculated CV UK RMSE per station (row) storm (column)

MesoMapObsK.txt: Matrix of each calculated BK RMSE per station (row) storm (column)

MesoMapFF.txt: Matrix of average wind speed per station (row) storm (column)

MesoMapFFUK.txt: Matrix of each calculated CV UK per station (row) storm (column)

MesoMapWRF.txt: Matrix of each calculated WRF per station (row) storm (column)

b) Performs averages over bias or RMSE

* C:/Users/alex/Desktop/Storm3Test/MesoMap.R

Simple averaging creates one value per location NA for stations without data:

mbObsKMeans.csv: Labeled BK by station Latitude, Longitude, Mean Bias (with NAs)

mbWRFMeans.csv: Labeled WRF by station Latitude, Longitude, Mean Bias (with NAs)

mbUKMeans.csv: Labeled UK by station Latitude, Longitude, Mean Bias (with NAs)

RMSEObsKMeans.csv: Labeled BK by station Latitude, Longitude, RMSE (with NAs)

RMSEWRFMeans.csv: Labeled WRF by station Latitude, Longitude, RMSE (with NAs)

RMSEUKMeans.csv: Labeled UK by station Latitude, Longitude, RMSE (with NAs)

c) Removes stations with no data for the 11 storms, yielding a final output that is ready to be mapped with LL pairs

* C:/Users/alex/Desktop/Storm3Test/MesoNaOmit.R

mbObsKMeansNAOM.csv: Labeled BK by station Latitude, Longitude, Mean Bias

mbWRFMeansNAOM.csv: Labeled WRF by station Latitude, Longitude, Mean Bias

mbUKMeansNAOM.csv: Labeled UK by station Latitude, Longitude, Mean Bias

ObsKMeansNAOM.csv: Labeled BK by station Latitude, Longitude, RMSE

WRFMeansNAOM.csv: Labeled WRF by station Latitude, Longitude, RMSE

UKMeansNAOM.csv: Labeled UK by station Latitude, Longitude, RMSE

**8.1 Figure 6: Geographic distribution of Bias from (c) IS Kriging**

**AND Figure 7: Geographic distribution of RMSE from (c)IS Kriging**

a) Output accuracy metrics from ([IS Kriging](#ISUK)) were written by (LOIRMSE.m), Outputs are Matrices with station and storm RMSE and bias information saved in matrix format to be used as inputs to R analysis I think this is a mistake technicaly for the RMSE)

MetMadMeso.txt: A base station, lat, lon, C, R file

MatRloiUK.txt: Corresponding station (row) storm (col) UK RMSE

MatRloiWRF.txt: Corresponding station (row) storm (col) WRF RMSE

MatBloiUK.txt: Corresponding station (row) storm (col) UK Bias

MatBloiWRF.txt: Corresponding station (row) storm (col) WRF Bias

\*note no data for last row resulting in one less at end, there are all 0 rows before this but due to the existence function because the last station was not used its blank

The code below performs averages over bias or RMSE

* C:/Users/alex/Desktop/Storm3Test/MesoMapLoiv2.R

LOImbWRFv2.csv: Labeled WRF by station Latitude, Longitude, Mean Bias (with NAs)

LOImbUKv2.csv: Labeled IS UK by station Latitude, Longitude, Mean Bias (with NAs)

LOIRWRFv2.csv: Labeled WRF by station Latitude, Longitude, RMSE (with NAs)

LOIRUKv2.csv: Labeled IS UK by station Latitude, Longitude, Mean Bias (with NAs)

c) Removes stations with no data for the 11 storms

* C:/Users/alex/Desktop/Storm3Test/MLOINaOmv2.R

LOImbWRFNAOMv2.csv: Labeled WRF by station Latitude, Longitude, Mean Bias

LOImbUKNAOMv2.csv: Labeled IS UK by station Latitude, Longitude, Mean Bias

LOIWRFNAOMv2.csv: Labeled WRF by station Latitude, Longitude, RMSE

LOIUKNAOMv2.csv: Labeled IS UK by station Latitude, Longitude, Mean Bias

**9. All Storms Method 2 Kriging:**

a) Kalman Filter outputs from the Metar Procedure (7. LOOCV RK -KrInMetHTDiff.m (Part2)) and Madis Procedure (7. LOOCV RK-KrInMadHTDiff.m (Part2)) are located in KrInMetDiff#/ and KrInMadDiff #/.

Kalman filter outputs are analyzed for temporal consistency among storm history. Storms need to be classified into three catagories in order to run the appropriate analyses. There is either the one timestep and no further analisis is needed (24h), two timesteps and further analisis is needed (48h), or two timesptestp that are constant throughout (48h).

* F:/Meth34nBase/Bias111evalv.m

Two outputs are produced

'StormHT.txt' has the number of stations not equal for the first and second 24h.

'StormConst.txt' has the same number of stations for the first and second 24 hours

b) Storms with a 48 hour history and uneven number of stations are listed in 'StormHT.txt' from the previous code. Data from Madis and Metar KrInMetDiff#/ and KrInMadDiff #/ are read and combined in order to produce one set of information that can be analyzed for proximitiy and temporal consistency.

* F:/Meth34nBase/BiasTC111.m

Stations with the appropriate amount of data are grouped together to conserve the order station relationship for CV (stations can have 24 hours of a full 48 hour storm history)

BiasCO111#/ GCHtrFF20001234\_00.txt: complete availability stations, combined grid column information

BiasCO111#/ GCHtrC20001234\_00.txt: complete availability stations, combined grid column information

BiasCO111#/ GCHtrR20001234\_00.txt: complete availability stations, combined grid row information

BiasCO111#/GCHtrFF20001234\_00.txt: complete availability stations, combined KF correction information

Stations with incomplete histories are compared to each other and then back to the complete histories to provide hourly data to be concatenated

BiasCO111#/ TTtrFFF20001234\_00.txt: Remaining stations, combined KF corrections

BiasCO111#/ TTtrC20001234\_00.txt: Remaining stations, combined grid column

BiasCO111#/ TTtrR20001234\_00.txt: Remaining stations, combined grid row

Information of which stations are combined (complete history) is listed in:

BiasBS111#/ GCHElim20001234\_00.txt: Stations with combined station as second column

c) Storms that have two time steps with constant station use throughout are listed in 'StormConst.txt' from step a. Data from Madis and Metar KrInMetDiff#/ and KrInMadDiff #/ are read and combined in order to produce one set of information that can be analyzed for proximitiy

* F:/Meth34nBase/BiasTC111M3.m

Outputs match step b

d) Storms that have only one timestep (24 hours) are listed in (‘totalKri.txt’) from step a. Data from Madis and Metar KrInMetDiff#/ and KrInMadDiff #/ are read and combined in order to produce one set of information that can be analyzed for proximitiy

* F:/Meth34nBase/BiasTC11124.m

Outputs that meet the demands of the proximity are of the same folder and files as the two other codes (b & c)

e) Outputs of steps b, c, and d are hourly files put into folders labeled by storm. Kriging can be run over the by storm time series, but current code reads the three storm list txt’s separately for internal analysis. The code below performs Kriging:

* F:/ Meth34nBase /M3uk111.m

Kriged outputs are as follows:

BiasZfKri111#/20001234\_00loiM3yx.txt: Full 88110 gridded output (extra values are because the domain must encompass a larger square representation of the field

BiasZfKri111#/20001234\_00loiM3mse.txt: corresponding interpolation error

BiasZfKri111#/20001234\_00loiM3CR.txt: Input location information (for book keeping)

BiasZfKri111#/20001234\_00loiM3ff.txt: Input Bias information (for book keeping)

**10. Internal Method 2 Comparison (Including WRF scatter)**

**10.1 Figure 14: Second Methodology Kalman Filter and Residual Kriged comparison**

**AND Figure 11: Scatter Plot (a)WRF forecast and (c)RK**

a) Arrays are organized for a common database that is easy to reference by storm and station. RK outputs BiasZfKri111#/20001234\_00loiM3yx.txt (Step 9. All Storms Method 2 Kriging- M3uk111.m) are then compared to Kalman Filter outputs BiasCombOutDiff#/GCHtr… and BiasBS111#/GCHElim20001234\_00.txt (Step 9. All Storms Method 2 Kriging- Steps b, c, and d) and corresponding WRF values (WRF/20001234\_00WRF.txt)

* F:/Meth34Diff/BSCVGC111.m

Outputs are hourly arrays of the Kalman filter outputs (BiasBS111#/Kal111FFaK123.csv), and Kriged outputs (BiasBS111#/KP111FFaK123.csv)

b) Comparisons with mutual availability within a storm (filter outputs are a time step ahead of observed wind speeds) and station (MetMad.csv) are made for M2 Kalman and RK (BiasBS111#/Kal111FFaK123.csv) and (BiasBS111#/KP111FFaK123.csv). Data is analyzed for RMSE, bias, and scatter information. Note the original purpose of the code was for internal analysis. A series of additional txt’s are read:

\* (Footnotes: Procedure Footnotes METHOD 2 – M3KOMet111.m) :

MetarrObsK123.csv: Hourly Observed wind of station K123 at storm #

MetarrWRFK123.csv: Hourly WRF wind of station K123 at storm #

MetarrKalK123.csv: Hourly M2 KF wind of station K123 at storm #

\*(Footnotes: Procedure Footnotes METHOD 2 – M3KOMad111.m):

madarObsK123.csv: Hourly Observed wind of station K123 at storm #

madarWRFK123.csv: Hourly WRF wind of station K123 at storm #

madarKalK123.csv: Hourly M2 KF wind of station K123 at storm #

The WRF arrays are constructed from the WRF files from the procedure, however WRF data was shown to be the same compared to the WRF txt’s created by step a.

* F:/Meth34nBase/RMSE111v6

c) In order to separate from the internal analysis, the graphing commands are run after a few additional steps. Due to the large size of the arrays and matrices created by the code above, the code was broken into three sets of storms with the code below. Sections are separated by commenting unused time ranges not run in that terminal

* F:/Meth34nBase/Bridge111v2.m

fin111gr.mat

d) Final graphing reads the workspace output with all the concatenated variables, fin111gr.mat

* F:/Meth34nBase/B3111v2.m **Additional plots are poorly labeled**

**10.2 Figure 9: Second Methodology (a) Boxplot Bias (b) PDF Bias (c)Boxplot RMSE (d)PDF RMSE**

a) Backup workspace CVGC#.mat from 7.LOOCV RK-ByStatGC.m are used to construct array output versions of the average files used to create the scatter plots with the code below:

* F:/Meth34Diff/ByStatCVGCArr.m

Outputs are hourly arrays of the Kalman filter outputs (BiasBStDiff#/KalFFaK123.csv), and LOOCV Residual Kriged outputs (BiasBStDiff#/KPFFaK123.csv)

b) Comparisons with mutual availability within a storm (filter outputs are a time step ahead of observed wind speeds) and station (MetMad.csv) are made for M2 Kalman (BiasBStDiff#/KalFFaK123.csv), and LOOCV RK outputs (BiasBStDiff#/KPFFaK123.csv).

Data is analyzed for RMSE, bias, and scatter information. Note the original purpose of the code was for internal analysis. A series of additional txt’s are read:

\* (Footnotes: Procedure Footnotes METHOD 2 – M3KOMetFin.m) :

MetarrObsK123.csv: Hourly Observed wind of station K123 at storm #

MetarrWRFK123.csv: Hourly WRF wind of station K123 at storm #

MetarrKalK123.csv: Hourly M2 KF wind of station K123 at storm #

\*(Footnotes: Procedure Footnotes METHOD 2 – M3KOMad.m):

madarObsK123.csv: Hourly Observed wind of station K123 at storm #

madarWRFK123.csv: Hourly WRF wind of station K123 at storm #

madarKalK123.csv: Hourly M2 KF wind of station K123 at storm #

The WRF arrays are constructed from the WRF files from the procedure, however WRF data was shown to be the same compared to the WRF txt’s created by step a.

* F:\Meth34nBase\RMSEfilprARR.m

b) Outputs are directly read by the graphing component using the same workspace, that is not saved just run sequential at this point in time

* F:\Meth34nBase\Big3.m

Population of station/storm Bias and RMSE values

KalRMSE.txt: RMSE of each M2KF Station

PkalRMSE.txt: RMSE of each LOOCV RK Station

WRFrmse.txt: RMSE of each WRF

KalBIAS.txt: Bias of each M2KF Station

PkalBIAS.txt: Bias of each LOOCV RK Station

WRFbias.txt: Bias of each WRF Station

c) PDF and boxplot information

* F:\Meth34Diff\Histograms2.R

**11. M1 Comparisons Scatter and PDF’s**

**11.1 Figure 10: (STEP 5) First Methodology (a) Boxplot Bias (b) PDF Bias**

a) M1 Kalman filter outputs KalWRF/RFO2/modeltom\_filt#.txt (5. M1 Kriging -> KF-RFO2/KalmanP10.f90) were copied and pasted into a separate folder under the name GCKalman/modeltom\_filt#.txt.

Outputs were organized in order to compare them back to the original wind speed using filenames of WRF (WRF/20001234\_00WRF.txt) and the original wind values created by 2. LOOCV UK-WindTCSTm2.m (WindCombOut#/Htr…).

Matching Times between the full history Kalman outputs and the by storm observation/kriged value pairs was achieved, using a list of temporal locations of the 10 storms firstarray2.txt & lastarray2.txt in Kalman History

* C:/Users/alex/Desktop/Storm3Test/KalmanCompar2.m

This code was originally used to create a scatter. The backup workspace (fin(Storm#).mat) is used in step b to create arrays that can calculate overall RMSE and bias using hourly data

b) In order to produce hourly RMSE values array versions of the previous code were created by reading the workspaces output of the code above

* C:/Users/alex/Desktop/Storm3Test/KCARM1.m

The final hourly array outputs were output as WindBStat/finMEANkalARK123.csv

c) Comparisons with mutual availability within a storm (filter outputs are a time step ahead of observed wind speeds) and station (MetMad.csv) are made for M1 Kalman WindBStat/finMEANkalARK123.csv and IS UK WindBStat#/loiUKK123.csv (4. IS UK-BSCVARfixloi.m). Data is analyzed for RMSE, bias, and scatter information. Note the original purpose of the code was for internal analysis. A series of additional txt’s are read:

\* (Footnotes: Procedure Footnotes METHOD 2 – M3KOMet111.m) :

MetarrObsK123.csv: Hourly Observed wind of station K123 at storm #

MetarrWRFK123.csv: Hourly WRF wind of station K123 at storm #

MetarrKalK123.csv: Hourly M2 KF wind of station K123 at storm #

\*(Footnotes: Procedure Footnotes METHOD 2 – M3KOMad111.m):

madarObsK123.csv: Hourly Observed wind of station K123 at storm #

madarWRFK123.csv: Hourly WRF wind of station K123 at storm #

madarKalK123.csv: Hourly M2 KF wind of station K123 at storm #

The WRF arrays are constructed from the WRF files from the procedure, however WRF data was shown to be the same compared to the WRF txt’s read at any time.

* C:/Users/alex/Desktop/Storm3Test/RMSEm1ukF.m

The graphing code (Step d) was run sequentially (no workspace or file transfer)

d) Graphs and outputs not related to the internal analysis were created using:

* F:/Meth34nBase/Big3kfloi.m

Txts were written in order to assess the populations

'loikfKalRMSE.txt': RMSE of each M1KF Station

'loikfPkalRMSE.txt': RMSE of each UK Station

'loikfWRFrmse.txt': RMSE of each WRF Station

'loikfKalBIAS.txt': Bias of each M1KF Station

'loipkfPkaBIAS.txt': Bias of each UK Station

'loikfWRFbias.txt': Bias of each WRF Station

e) Population information was generated from the txt’s above

* F:/Meth34Diff/Histom1UKF.R (was originally written without the m1 but DNE)

**11.2 Figure 11: Scatter Plot (b)M1 KF Note figure in original document is mislabeled**

**(Template)** M1 Kalman filter outputs KalWRF/RFO2/modeltom\_filt#.txt (5. M1 Kriging -> KF-RFO2/KalmanP10.f90) were copied and pasted into a separate folder under the name GCKalman/modeltom\_filt#.txt.

Outputs were organized in order to compare them back to the original wind speed using filenames of WRF (WRF/20001234\_00WRF.txt) and the original wind values created by 2. LOOCV UK-WindTCSTm2.m (WindCombOut#/Htr…).

Matching Times between the full history Kalman outputs and the by storm observation/kriged value pairs was achieved, using a list of temporal locations of the 10 storms firstarray2.txt & lastarray2.txt in Kalman History

a) BiasCO111#/GCHtr (9. All Storms Method 2 Kriging-Steps b, c and d)

**F:/Meth34nBase/KF111m1v2.m**

BiasBS111/fin111kalK123.csv Kalman Array

a2) Comparisons with mutual availability within a storm (filter outputs are a time step ahead of observed wind speeds) and station (MetMad.csv) are made for (10. Internal Method 2-BSCVGC111.m KP111FFa) and (step a -fin111kal). Data is analyzed for RMSE, bias, and scatter information. Note the original purpose of the code was for internal analysis. A series of additional txt’s are read:

\* (Footnotes: Procedure Footnotes METHOD 2 – M3KOMet111.m) :

MetarrObsK123.csv: Hourly Observed wind of station K123 at storm #

MetarrWRFK123.csv: Hourly WRF wind of station K123 at storm #

MetarrKalK123.csv: Hourly M2 KF wind of station K123 at storm #

\*(Footnotes: Procedure Footnotes METHOD 2 – M3KOMad111.m):

madarObsK123.csv: Hourly Observed wind of station K123 at storm #

madarWRFK123.csv: Hourly WRF wind of station K123 at storm #

madarKalK123.csv: Hourly M2 KF wind of station K123 at storm #

The WRF arrays are constructed from the WRF files from the procedure, however WRF data was shown to be the same compared to the WRF txt’s created by other steps? Wouldn’t m1 obs equal an interpolation… but its wrf so all are same.

* F:/Meth34nBase/RMSE111m1m2.m

b) Outputs are directly read by the graphing component using a workspace, that is not saved just run sequential

* F:/Meth34nBase/bridge111m1m3.m (make sure I wasn’t using the p1-p3) format

c) Final comparison Scatter

* F:/Meth34nBase/B3111m1m3v4.m

**12. M1M2 Comparisons Scatter, PDF’s, Figure 12: Final output (a) Boxplot Bias (b) PDF Bias (c)Boxplot RMSE (d)Boxplot PDF**

a) Compilation of both datasets: Fair comparisons with varying availability every storm (Stormlist.csv) and station (MetMad.csv) is referenced for availability. Vestigal functions read MetarrObs, MetarrWRF, MetarrKal, madarObs, madarWRF, madarKal. The functions exist because comparisons were made for accuracy checks of internal comparisons. Kalman data is analyzed for RMSE, and bias and scatter information was made with the arrays created in the previous step (LOIKPFFa) and (finMEANkalAR).

* F:/Meth34nBase/RMSEm1m3.m

b) Graphing codes were run immediately after the RMSE due to the smaller 10% sample size

* F:/Meth34nBase/B3LOIm3m1.m

KalRMSE13.txt: RMSE of each M2KF Station

PkalRMSE13.txt: RMSE of each RK Station

WRFrmse13.txt: RMSE of each WRF

KalBIAS13.txt: Bias of each M2KF Station

PkalBIAS13.txt: Bias of each ?RK Station

WRFbias13.txt: Bias of each WRF Station

c) Final comparison PDF and Histo

* F:/Meth34Diff/Histom1m3.R

**13. Lineplots of KF outputs**

Inputs:

Reads GClistMet32.txt, MetCRno.csv, FC24JS.txt, ModYes#.txt, LocOut#.txt, modeltom\_filt#.txt, Obs#.txt,

Vestigial: calcaulation of bias and rmse and plots by storm helped with station decision making process

F:/Meth34nBase/KrInMetKaLi.m

Second half is a template of the graphing

**Fig 4.3: Method 2 good results converging thru training**

F:/Meth34nBase/M2GR.m

**Fig. 4.3.2?: Method 2 peak behavior misrepresentation**

F:/Meth34nBase/M2PPR.m

**Fig 4.3.3?: Method 2 Storm change misrepresentation**

F:/Meth34nBase/M2SR.m

**Fig 4.3.4?: Method 1-> M1 UK oversimplification**

F:/Meth34nBase/M1M2BRGR.m

**Fig 4.3.5?: Method 1 good results**

F:/Meth34nBase/M1M2GrBr.m

**Fig 4.3.6?: Meth1 and Meth2 Both Bias run**

F:/Meth34nBase/M1M2GrgR.m

**14. MADIS Pair Data.**

F:/CV62015Cast/CEELab20/Madis/MadPaIR.m

**15. Beta interplator.**

F:\BetaKrig021517\CrossVal\BCV.m

**Procedure Footnotes**

F:/Meth34nBase/KrInMadFix.m(This is where ID’d issues with GC)

**Maps (Figure 13, Figure 15)**

* [111](#AllSto)

F:/Meth34nBase/Mes12Seasv3.m (season not in other maps)

F:/Meth34nBase/m12v3.R

F:/Meth34nBase/MesNa12v3.R

**Procedure Footnotes METHOD 2**

CVp1 inputs 1D time

Note Axis are not set according to Axis Min and Axis Max. Also,Check RMSE values in order to identify if it is a coding

Moved Everything (on Azula) to the G drive:

ADDED UNIQUE FUNCTION 2016/08/16 (G:drive version)

**G:/Meth34nBase/Meth3KOMetFin.m**

**Azula/Documents/Meth34nBase/Meth3KOMetFin.m**

**Actual plot inputs**

Note Axis are not set according to Axis Min and Axis Max. Also,Check RMSE values in order to identify if it is a coding

**Azula/Documents/Meth34nBase/CVp1Met.m:**

plot

G:Meth34nBase/CK2.m (final Graphing)

Wrf compare

Only for Metar: **G:/Meth34nBase/CVp1MetEVBSt.m** compares past storm individually

**G:/Meth34nBase/CVp1Meteval.m**

Edited Helim 16,39,44,57,64,69,105 Saved changes into **Laptop/ Desktop/Storm3Test/REcHelimEdit.txt**

**Laptop/ Desktop/Storm3Test/KalCrev.m**

**Post MatMAnip was run on G? at some point I moved everything August 10th is the threshold date for when I reran all the KalinMetFin Data…. Reran in cape cod on desktop**

**Appears to have same origin… C:Users/alex/Desktop/Meth3Met/Method34n.m, copied and pasted data including TPSMet2.txt in between not perfect but Kalman run in Azula/Documents/Meth34nBase/M03d2Met old but remember that Discovered bad dates in library very long time ago, that was error 1. Error 2 was the 3rd row in the labels of old files dates match for both there was an extensive Metar investigation… however the change came in manual edits saved in REcHelimEdit.txt Much more modern madis because never fixed original problem due to the fact that I wanted to do Metar First**

CVp1 inputs 1D time

Note Axis are not set according to Axis Min and Axis Max. Also,Check RMSE values in order to identify if it is a coding

Moved Everything (on Azula) to the G drive:

**Azula/Documents/Meth34nBase/Meth3KO.m**

**Actual plot inputs**

**Azula/Documents/Meth34nBase/CVp1.m**

plot

G:Meth34nBase/CK2.m

Wrf compare

**G:/Meth34nBase/CVp1Madeval.m**

Note folder change is due to error found from:

Edited Helim 16,39,44,57,64,69,105 Saved changes into **Laptop/ Desktop/Storm3Test/REcHelimEdit.txt**

**Laptop/ Desktop/Storm3Test/KalCrev.m**

**EDITED TIMING ON KALFIN AND KALMET: Laptop/ Desktop/Storm3Test/MatMAnip.m**

**After KalinFin.txt was created different filepaths were used among the three locations. Because MatMAnip exists in the laptop, Method34n.m was run on the laptop 🡪 M03d2 was copied and pasted to G drive and AGAIN copied into Azula as M03d2MadFin. Kalman was run (with Kriging inputs version)**

**Metar Kalman Compiling**

a) Stations are referenced from MetCRno.csv using GCHElim and GCMaxReps (9b, 9c and 9d) to create stations used in that storm

* F:/Meth34nBase/HMet111.m

HMetLoc#.txt is a txt output with a list of locations used in the storm represented by an ID of MetCRno.csv

b) Using this list of information, the final Kalman Arrays are temporally located using, firstarray111.txt and lastarray111.txt with accompanying strings FC24JS.txt. Station information is referenced using HMetLoc within MetCRno.csv. Each storm individual temporal history LocOut, and accompanying observation, and WRF data Obs, ModYes, modeltom\_filt

* F:/Meth34nBase/M3KOMet111.m

MetarrObsK123.csv

MetarrWRFK123.csv

MetarrKalK123.csv

**MADIS Kalman Compiling**

a) Stations are referenced from MetCRno.csv using GCHElim and GCMaxReps (9b, 9c and 9d) to create stations used in that storm

* F:/Meth34nBase/HMad111.m

HMadLoc#.txt is a txt output with a list of locations used in the storm represented by an ID of MetCRno.csv

b) Using this list of information, the final Kalman Arrays are temporally located using, firstarray111.txt and lastarray111.txt with accompanying strings FC24JS.txt. Station information is referenced using HMadLoc within MadisCRno.csv. Each storm individual temporal history LocOut, and accompanying observation, and WRF data Obs, ModYes, modeltom\_filt

* F:/Meth34nBase/Meth3KO111.m

madarObsK123.csv

madarWRFK123.csv

madarKalK123.csv