**Scheme for Web Portal Development**

**The Program has to run on internet, so that the model/data can be dynamic**

1. Opening page

Drought Early Warning System for Northern Nigeria –as title

* Logo of FUT and TETFUND
* Picture of a drought event in Nigeria/sub-saharan Africa (as background)
* TETFUND Research number
* Research Team

With 'next' button to continue

1. Draw-down button:

1st button: state, then drop down for stations

(Archive: station/LGA name, location, region)

Instruction: select state/station name

: select year using drawdown (model from 1982 to current year+2)

\*\* read data – identify last period of record. Do you need to forecast SST or ITCZ? If yes, 3a, otherwise 3b

1. Behind the scene

Please find attached the following:

1. Historical data for SST =  DATAsst.xlsx

2. Historical data for ITCZ at 5 degree = DATAitcz5.xlsx

3. Historical data for ITCZ at 10 degree = DATAitcz10.xlsx

4. Parameters for model for estimating SST = PARAsst.xlsx

5. Parameters for model for estimating ITCZ at 5degree = PARAitcz5.xlsx

6. Parameters for model for estimating ITCZ at 10degree = PARAitcz10.xlsx

7. Random number with mean zero and unit standard deviation generated  = DATArv.xlsx

Run SSTestimator for year selected plus Jan to April of subsequent year).

The equation for SSTestimator

1.     Read the monthly parameters from the data file

2.     Read the random number (rv) from the file as well

3.     To generate the SST for January in year 2022, the SST for December in year 2021 must be known.

4.     The equation for each month is as shown below:

SSTJan, 2022 = meanJan +  bDec (SSTDec,2021 – meanDec) + rvJan, 2022 \* sJan((1 - rDec2)^0.5)

SSTFeb, 2022 = meanFeb +  bJan (SSTJan,2022 – meanJan) + rvFeb, 2022 \* sFeb((1 - rJan2)^0.5)

SSTAug, 2022 = meanAug +  bJul (SSTJul,2022 – meanJul) + rvAug, 2022 \* sAug((1 - rJul2)^0.5)

**Run ITCZ5 estimator and ITCZ10 estimator for year selected plus January to April of subsequent year (same equation as SST estimator above**

3b. Behind the scene

Data:

MSSTD = 28.1

MSSTJ = 28.1

MSSTF = 28.4

MSSTDJF = 28.2

MITCZ10D = 5.8

MITCZ10J = 6.1

MITCZ10F = 4.8

MITCZ10M = 7.2

MITCZ10A = 10.8

ITCZ10DEM = 21.6

MMITCZ10 = 4.8

AVITCZ10 = 6.9

Select SST for December (previous year selected), January and February (selected year): SSTD, SSTJ, SSTF

Select ITCZ10 for December (previous year selected), January, February, March and April (selected year): ITCZ10D, ITCZ10J, ITCZ10F, ITCZ10M and ITCZ10A

AVSST = (SSTD + SSTJ + SSTF)/3

If (AVSST – MSSTDJF) < -0.4, then oceanT = Very Cold

If (AVSST – MSSTDJF) ≥ -0.4 and < -0.2, then oceanT = Cold

If (AVSST – MSSTDJF) ≥ -0.2 and < 0.2, then oceanT = Average

If (AVSST – MSSTDJF) ≥ 0.2 and < 0.4, then oceanT = Warm

If (AVSST – MSSTDJF) > 0.4, then oceanT= Very Warm

MINITCZ10 = minimum (ITCZ10D, ITCZ10J, ITCZ10F, ITCZ10M, ITCZ10A)

Which month does minimum itcz10 occurs:

If (ITCZ10D = MINITCZ10), LITCZ10 = 12

If (ITCZ10J = MINITCZ10), LITCZ10 = 1

If (ITCZ10F = MINITCZ10), LITCZ10 = 2

If (ITCZ10M = MINITCZ10), LITCZ10 = 3

If (ITCZ10A = MINITCZ10), LITCZ10 = 4

If (MINITCZ10 – MMITCZ10) < -1.5, THEN ITCZ10P = EXTREME SOUTH

If (MINITCZ10 – MMITCZ10) ≥ -1.5 AND < -1.0, THEN ITCZ10P = SEVERE SOUTH

If (MINITCZ10 – MMITCZ10) ≥ -1.0 AND < -0.5, THEN ITCZ10P = MODERATE SOUTH

If (MINITCZ10 – MMITCZ10) ≥ -0.5 AND < 0.5, THEN ITCZ10P = NORMAL

If (MINITCZ10 – MMITCZ10) ≥ 0.5 AND < 1.0, THEN ITCZ10P = MODERATE NORTH

If (MINITCZ10 – MMITCZ10) ≥ 1.0 AND < 1.5, THEN ITCZ10P = SEVERE NORTH

If (MINITCZ10 – MMITCZ10) > 1.5, THEN ITCZ10P = EXTREME NORTH

Compute NASH and deviations of itcz10 to one decimal place: NASH, NEG10MAX, POS10MAX, SUMPOS10, SUMNEG10, ITCZRATIO

NASH = 1-((ITCZ10D-MITC10D)2 + (ITCZ10J-MITC10J)2 + (ITCZ10F-MITC10F)2 + (ITCZ10M-MITC10M)2 + (ITCZ10A-MITC10A)2)/ (ITCZDEM)2

IF (ITCZ10D < MITCZ10D) THEN NEG10D=MITCZ10D-ITCZ10D

ELSE

POS10D=ITCZ10D-MITCZ10D

IF (ITCZ10J < MITCZ10J) THEN NEG10J=MITCZ10J-ITCZ10J

ELSE

POS10J=ITCZ10J-MITCZ10J

IF (ITCZ10F < MITCZ10F) THEN NEG10F=MITCZ10F-ITCZ10F

ELSE

POS10F=ITCZ10F-MITCZ10F

IF (ITCZ10M < MITCZ10M) THEN NEG10M=MITCZ10M-ITCZ10M

ELSE

POS10M=ITCZ10M-MITCZ10M

IF (ITCZ10A < MITCZ10A) THEN NEG10A=MITCZ10A-ITCZ10A

ELSE

POS10A=ITCZ10A-MITCZ10A

NEG10MAX = MAXIMUM(NEG10D, NEG10J, NEG10F, NEG10M, NEG10A)

POS10MAX = MAXIMUM(POS10D, POS10J, POS10F, POS10M, POS10A)

SUMNEG10 = NEG10D+ NEG10J+ NEG10F+ NEG10M+ NEG10A

SUMPOS10 = POS10D+ POS10J+ POS10F+ POS10M+ POS10A

ITCZRATIO=SUMPOS10/SUMNEG10

Regionalise

FOR SAHEL:

IF (oceanT = average and ITCZ10P=MODERATE SOUTH OR ITCZ10P=EXTREME SOUTH) DROUGHT INDEX = NO DROUGHT

IF (oceanT=AVERAGE AND ITCZ10P=NORMAL AND NASH ≥ 0.85) DROUGHT INDEX = NO DROUGHT

IF (oceanT=AVERAGE AND ITCZ10P=NORMAL AND NASH < 0.85) DROUGHT INDEX = MODERATE DROUGHT

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IF(oceanT=COLD AND ITCZ10P = NORMAL OR ITCZ10P=EXTREME SOUTH) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME NORTH AND NASH ≥0.85) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME NORTH AND NASH <0.85) DROUGHT INDEX=MODERATE DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME SOUTH AND NASH ≥0.85 AND LITCZ10=12 AND SUMPOS10 ≥ 3 AND SUMPOS10 < 4) DROUGHT INDEX=SEVERE DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME SOUTH AND NASH ≥0.85 AND LITCZ10=12 AND SUMPOS10 ≥ 4) DROUGHT INDEX=MILD DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME SOUTH AND NASH ≥0.85 AND LITCZ10 ≠12 ) DROUGHT INDEX=NO DROUGHT

IF(oceanT=WARM AND ITCZ10P=EXTREME SOUTH) DROUGHT INDEX=NO DROUGHT

SUDAN:

IF(oceanT=AVERAGE AND ITCZ10P=MODERATE SOUTH) DROUGHT INDEX=NO DROUGHT

IF(oceanT=AVERAGE AND ITCZ10P=EXTREME SOUTH AND LITCZ10=12) DROUGHT INDEX=MILD DROUGHT

IF(oceanT=AVERAGE AND ITCZ10P=EXTREME SOUTH AND LITCZ10≠12) DROUGHT INDEX=NO DROUGHT

IF(oceanT=AVERAGE AND ITCZ10P=NORMAL AND LITCZ10≠12) DROUGHT INDEX=NO DROUGHT

IF(oceanT=AVERAGE AND ITCZ10P=NORMAL AND LITCZ10=12 AND SUMNEG10 <1) DROUGHT INDEX=MODERATE DROUGHT

IF(oceanT=AVERAGE AND ITCZ10P=NORMAL AND LITCZ10=12 AND NASH <0.7) DROUGHT INDEX=SEVERE DROUGHT

IF(oceanT=COLD AND ITCZ10P=EXTREME SOUTH) DROUGHT INDEX=NO DROUGHT

IF(oceanT=COLD AND ITCZ10P=NORMAL) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=SEVERE SOUTH AND ITCZRATIO < 1) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=SEVERE SOUTH AND ITCZRATIO > 1) DROUGHT INDEX=MILD DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=NORMAL) DROUGHT INDEX=MODERATE DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=MODERATE SOUTH) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME NORTH) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME SOUTH AND NASH ≥0.85 AND SUMNEG10>5.3 AND SUMPOS10 <4) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME SOUTH AND NASH ≥0.85 AND SUMNEG10 <5.3 AND SUMPOS10 > 4) DROUGHT INDEX=SEVERE DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME SOUTH AND NASH < 0.85 AND NEG10MAX > 7) DROUGHT INDEX=MODERATE DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME SOUTH AND NASH ≤ 0.8 AND NEG10MAX < 7) DROUGHT INDEX=NO DROUGHT

IF(oceanT=WARM AND ITCZ10P=EXTREME SOUTH AND ITCZRATIO > 1) DROUGHT INDEX=NO DROUGHT

IF(oceanT=WARM AND ITCZ10P=EXTREME SOUTH AND ITCZRATIO < 1 AND LITCZ = 12) DROUGHT INDEX=MILD DROUGHT

IF(oceanT=WARM AND ITCZ10P=EXTREME SOUTH AND ITCZRATIO < 1 AND LITCZ ≠ 12) DROUGHT INDEX=MODERATE DROUGHT

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NORTHERN GUINEA

IF(oceanT=AVERAGE AND ITCZ10P=MODERATE SOUTH) DROUGHT INDEX=NO DROUGHT

IF(oceanT=AVERAGE AND ITCZ10P=EXTREME SOUTH AND LITCZ=12) DROUGHT INDEX=MODERATE DROUGHT

IF(oceanT=AVERAGE AND ITCZ10P=EXTREME SOUTH AND LITCZ≠12) DROUGHT INDEX=NO DROUGHT

IF(oceanT=AVERAGE AND ITCZ10P=NORMAL AND NASH <0.85) DROUGHT INDEX=MODERATE DROUGHT

IF(oceanT=AVERAGE AND ITCZ10P=NORMAL AND NASH ≥0.85) DROUGHT INDEX=NO DROUGHT

IF(oceanT=COLD AND ITCZ10P=NORMAL OR ITCZ10P = EXTREME SOUTH) DROUGHT INDEX=NO DROUGHT

IF(oceanT=WARM AND ITCZ10P=EXTREME SOUTH AND NASH ≥ 0.85) DROUGHT INDEX=MILD DROUGHT

IF(oceanT=WARM AND ITCZ10P=EXTREME SOUTH AND NASH <0.85) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME NORTH AND NASH ≥0.85) DROUGHT INDEX=MODERATE DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME NORTH AND NASH <0.85) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=SEVERE SOUTH AND ITCZRATIO<0.7) DROUGHT INDEX=MODERATE DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=SEVERE SOUTH AND ITCZRATIO >0.7) DROUGHT INDEX=SEVERE DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=NORMAL AND SUMNEG10 <0.6) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=NORMAL AND SUMNEG10 >0.6 AND ITCZRATIO <10) DROUGHT INDEX=MILD DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=NORMAL AND SUMNEG10 >0.6 AND ITCZRATIO >10) DROUGHT INDEX=MODERATE DROUGHTC

IF(oceanT=VERY WARM AND ITCZ10P=MODERATE SOUTH AND POS10MAX > 1 AND ITCZRATIO >1) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=MODERATE SOUTH AND POS10MAX < 1 AND ITCZRATIO <0) DROUGHT INDEX=MILD DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME SOUTH AND NASH < 0.85) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME SOUTH AND NASH ≥0.75 AND NASH <0.85 AND SUMNEG10 < 14) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME SOUTH AND NASH ≥ 0.75 AND NASH <0.85 AND SUMNEG10 > 14) DROUGHT INDEX=MILD DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME SOUTH AND NASH ≥ 0.85 AND LITCZ=12 AND NEG10MAX > 5) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME SOUTH AND NASH ≥ 0.85 AND LITCZ=12 AND NEG10MAX < 3.8) DROUGHT INDEX=MODERATE DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME SOUTH AND NASH ≥ 0.85 AND LITCZ=12 AND NEG10MAX > 3.8 AND NEG10MAX<5) DROUGHT INDEX=MILD DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME SOUTH AND NASH > 0.85 AND SUMNEG10 > 13) DROUGHT INDEX=MODERATE DROUGHT

IF(oceanT=VERY WARM AND ITCZ10P=EXTREME SOUTH AND NASH ≥ 0.85 AND SUMNEG10 < 13) DROUGHT INDEX=NO DROUGHT

SOUTHERN GUINEA

IF(oceanT=AVERAGE AND ITCZ10P=MODERATE SOUTH) DROUGHT INDEX=NO DROUGHT

IF(oceanT=AVERAGE AND ITCZ10P=EXTREME SOUTH) DROUGHT INDEX=NO DROUGHT

IF(oceanT=AVERAGE AND ITCZ10P=NORMAL AND NASH≥0.85) DROUGHT INDEX=NO DROUGHT

IF(oceanT=AVERAGE AND ITCZ10P=NORMAL AND NASH<0.85) DROUGHT INDEX=MODERATE DROUGHT

IF(oceanT=COLD AND ITCZ10P=NORMAL OR ITCZ10P=EXTREME SOUTH) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VER WARM AND ITCZ10P=NORMAL AND ITCZRATIO > 10) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VER WARM AND ITCZ10P=NORMAL AND ITCZRATIO < 10) DROUGHT INDEX=MODERATE DROUGHT

IF(oceanT=VER WARM AND ITCZ10P=MODERATE SOUTH) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VER WARM AND ITCZ10P=SEVERE SOUTH AND ITCZRATIO > 1) DROUGHT INDEX=MILD DROUGHT

IF(oceanT=VER WARM AND ITCZ10P=SEVERE SOUTH AND ITCZRATIO < 1) DROUGHT INDEX=SEVERE DROUGHT

IF(oceanT=VER WARM AND ITCZ10P=EXTREME NORTH) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VER WARM AND ITCZ10P=EXTREME SOUTH AND NASH < 0.3) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VER WARM AND ITCZ10P=EXTREME SOUTH AND NASH < 0.85 AND LITCZ=3 AND NEG10MAX ≥ 8.5) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VER WARM AND ITCZ10P=EXTREME SOUTH AND NASH < 0.85 AND LITCZ=3 AND NEG10MAX < 8.5 AND ITCZRATIO>2) DROUGHT INDEX=MILD DROUGHT

IF(oceanT=VER WARM AND ITCZ10P=EXTREME SOUTH AND NASH < 0.85 AND LITCZ=3 AND NEG10MAX < 8.5 AND ITCZRATIO<2) DROUGHT INDEX=MODERATE DROUGHT

IF(oceanT=VER WARM AND ITCZ10P=EXTREME SOUTH AND NASH > 0.85 AND LITCZ=12 AND NEG10MAX > 5) DROUGHT INDEX=MILD DROUGHT

IF(oceanT=VER WARM AND ITCZ10P=EXTREME SOUTH AND NASH > 0.85 AND LITCZ=12 AND NEG10MAX < 5) DROUGHT INDEX=MODERATE DROUGHT

IF(oceanT=VER WARM AND ITCZ10P=EXTREME SOUTH AND NASH ≥ 0.85 AND LITCZ=2 AND NEG10MAX < 3.5 AND SUMNEG10 > 13) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VER WARM AND ITCZ10P=EXTREME SOUTH AND NASH ≥ 0.85 AND LITCZ=2 AND NEG10MAX > 3.5) DROUGHT INDEX=MILD DROUGHT

IF(oceanT=VER WARM AND ITCZ10P=EXTREME SOUTH AND NASH ≥ 0.85 AND LITCZ=1) DROUGHT INDEX=NO DROUGHT

IF(oceanT=VER WARM AND ITCZ10P=EXTREME SOUTH AND NASH < 0.6) DROUGHT INDEX=MILD DROUGHT

IF(oceanT=VER WARM AND ITCZ10P=EXTREME SOUTH AND NASH > 0.6) DROUGHT INDEX=NO DROUGHT

3C

RUN ‘STNDRDINDEX’ model - evaluating the model SPEI-3 MONTH for the station

Read the SPEI data for the chosen station

Read the PARAMETER for the station

Read the RV for the station

If the SPEI for the selected station is not available, estimate the SPEI using the following procedure:

SPEIJan, 2022 = meanJan +  bDec (SPEIDec,2021 – meanDec) + rvJan, 2022 \* sJan((1 - rDec2)^0.5)

SPEIFeb, 2022 = meanFeb +  bJan (SPEIJan,2022 – meanJan) + rvFeb, 2022 \* sFeb((1 - rJan2)^0.5)

SPEIAug, 2022 = meanAug +  bJul (SPEIJul,2022 – meanJul) + rvAug, 2022 \* sAug((1 - rJul2)^0.5)

Classify the monthly SPEI into drought class as follows:

If SPEI for month i > -0.5: No drought

If SPEI for month i ≤ -0.5 & >-1: Mild drought

If SPEI for month i ≤ -1 & >-1.5: Moderate drought

If SPEI for month i ≤ -1.5 & >-2: Severe drought

If SPEI for month i ≤ -2: Extreme drought

Draw a bar chart indicating the monthly drought pattern

1. Display: Draw the drought classification for the region (colour MAP1 depending on the drought classification for the region) and overlay with drought pattern for the station.
2. Comment page

Create an email to receive comments, questions and suggestions/FAQ

A button: continue or end or print the display

1. For 'continue', go to step 2.