

Post-processing of model output made easy

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NWP forecasts not perfect

- Systematic errors
- Uncertainty in the initial conditions
- Influence of the resolution of the model
- Global model to Regional domain

Model Output Statistics

- Determining a statistical relationship between forecast and observation
- Sufficient historical archive
- Quantify the systematic forecast errors (bias) for each observation point
- Error at each point is then used to correct future forecasts at the respective point
- MOS requires separate calculations of statistics based on forecast-observation pairs for each lead-time, for each observation location and for each variable

Warner, 2011

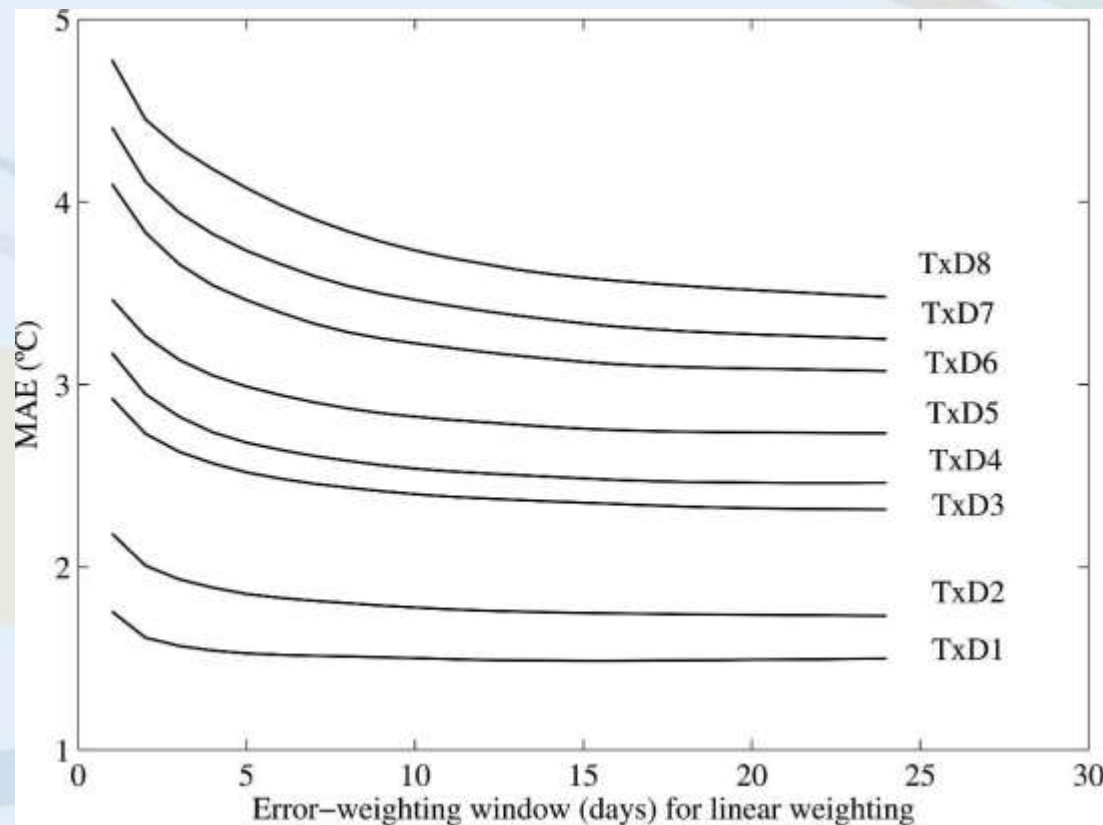
Model Output Statistics

- Short-training periods are possible for MOS-based methods
 - **HOWEVER:**
 - Longer lead-time forecasts
 - Rare-events
 - Surface variables with significant bias
- ALL need longer training periods

Warner, 2011

Model Output Statistics

- Short-training periods are possible for MOS-based methods



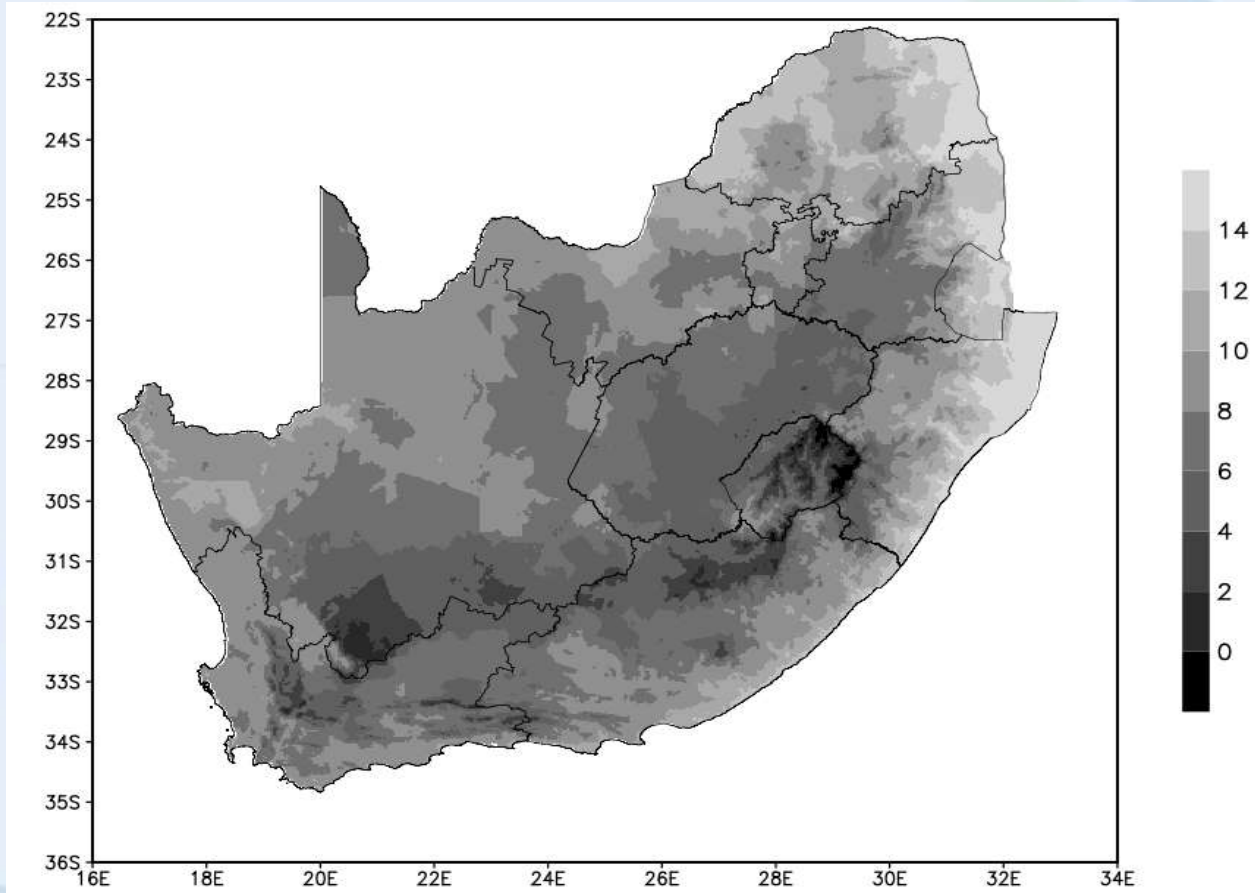
Warner, 2011

Model Output Statistics : Bias Correction Methods

- Very-short-update-period dynamic MOS
- Bias-calculation approach:
 - *Seasonal-mean-error* : average mean forecast error is calculated for 6-month period of previous “warm season”. Error then is used to correct forecast of “warm season”.
 - *Moving average with uniform weighting* : mean forecast error is calculated using an unweighted average of the bias error from the previous n days.
 - *Moving average with linear weighting* : Same, but linearly average, with recent errors weighing more – responsive to regime changes but have long averaging period in order to provide statistical stability
 - *Moving average with non-linear weighting* : Same, but using a nonlinearly weighted average.

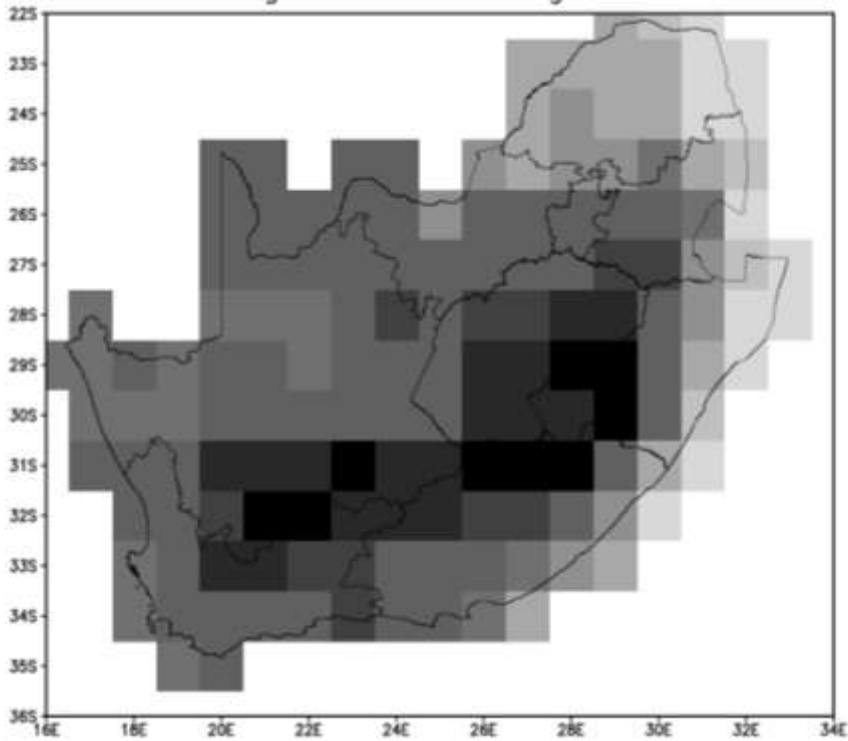
Warner, 2011

Bias Correction Methods : A SAWS Example



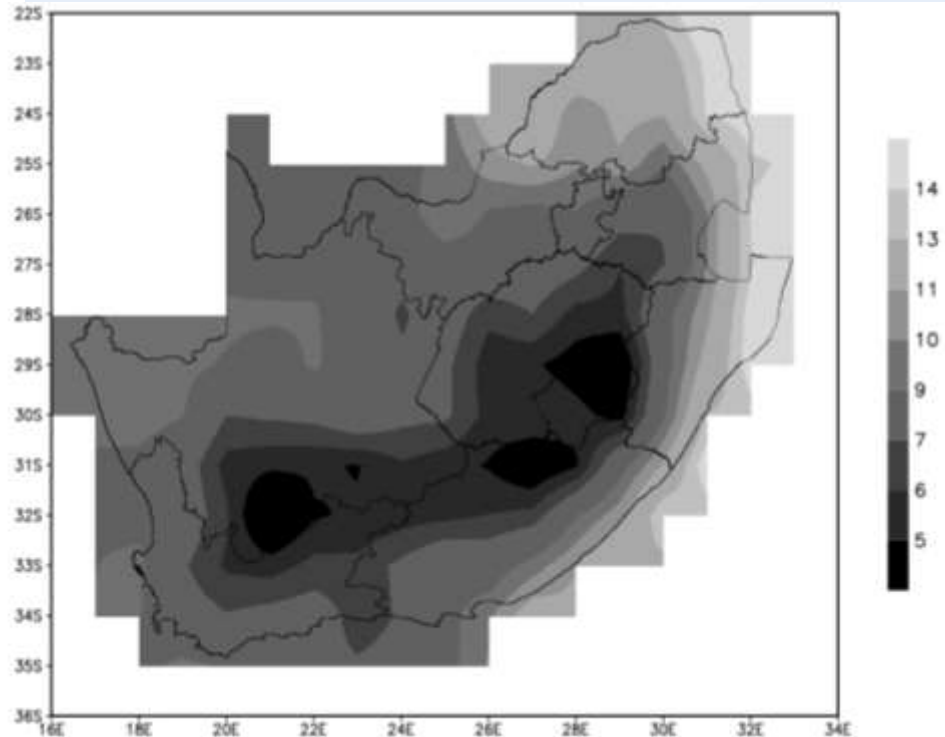
Marx & Landman, 2011

Bias Correction Methods : A SAWS Example



1Deg NCEP forecast

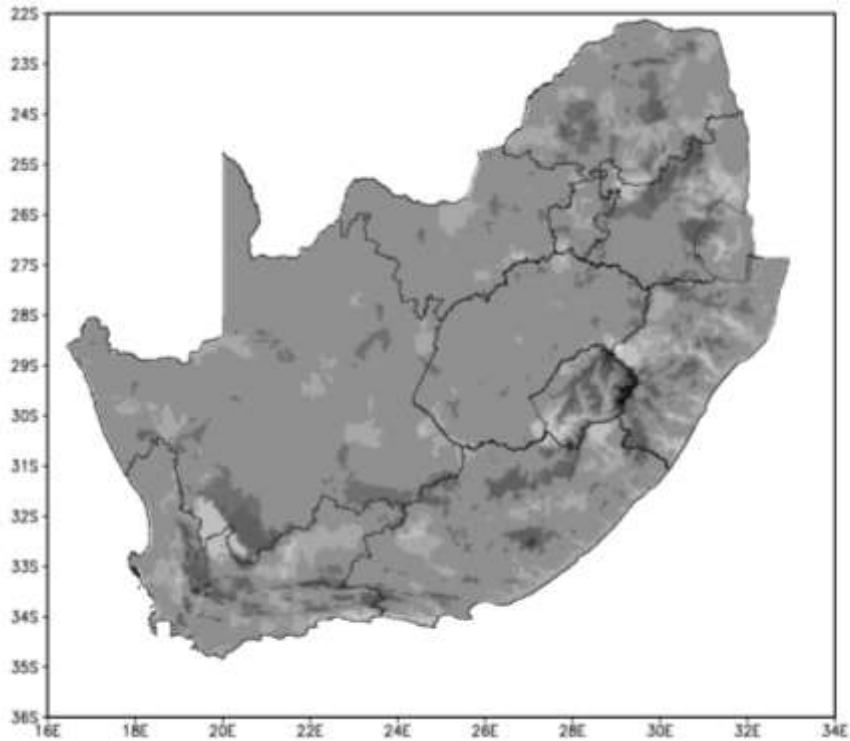
1' NCEP bi-linear
interpolation forecast



Marx & Landman, 2011

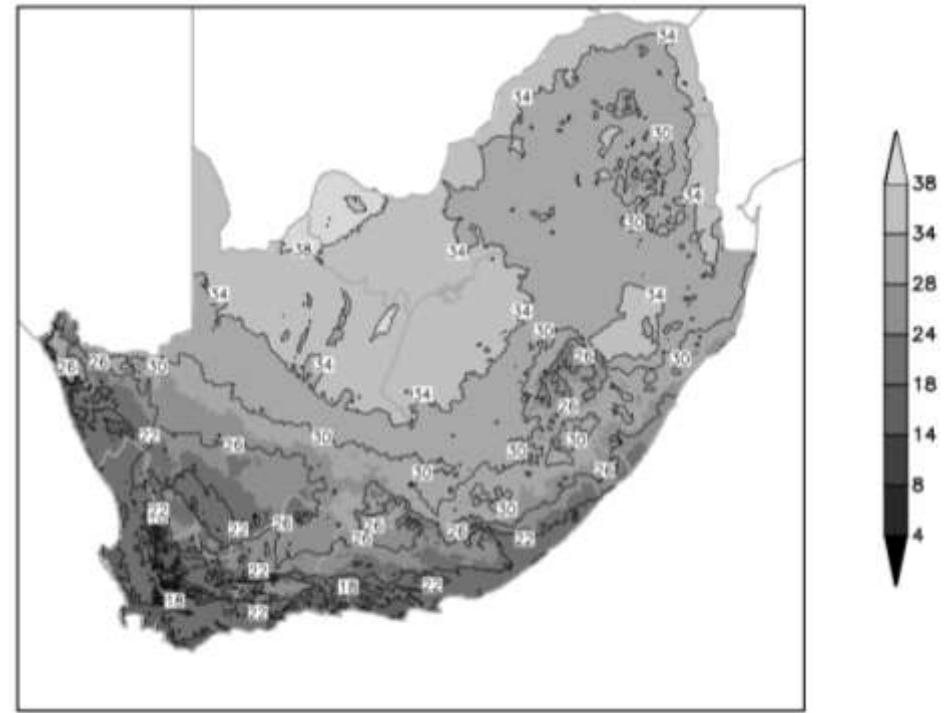
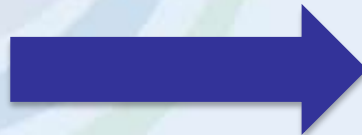
Doc Ref no: RES-PSN-SWFDP_Bias_cor

Bias Correction Methods : A SAWS Example



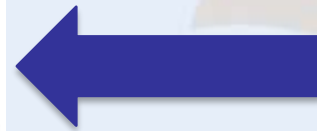
Average monthly map - NCEP
1' interpolated forecast
CLIMATE ERROR

CLIMATE ERROR
field applied to 1'
interpolated forecast



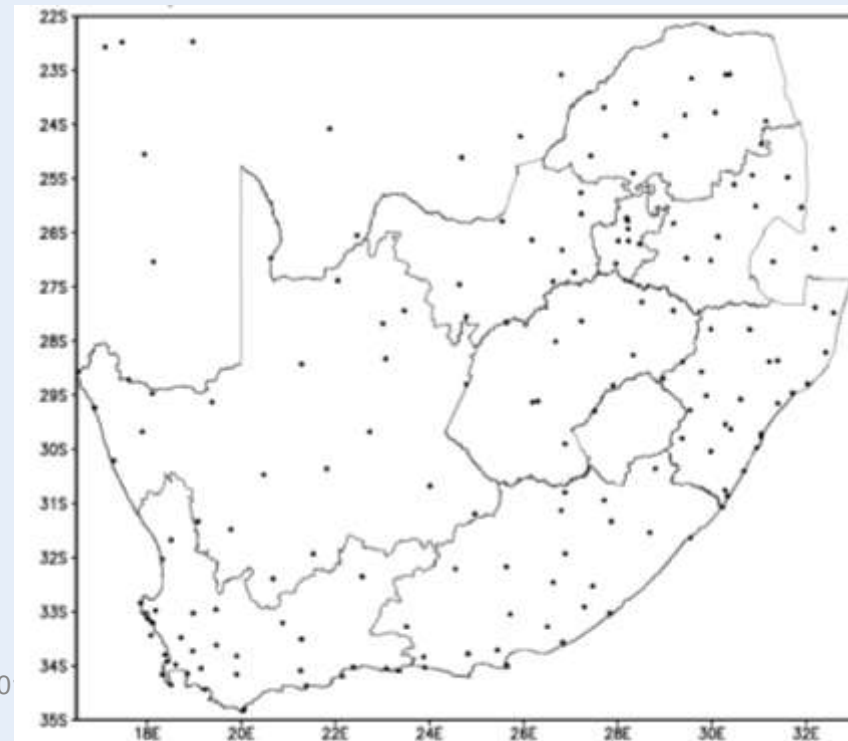
Marx & Landman, 2011

Bias Correction Methods : A SAWS Example

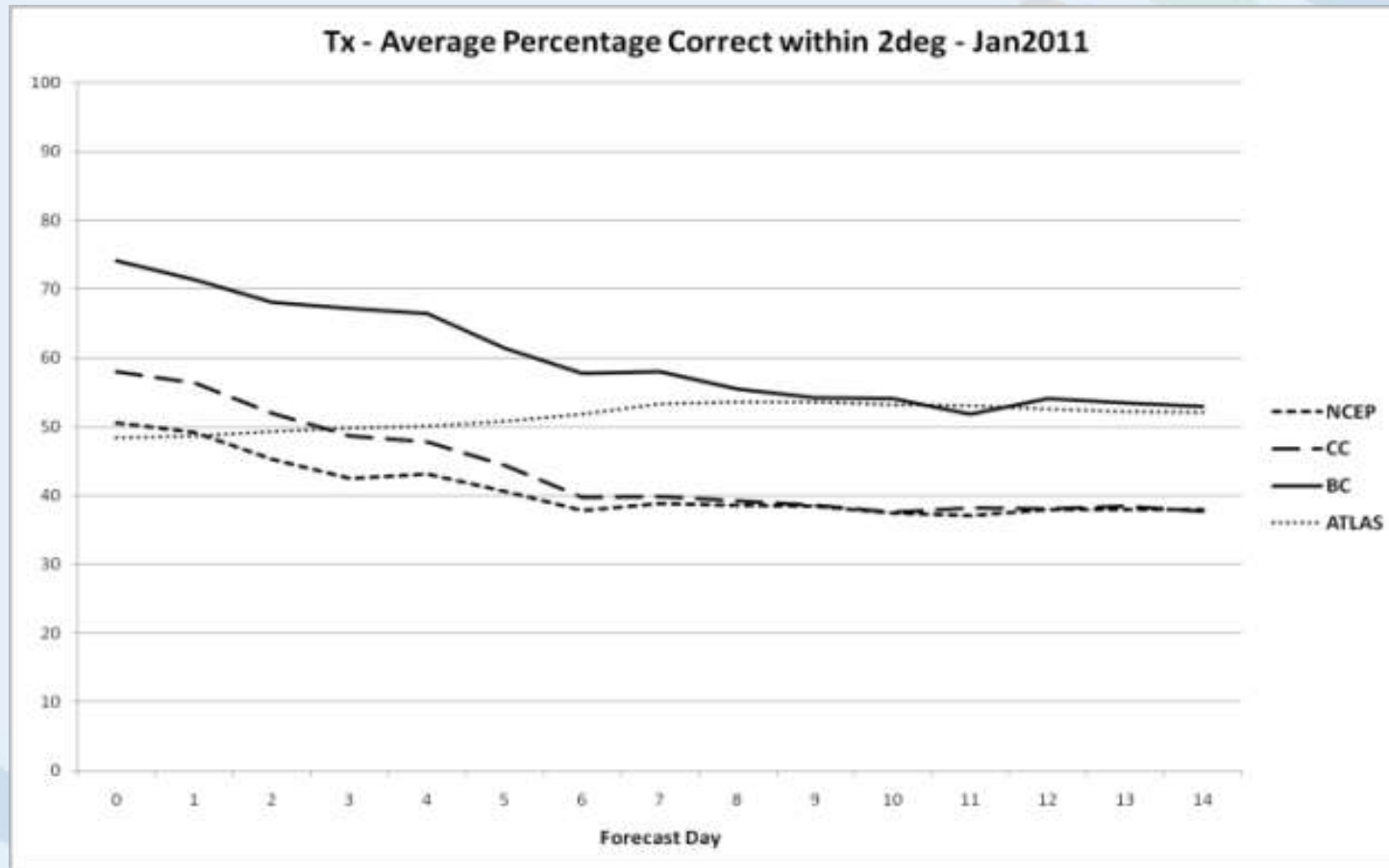


14-day running unweighted bias corrections on 167 stations – inverse bi-linear interpolation to apply bias to whole domain

CLIMATE-BIAS CORRECTED FORECAST



Bias Correction Methods : A SAWS Example



Marx & Landman, 2011

Doc Ref no: RES-PSN-SWFDP_Bias_correction-20121116-LAN002.1

Bias Correction Methods : Made Easy

1. Daily minimum and maximum temperature forecast
2. Daily minimum and maximum temperature observations
3. Calculate daily: $Bias = (F - O)$
4. After at least 14-days, calculate:

$$raBias = \frac{1}{n} \sum_{k=1}^n (F_k - O_k)$$

Bias Correction Methods : Made Easy

5. For new forecast:

$$\textit{newFcst} = \textit{NWPfcst} - \textit{raBias}$$

5. New forecast now bias corrected!

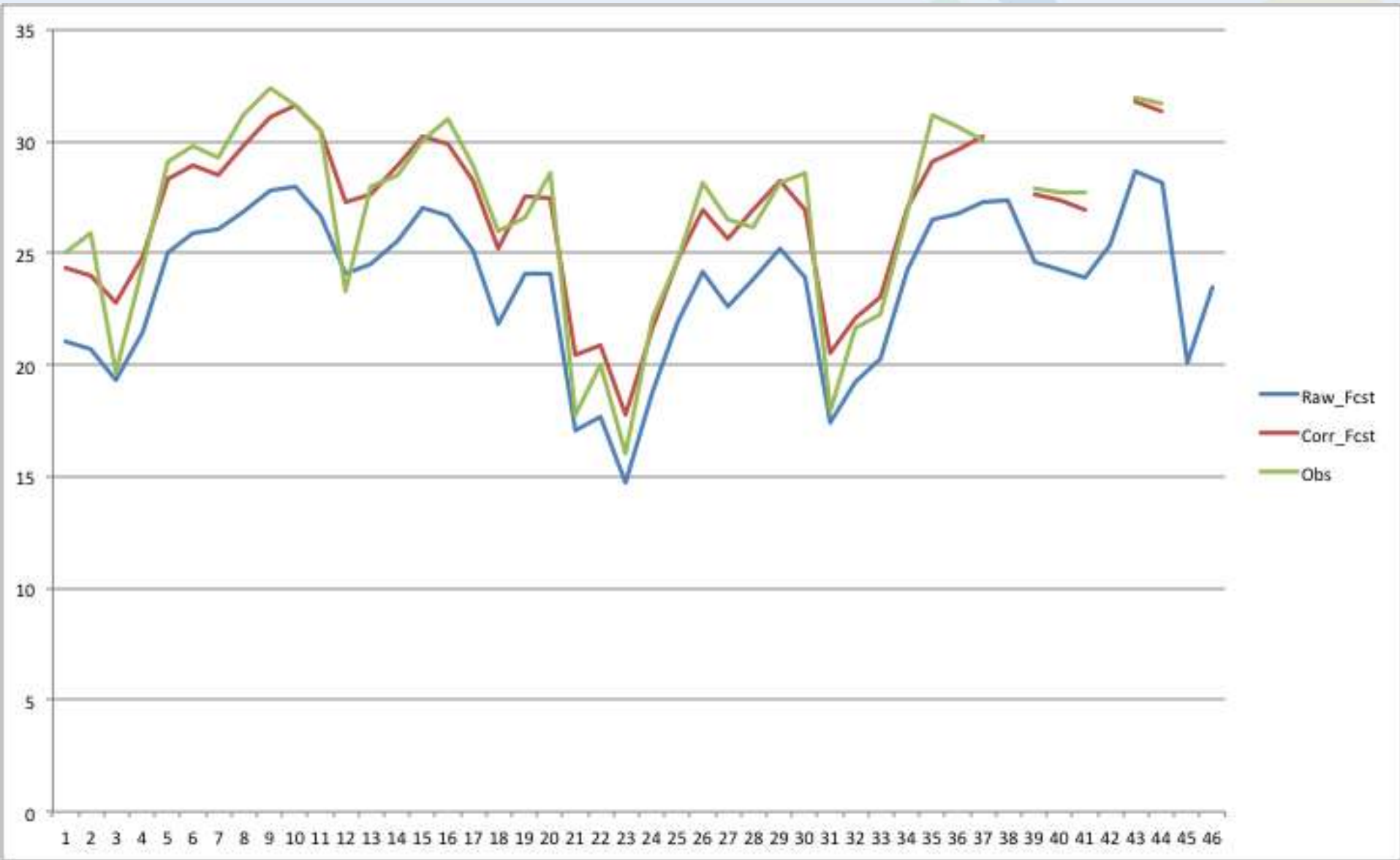
6. Adjust *raBias* daily for current 14-day average.

7. Apply to Tn and Tx.

Bias Correction Methods : Made Easy - example

Date	ID	Lat	Lon	Txo	Txf	Bias	14d mean	Tnf bc
20120801	68262	-25,74	28,18	222		-		
20120802	68262	-25,74	28,18	208	18,1	-2,7	-	
20120803	68262	-25,74	28,18	231	20,2	-2,9	-	
20120804	68262	-25,74	28,18	248	22,2	-2,6	-	
20120805	68262	-25,74	28,18	260	22,6	-3,4	-	
20120806	68262	-25,74	28,18	256	17,9	-7,7	-	
20120807	68262	-25,74	28,18	215	8,9	-12,6	-	
20120808	68262	-25,74	28,18	89	12,4	3,5	-	
20120809	68262	-25,74	28,18	148	15,5	0,7	-	
20120810	68262	-25,74	28,18	183	18,3	0	-	
20120811	68262	-25,74	28,18	219	21,1	-0,8	-	
20120812	68262	-25,74	28,18	251	12,3	-12,8	-	
20120813	68262	-25,74	28,18	154	16,6	1,2	-	
20120814	68262	-25,74	28,18	206	19,8	-0,8	-	
20120815	68262	-25,74	28,18	285	23,9	-4,6	-3,25	
20120816	68262	-25,74	28,18	250	21,1	-3,9	-3,33571	24,35
20120817	68262	-25,74	28,18	259	20,7	-5,2	-3,5	24,03571
20120818	68262	-25,74	28,18	197	19,3	-0,4	-3,34286	22,8
20120819	68262	-25,74	28,18	244	21,5	-2,9	-3,30714	24,84286
20120820	68262	-25,74	28,18	291	25	-4,1	-3,05	28,30714
20120821	68262	-25,74	28,18	298	25,9	-3,9	-2,42857	28,95
20120822	68262	-25,74	28,18	293	26,1	-3,2	-2,90714	28,52857
20120823	68262	-25,74	28,18	312	26,9	-4,3	-3,26429	29,80714
20120824	68262	-25,74	28,18	324	27,8	-4,6	-3,59286	31,06429
20120825	68262	-25,74	28,18	316	28	-3,6	-3,79286	31,59286
20120826	68262	-25,74	28,18	305	26,7	-3,8	-3,15	30,49286
20120827	68262	-25,74	28,18	233	24,1	0,8	-3,17857	27,25

Bias Correction Methods :



Bias Correction Methods : Made Easy

QUESTIONS?