

Leveraging the 'Analysis of Record for Calibration' (AORC) to Improve Precipitation and Temperature Inputs for Hydrologic Modeling

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Introduction:

- Protecting lives and property is reliant upon timely and accurate forecasts
- Deterministic and probabilistic forecasts are dependent upon consistent, long-term datasets
- Objective:** Leveraging AORC to address spatial and temporal concerns with existing datasets

Data Sources:

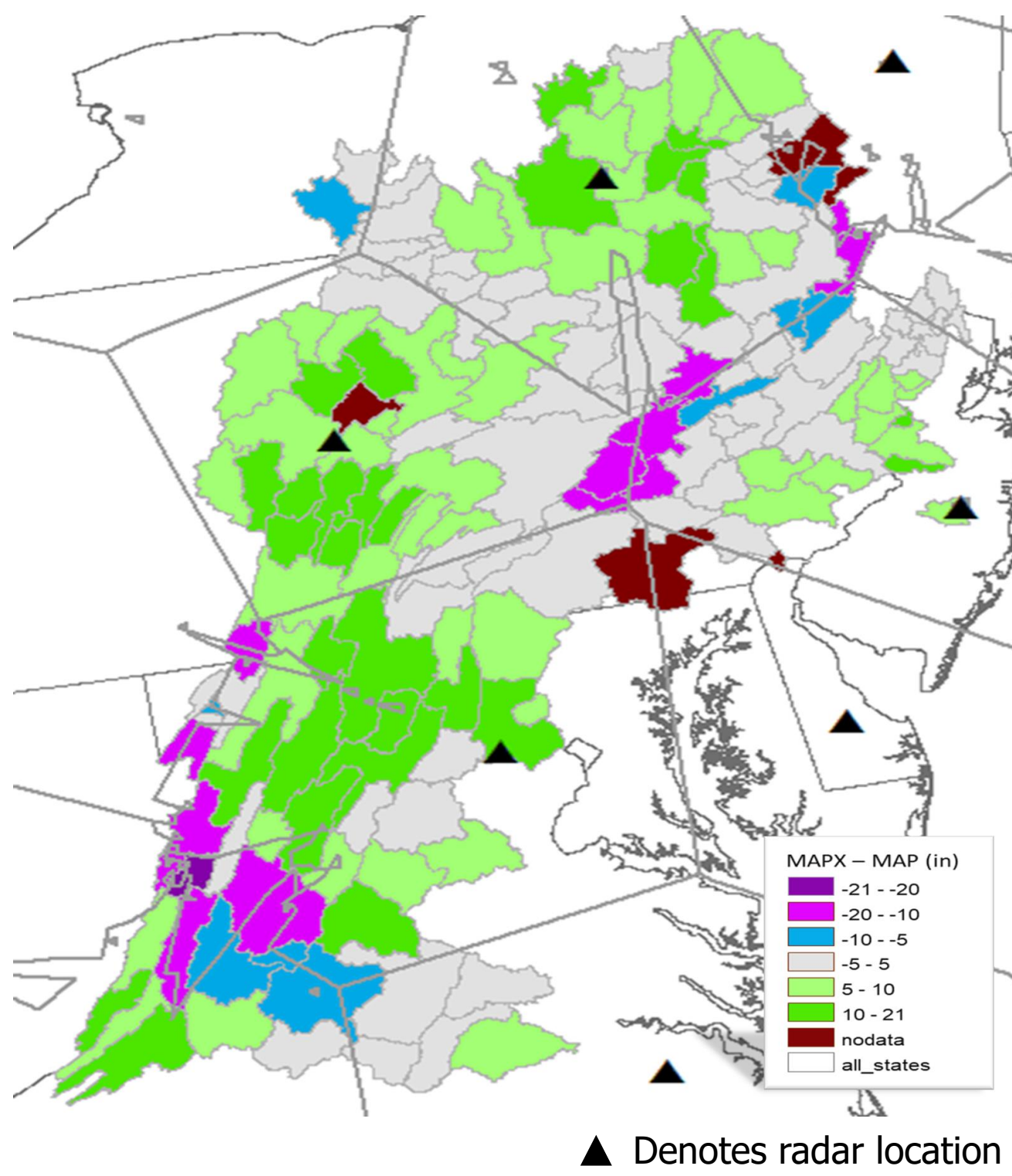
- MAP: Mean Areal Precipitation (gage-estimated)
- MAPX: Radar-based MAP with gage corrections
- MAT: Mean Areal Temperature
- RTMA: Real-time Mesoscale Analysis

Precipitation Temperature

Data Source	Short Name	Years of Availability
MARFC Gage-based Calibration	MAP-Cal	1949 - 1998
MARFC Gage-based Real-time	MAP-RT	1998 -, varies per site
MARFC Radar-based Real-time	MAPX-RT	2003 -, varies per site
OWP Analysis of Record	AORC	1979 - 2017

Data Source	Short Name	Years of Availability
NWSRFS Calibration Algorithm	MAT-Cal	1949 - 1998
NWSRFS Operational Algorithm	MAT-RT	2001 - 2013, varies per site
RTMA	RTMA	2014 -, varies per site
OWP Analysis of Record	AORC	1979 - 2017

- MAPX estimates often lower than cumulative MAP estimates further from radar, especially during the cold season



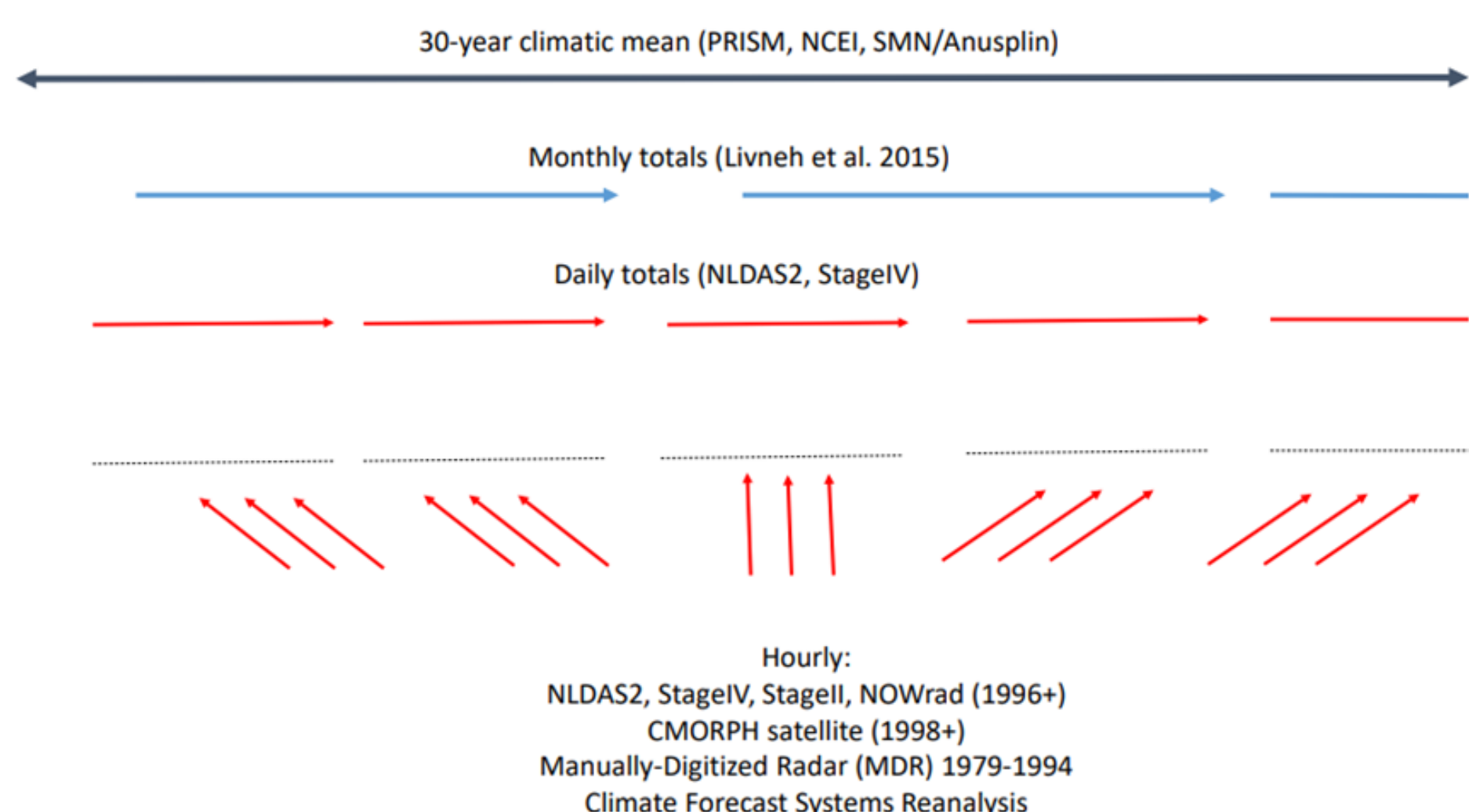
Challenges:

- Radar Proximity
- Bright banding
- Radar blockage
- Sparse gage networks

5-year analysis
8/2013 - 7/2018

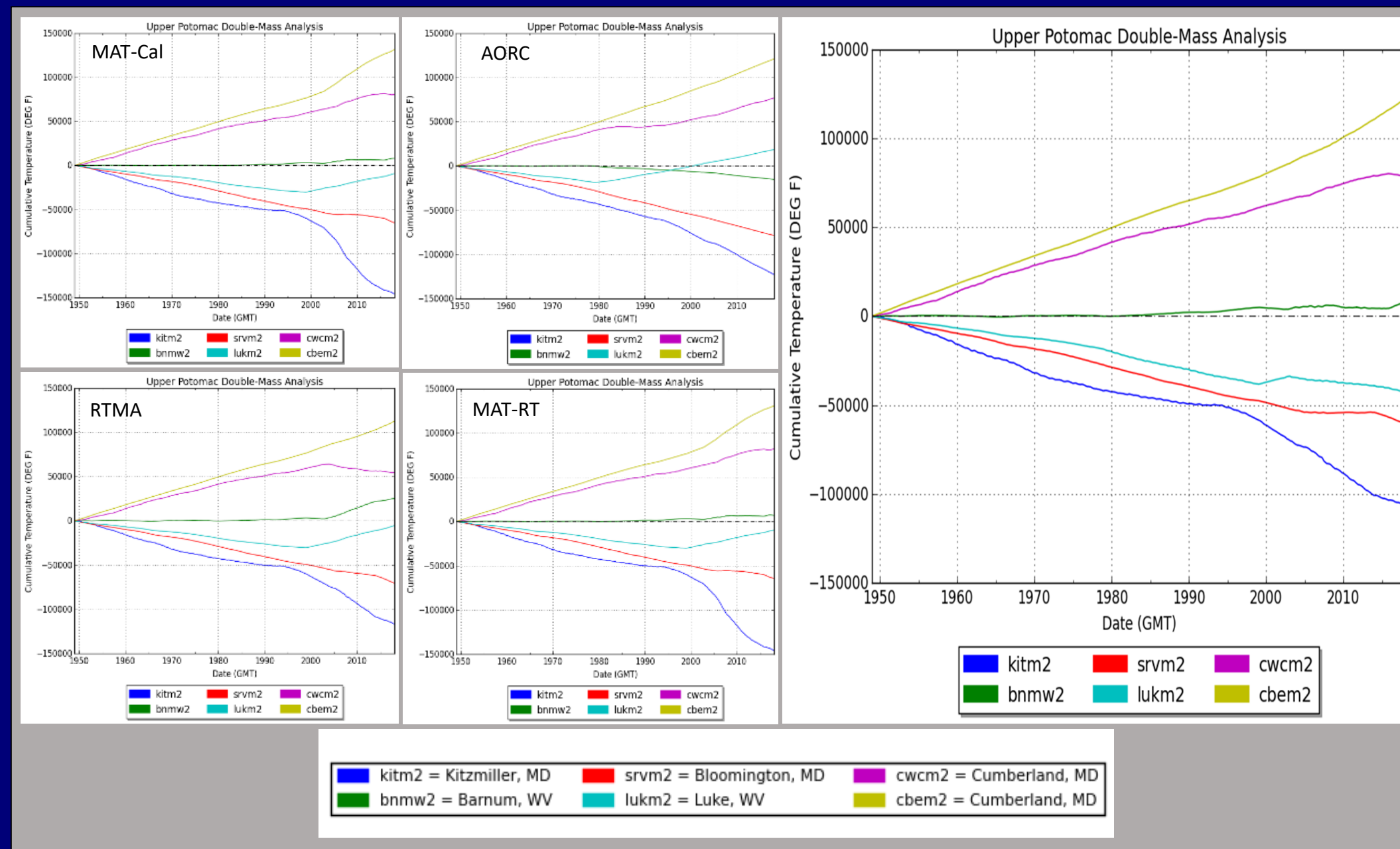
AORC:

- Long-term, high resolution dataset developed to be single source of meteorological data for model calibration
- Addresses some sources of inconsistency

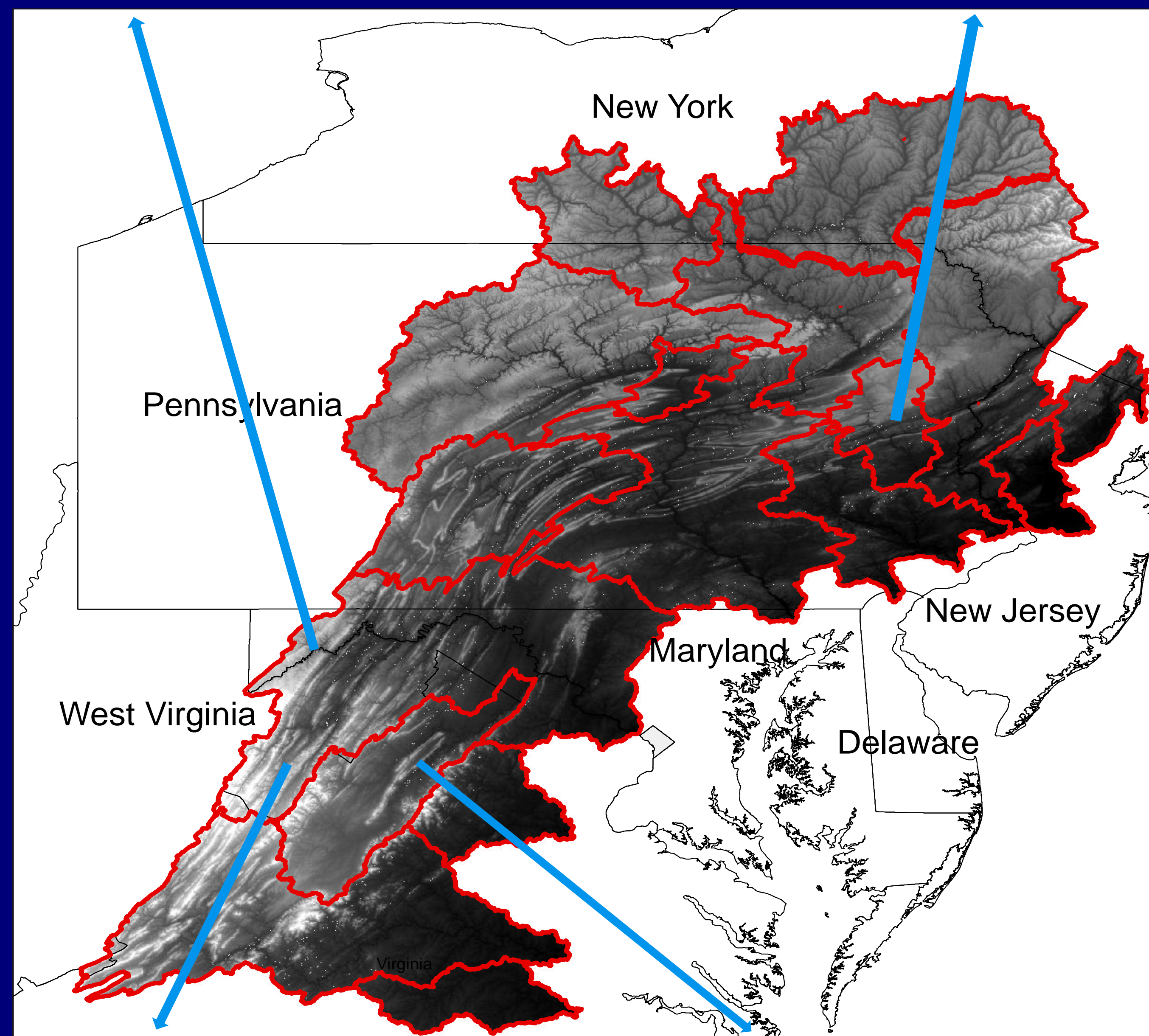
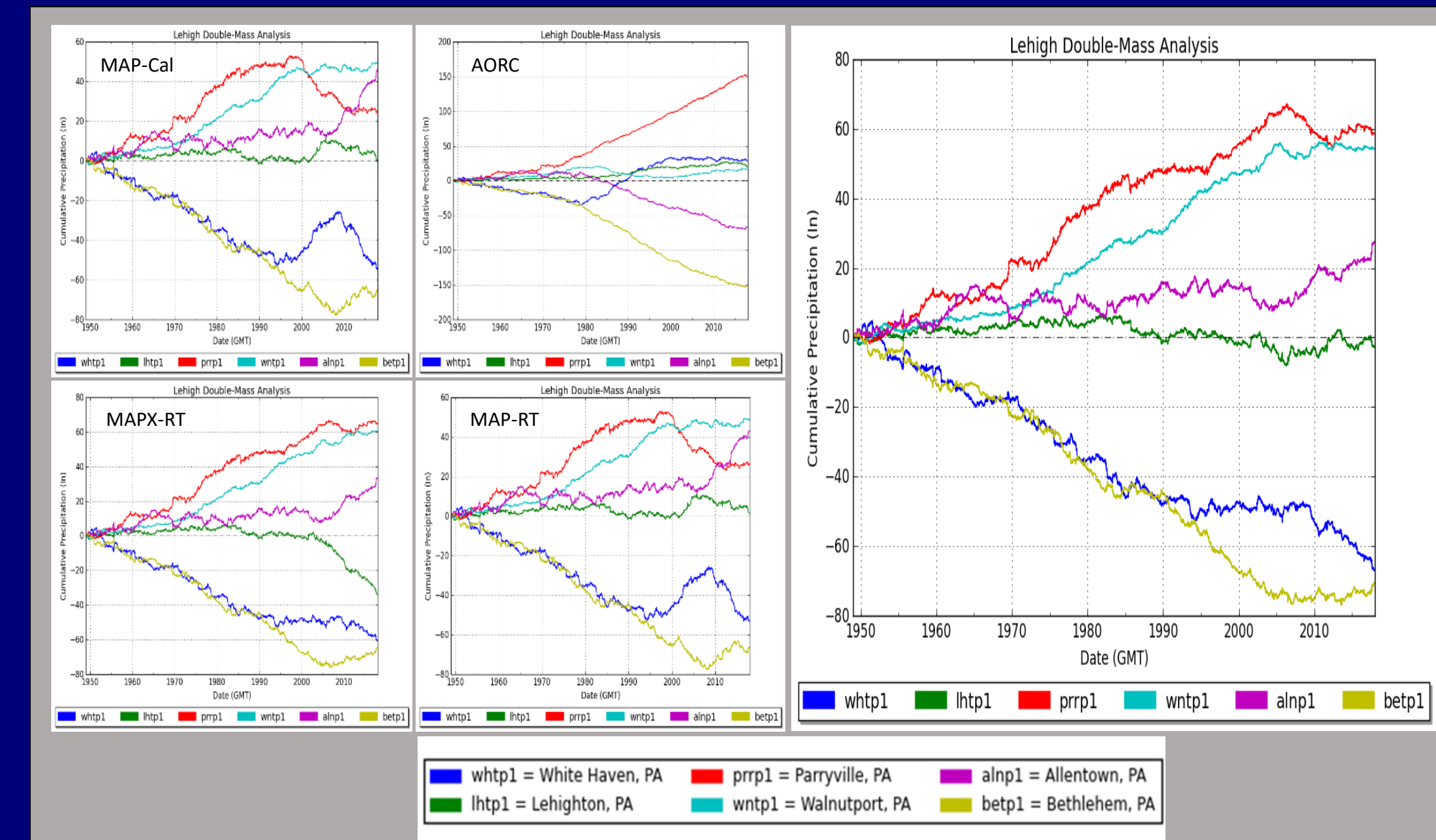


Conclusion: Utilizing AORC addresses spatial and temporal inconsistencies for MAP and MAT in the MARFC basin

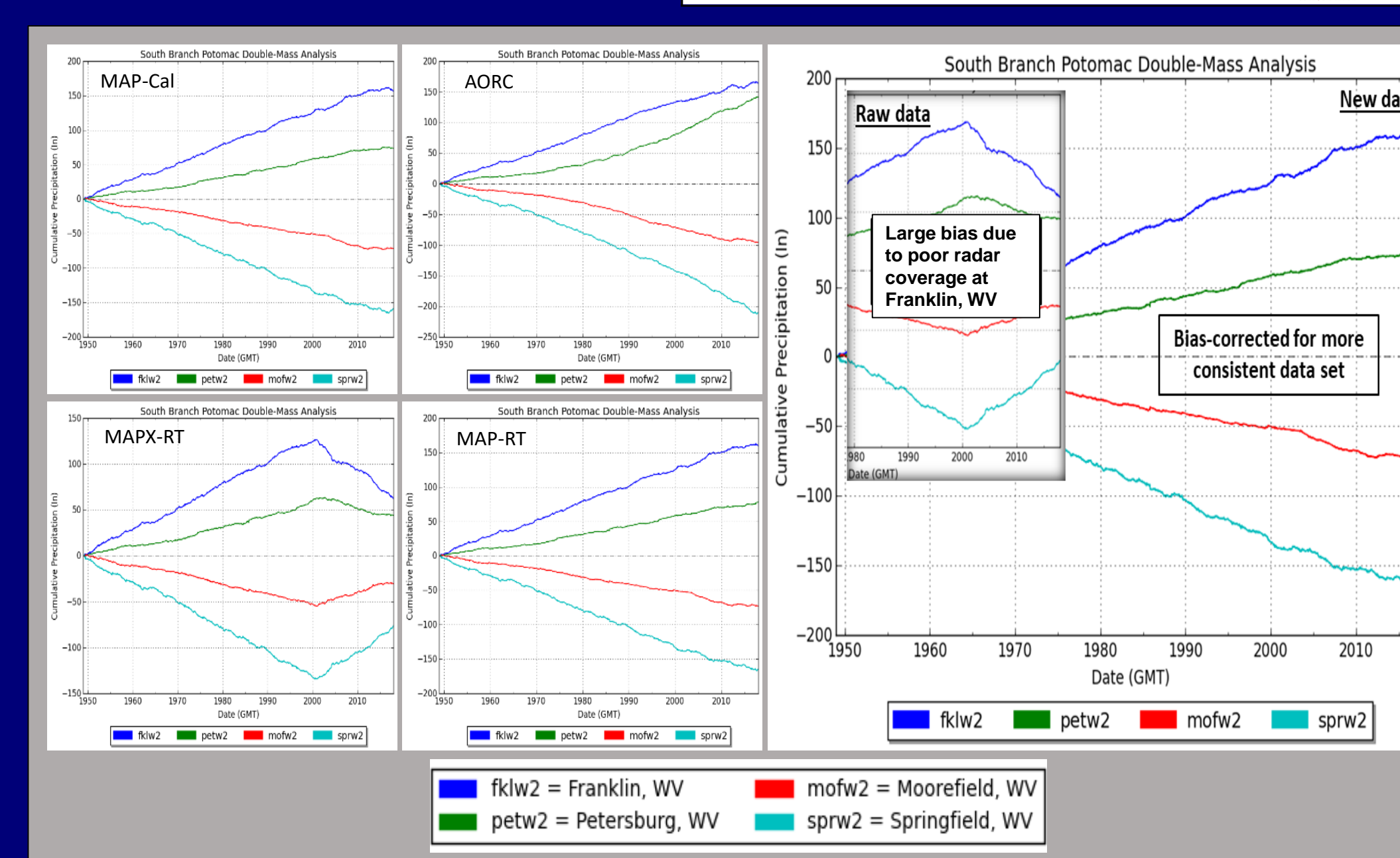
MAT



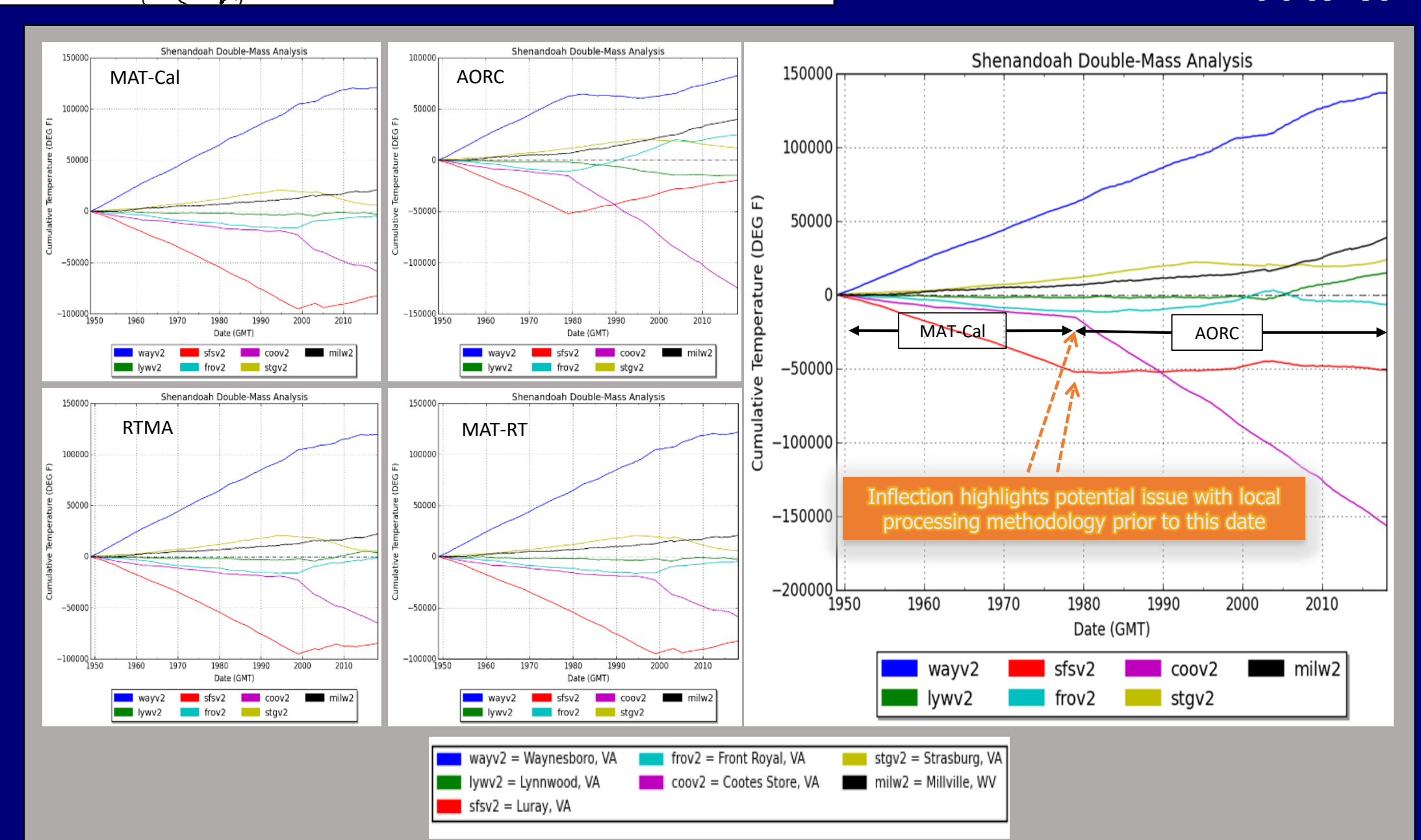
MAP



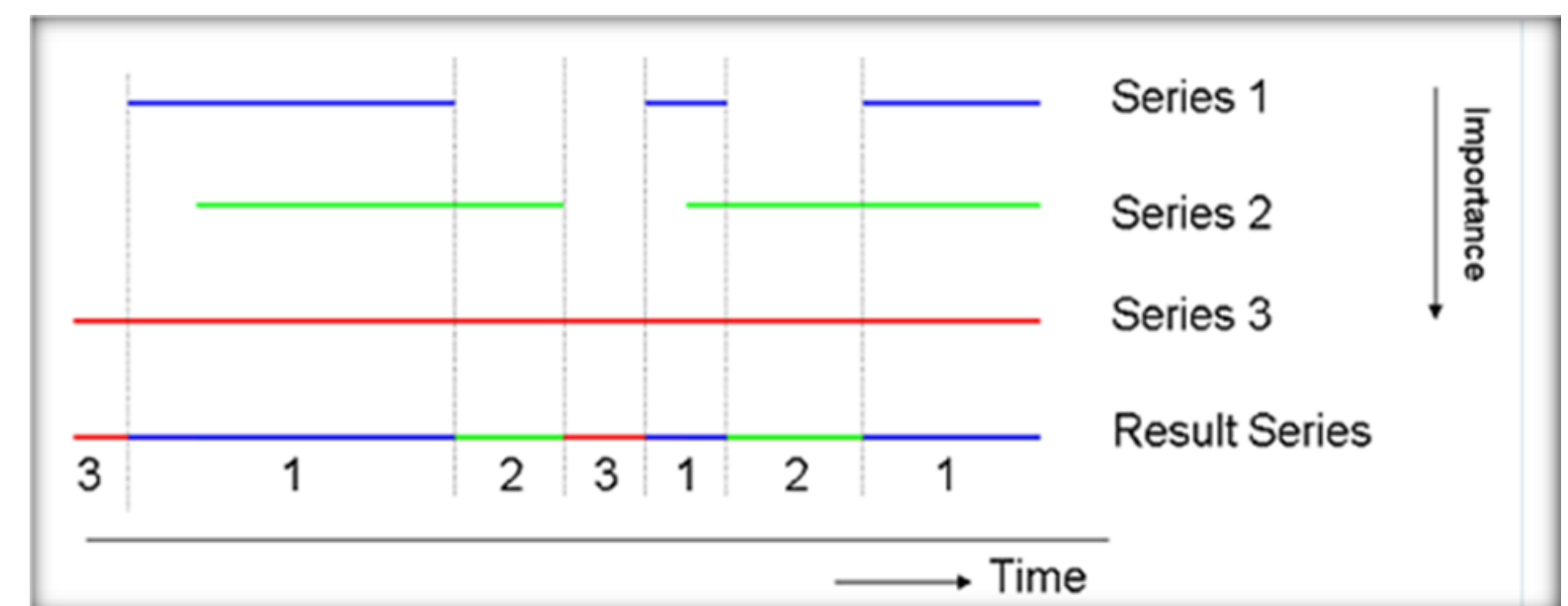
MAP



MAT



Methods:
Merging Data:



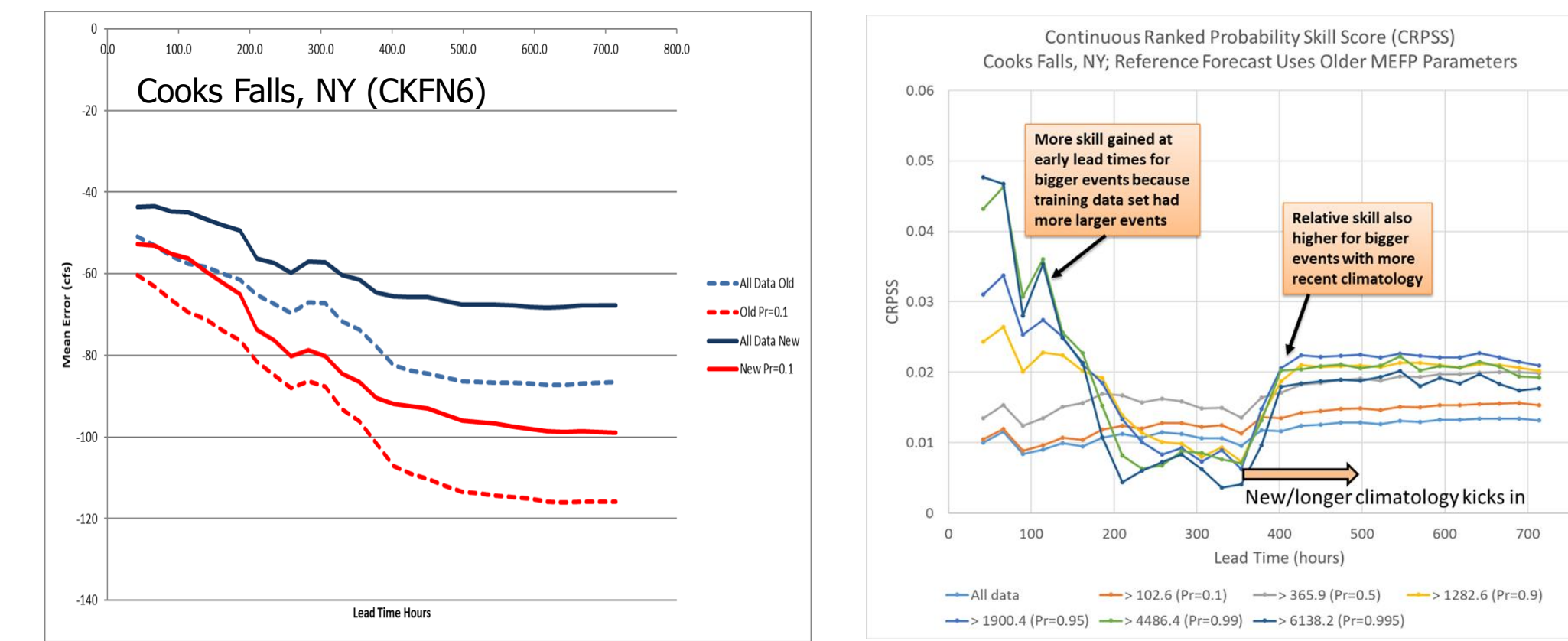
- Datasets used in merge process (Figure in center: 4 smaller plots correspond with graphic below, larger plot to right represents 'best' combination)

Upper left	Upper right	Upper left	Upper right
MAT-Cal:	AORC:	MAP-Cal:	AORC:
1) MAT-Cal	1) AORC	1) MAP-Cal	1) AORC
2) MAT-RT	2) MAT-Cal	2) MAP-RT	2) MAP-Cal
3) RTMA	3) MAT-RT	3) MAPX-RT	3) MAP-RT
4) AORC	4) RTMA	4) AORC	4) MAPX-RT
Lower left	Lower right	Lower left	Lower right
RTMA:	MAT-RT:	MAPX-RT:	MAP-RT:
1) MAT-Cal	1) MAT-RT	1) MAP-Cal	1) MAP-RT
2) RTMA	2) MAT-RT	2) MAPX-RT	2) MAP-RT
3) AORC	3) AORC	3) AORC	3) AORC
4) MAT-RT	4) RTMA	4) MAP-RT	4) MAPX-RT

Double Mass Analysis:

- Often applied to station data, applied to basins in this example
- Highlights inconsistencies as long term shifts in the general slope of the station accumulation curve
- Plots accumulation for a basin minus the average accumulation of a basin forecast group

Example use of merged data in ensemble forecasting



Less Bias

Higher Skill

Analysis was conducted on 21 forecast groups, each containing anywhere from 3 to 18 basins

In general, improved bias in calibrations and skill in probabilistic forecasts for the MARFC basin

AORC will be used to calibrate version 2.1 of the National Water Model