# Updates on CBP Phase 6 Watershed Model and DLEM Comparisons

CHAMP Meeting – February 2019

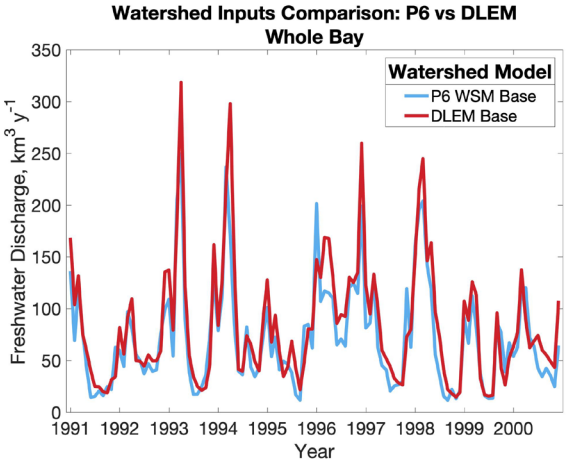
# Presentation Outline

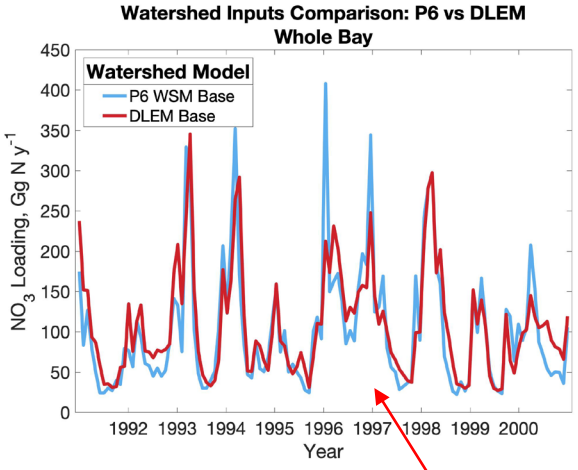
1. Comparison of Phase 6 Watershed Model (**P6WSM**) and Dynamic Land Ecosystem Model (**DLEM**) calibrations

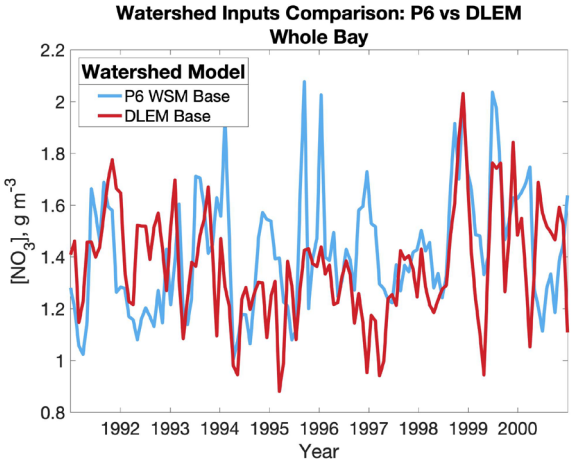
2. Agreement in how delta change data are applied in climate change simulations – **Yuanzhi Yao** & **Zihao Bian**

# Kyle & Pierre have shown P6WSM and DLEM comparisons

## Chesapeake Bay Watershed –

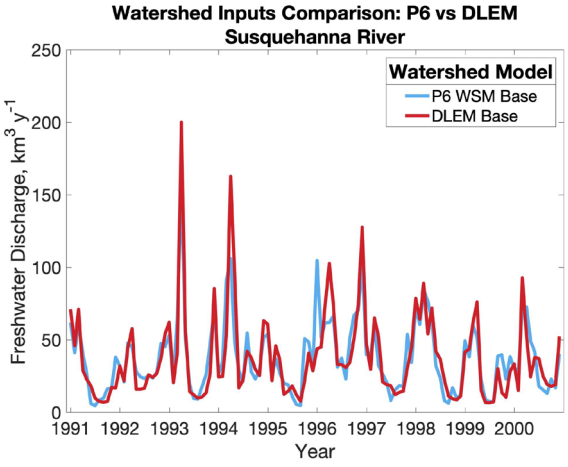


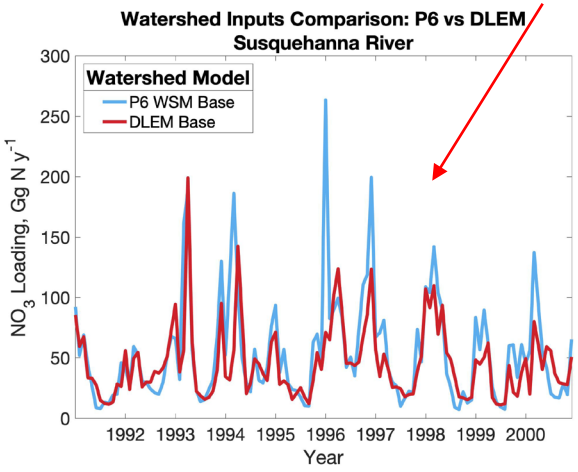



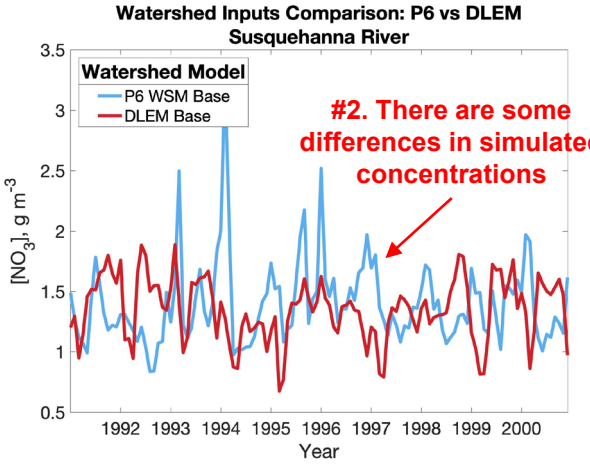




**#1. There is good agreement in P6WSM and DLEM monthly Nitrate Loads**

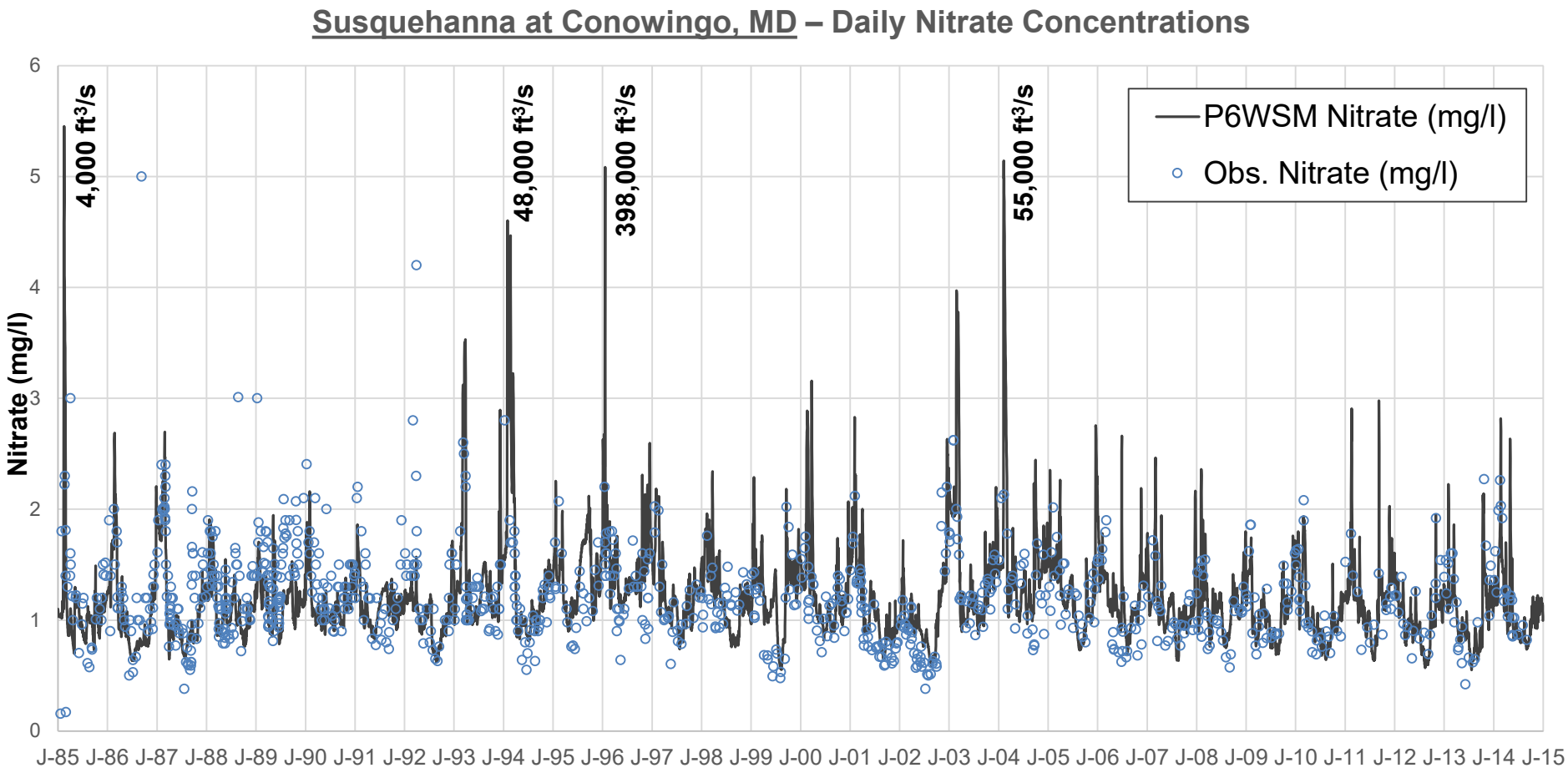
## Susquehanna River Basin –

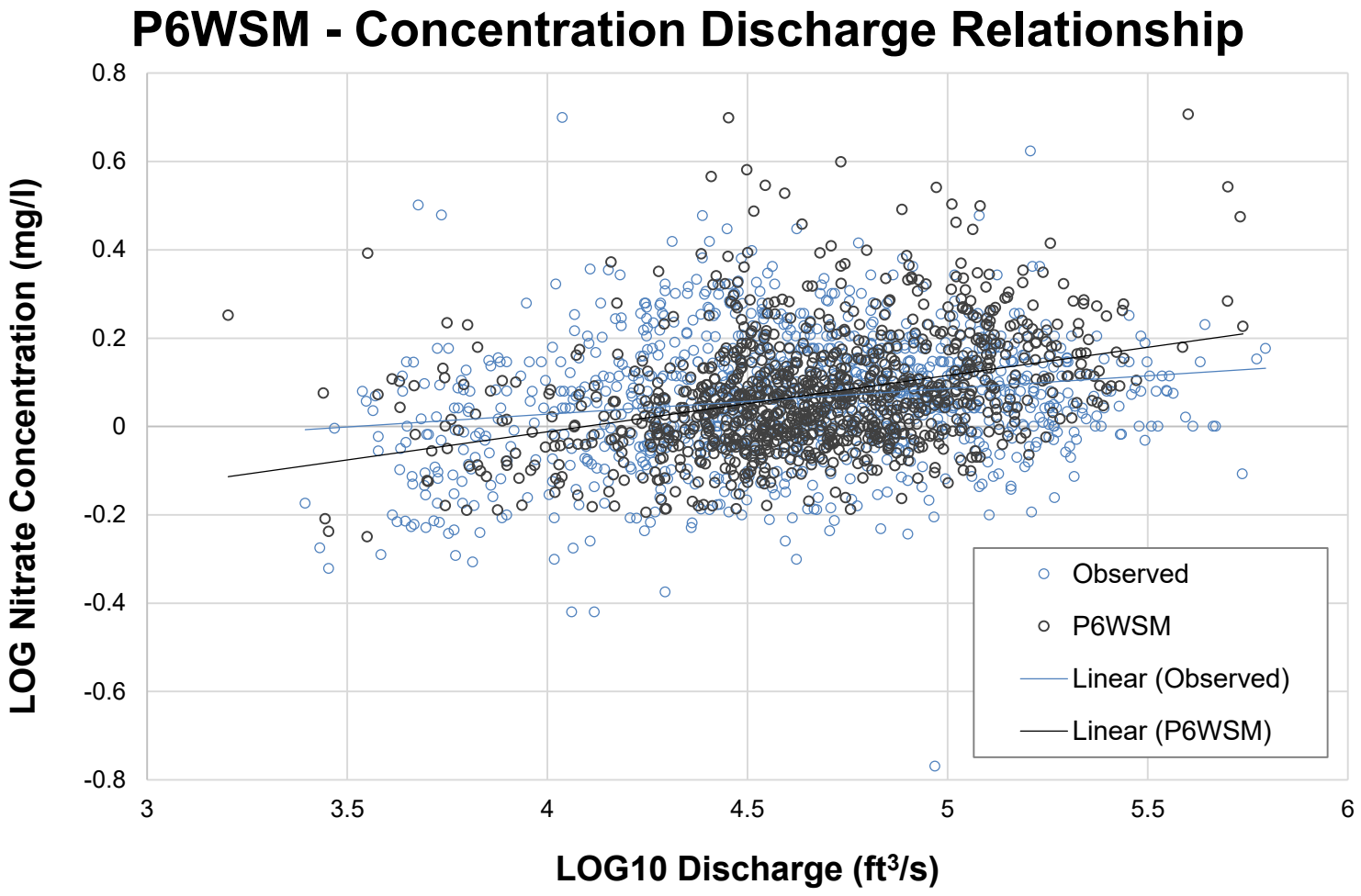


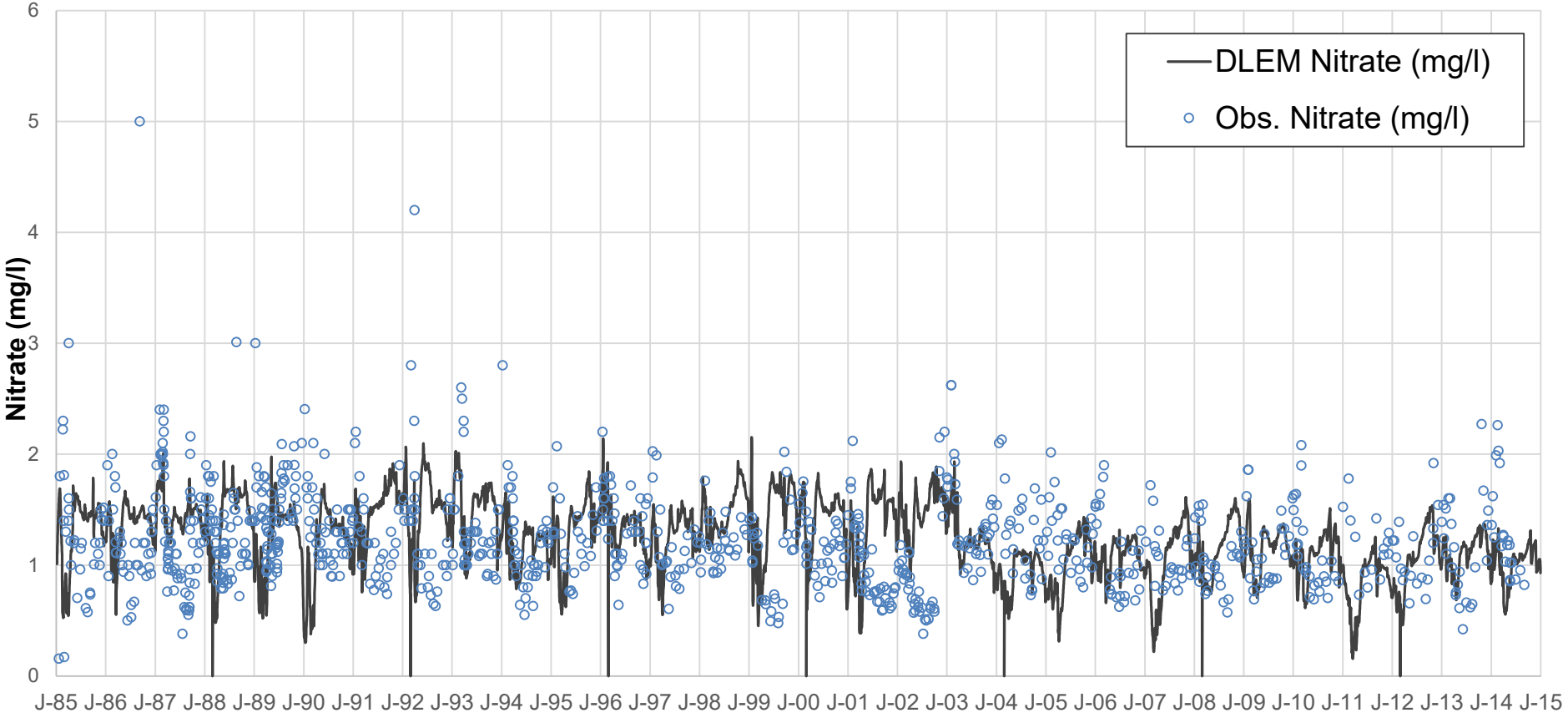



# Nitrate Concentrations (daily)

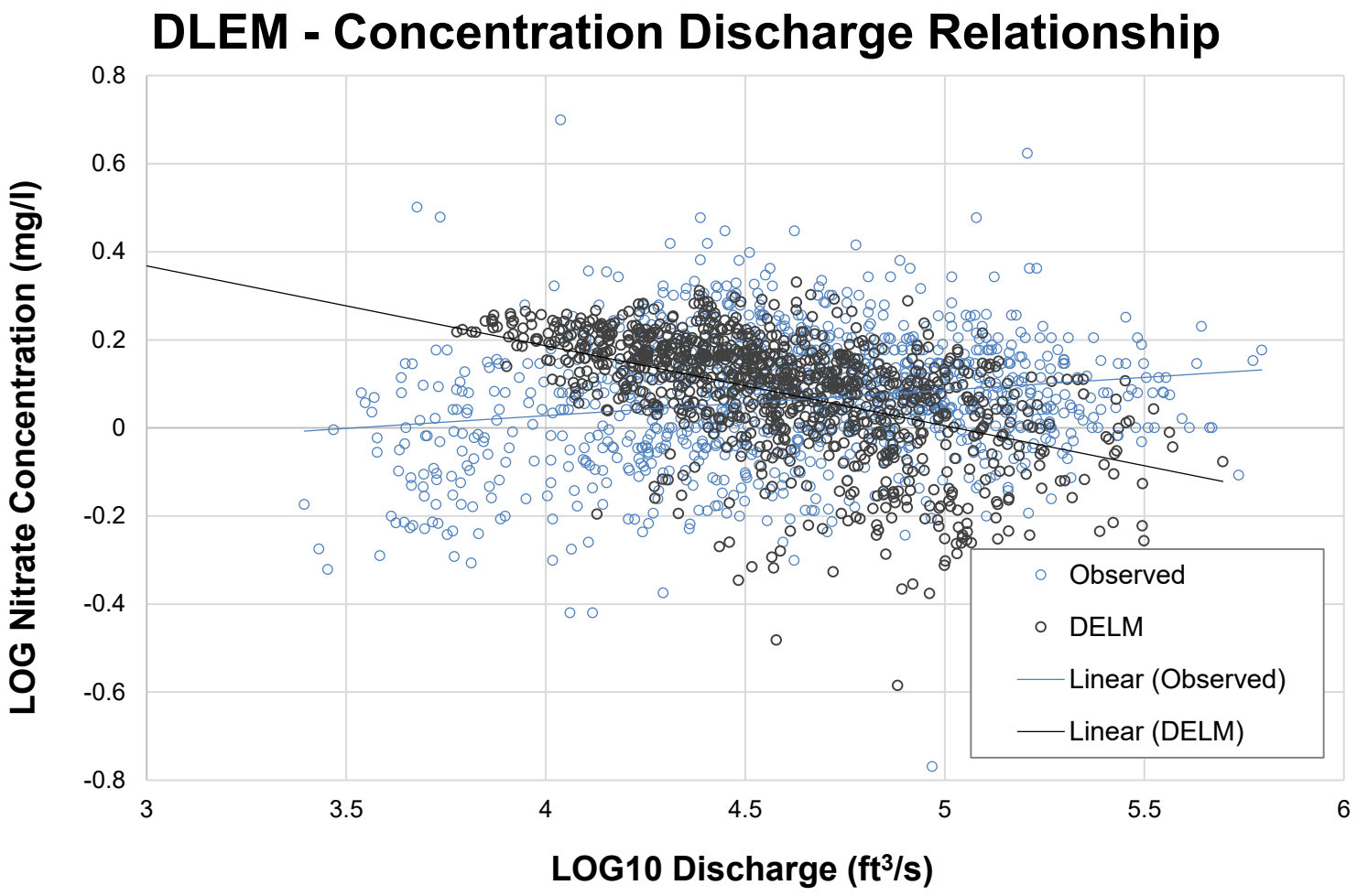



P6WSM - Concentration Discharge Relationship
LOG Nitrate Concentration (mg/l)
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
3
3.5
4
4.5
5
5.5
6
LOG10 Discharge (ft3/s)
Observed
P6WSM
Linear (Observed)
Linear (P6WSM)

## Susquehanna at Conowingo, MD – Daily Nitrate Concentrations

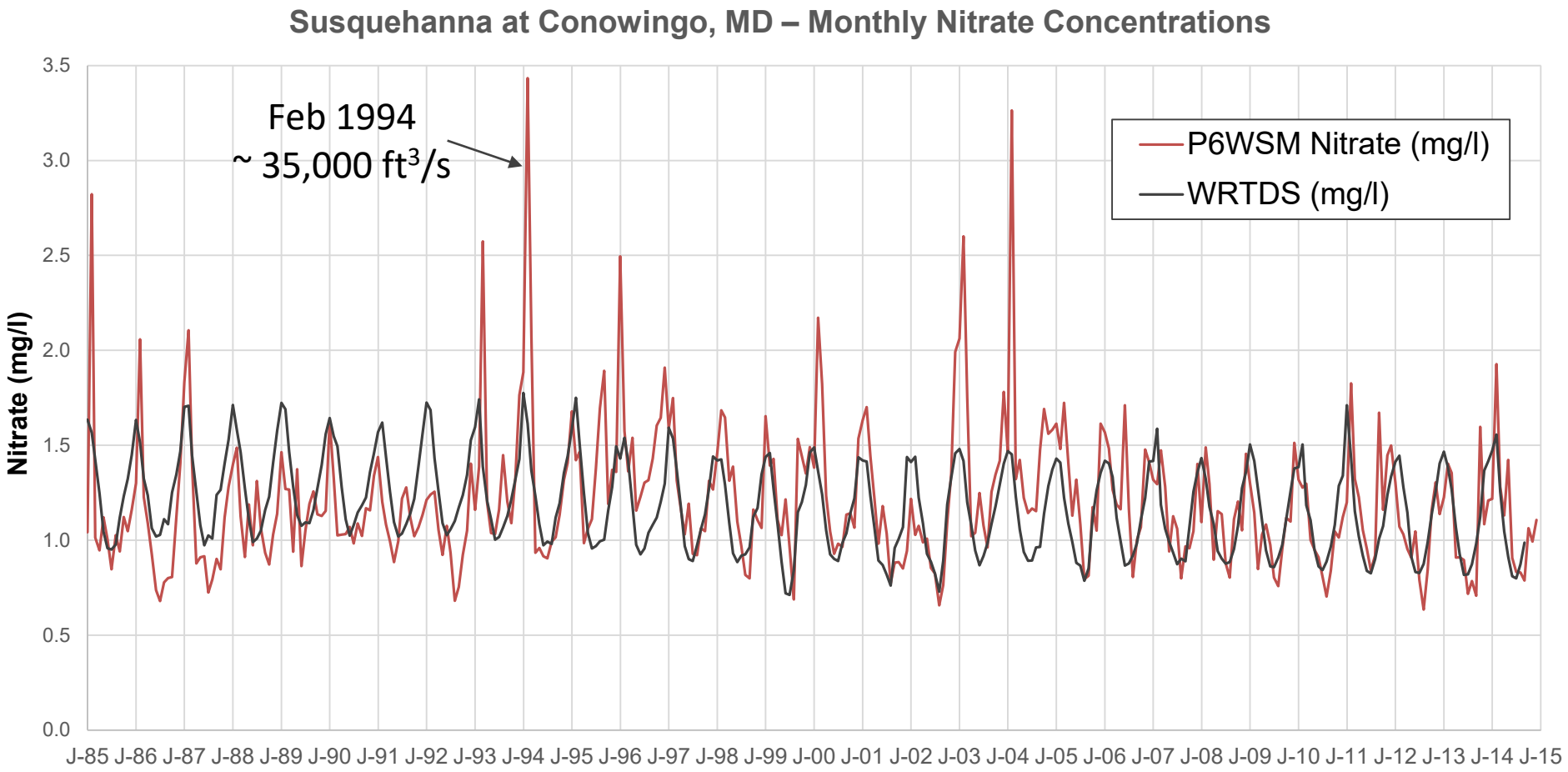


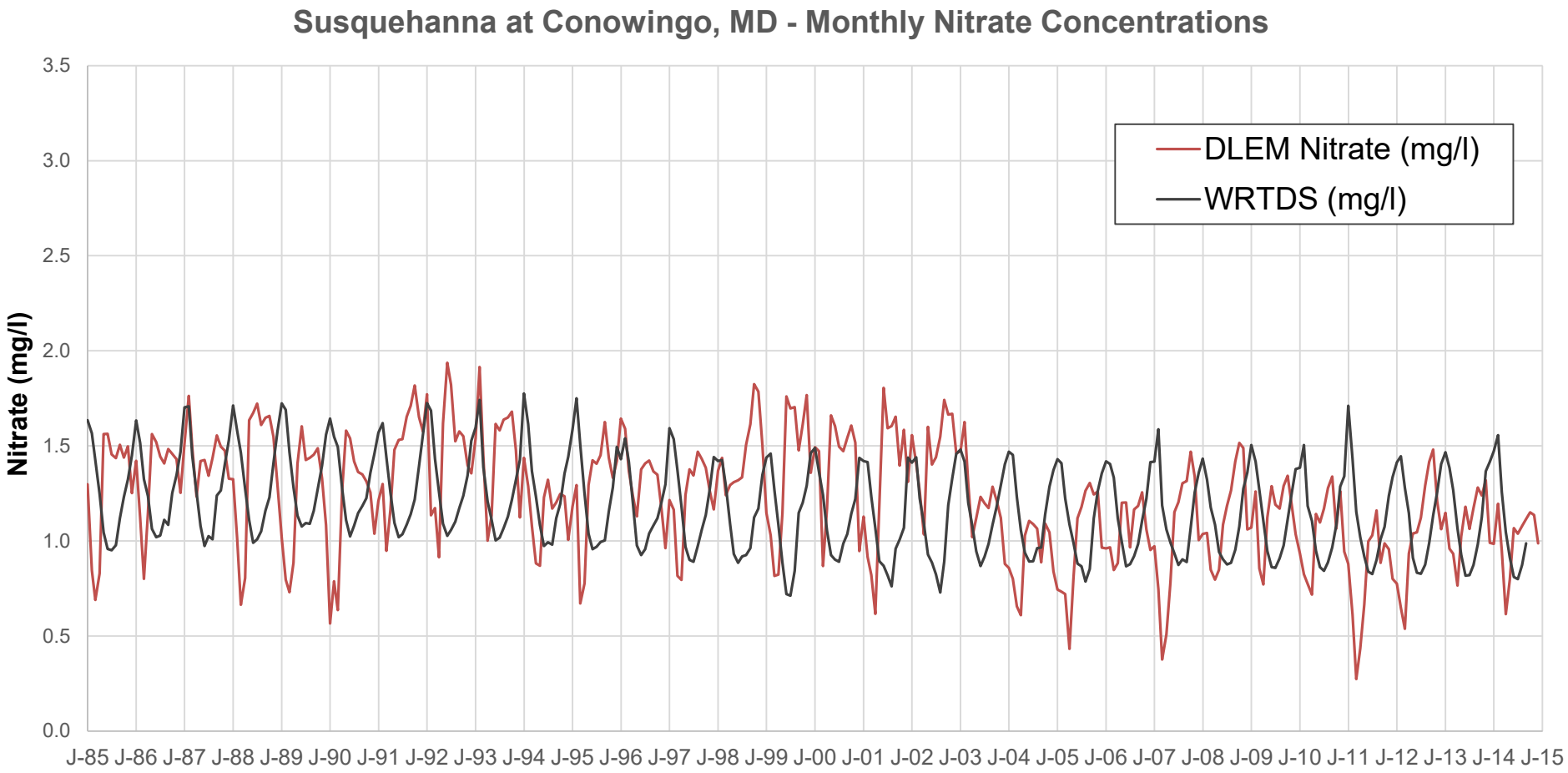

DLEM data from Yuanzhi Yao, Zihao Bian, and Hanqin Tian



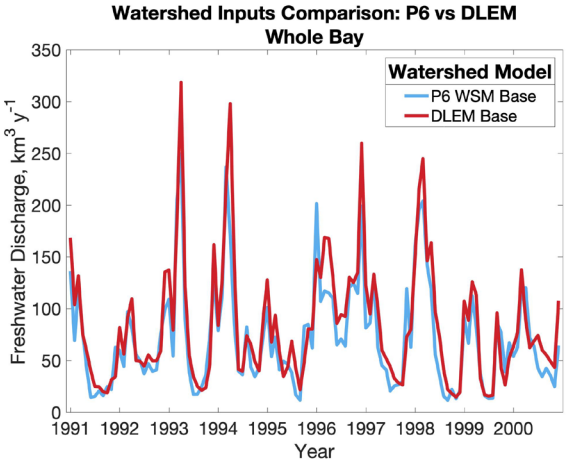

DLEM data from Yuanzhi Yao, Zihao Bian, and Hanqin Tian

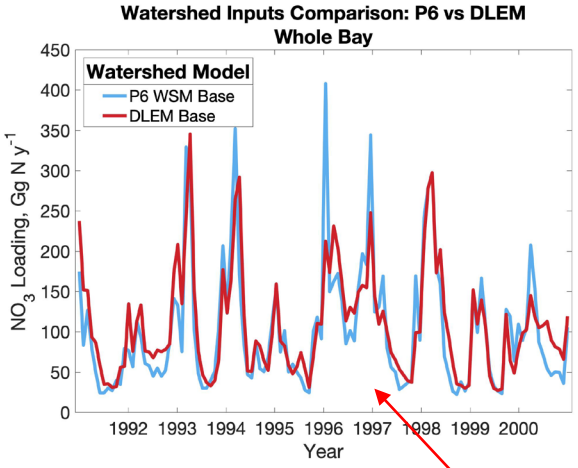
# USGS WRTDS - Nitrate Concentrations

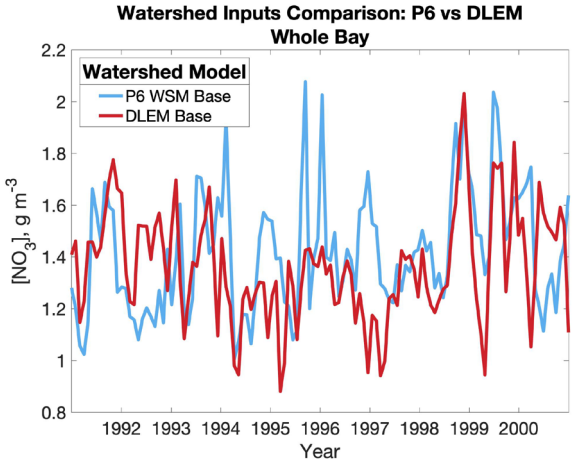



Susquehanna at Conowingo, MD - Monthly Nitrate Concentrations
Nitrate (mg/l)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
DLEM Nitrate (mg/l)
WRTDS (mg/l)
J-85 J-86 J-87 J-88 J-89 J-90 J-91 J-92 J-93 J-94 J-95 J-96 J-97 J-98 J-99 J-00 J-01 J-02 J-03 J-04 J-05 J-06 J-07 J-08 J-09 J-10 J-11 J-12 J-13 J-14 J-15

## Chesapeake Bay Watershed –

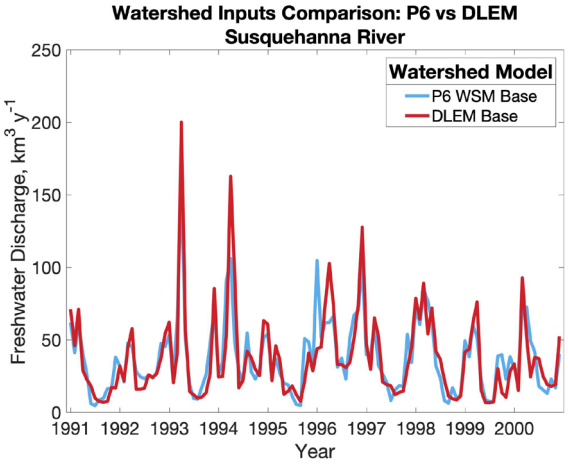


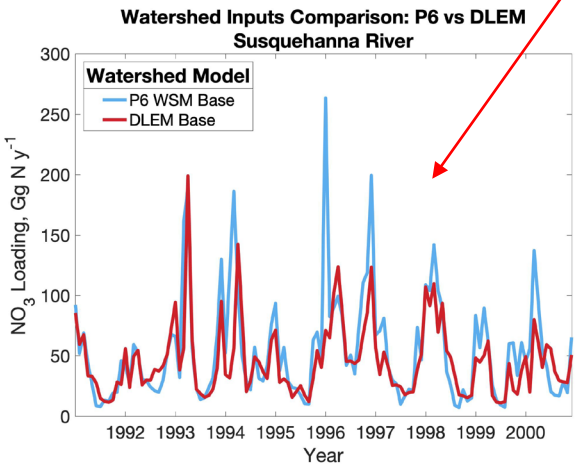



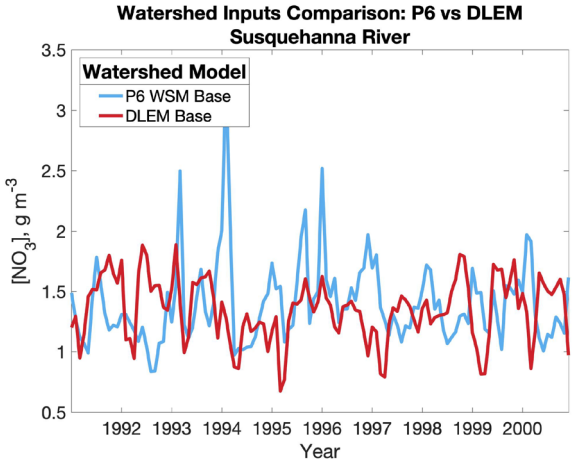




**There is good agreement in P6WSM and DLEM monthly Nitrate Loads**

## Susquehanna River Basin –



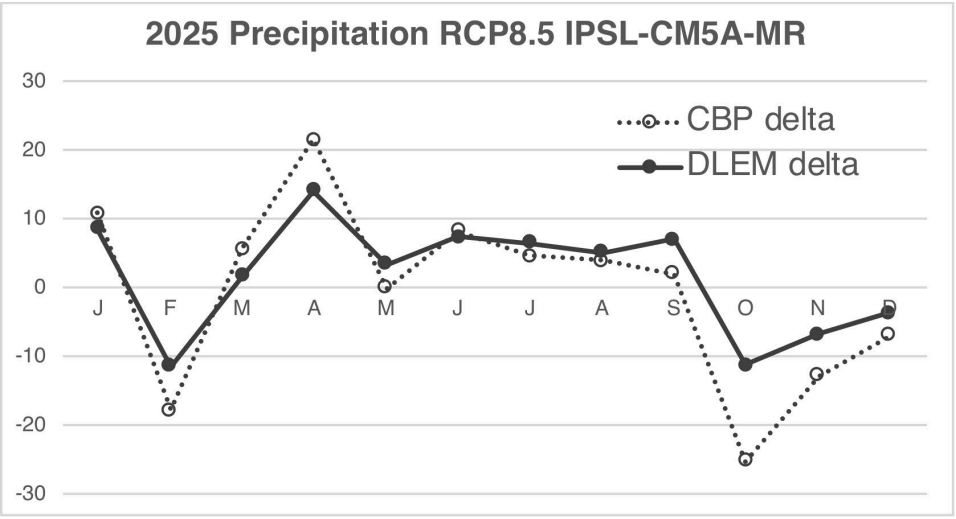



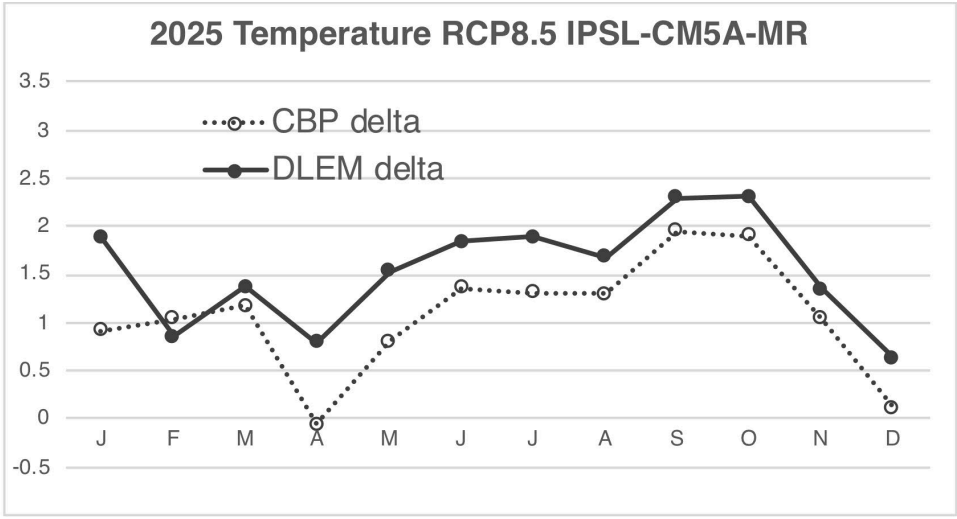



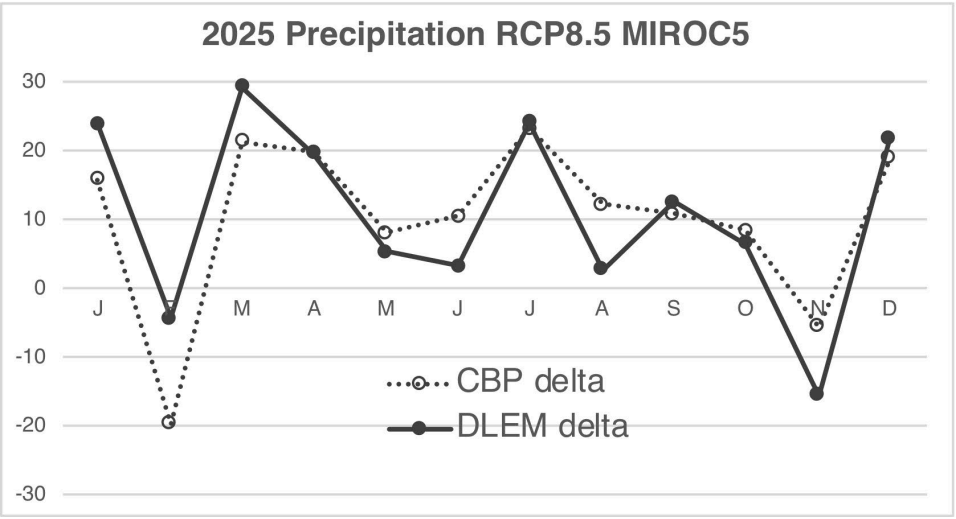
# Watershed Average Delta Change

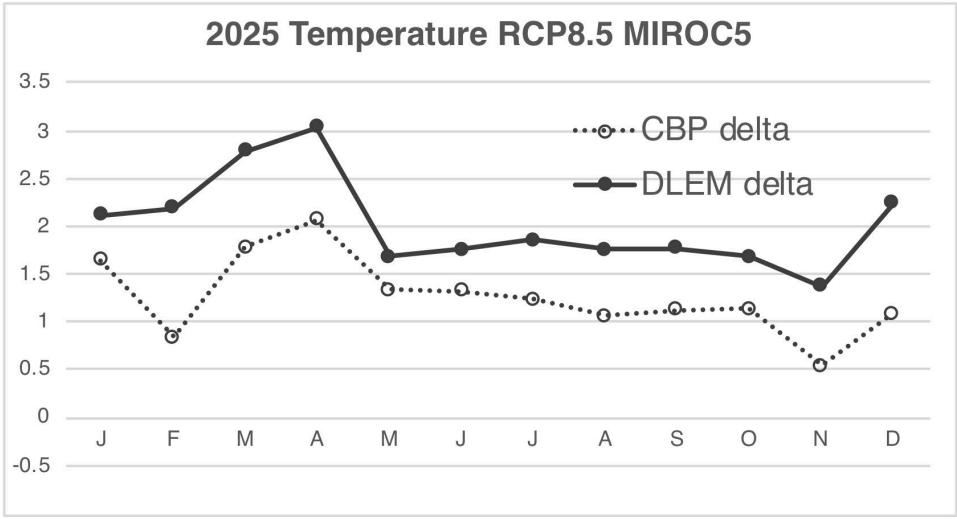
*MACA RCP 8.5 data were provided by Maria Herrmann & Ray Najjar*

# 2025 Watershed Average Delta Change – BEFORE



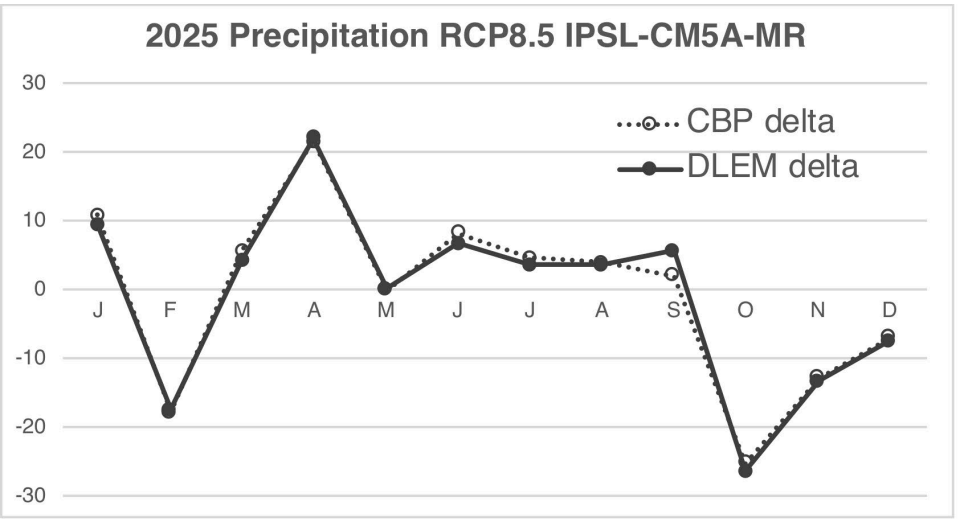



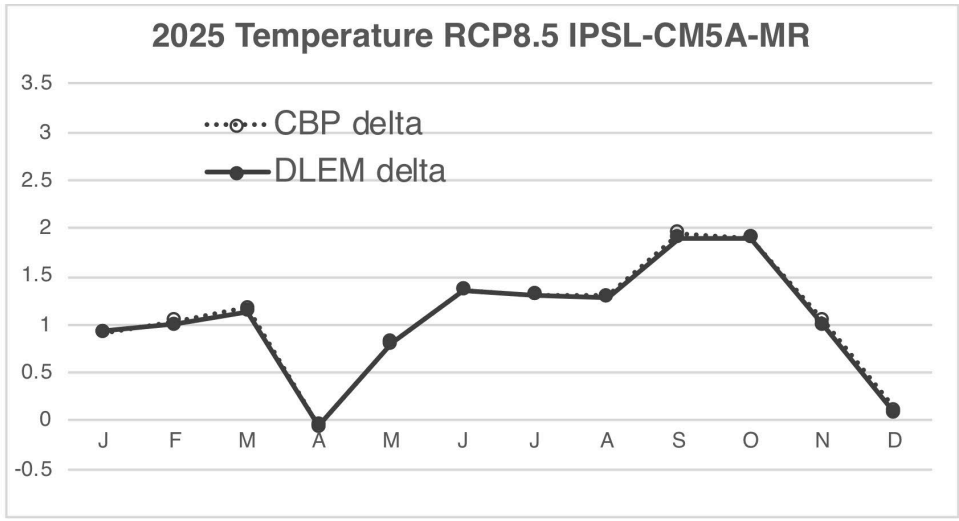



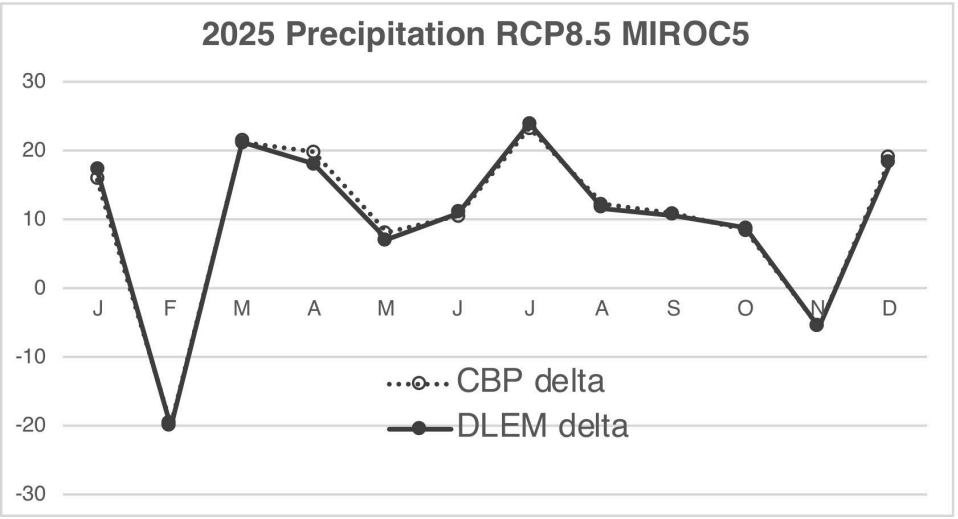

**Precipitation delta change – percent**

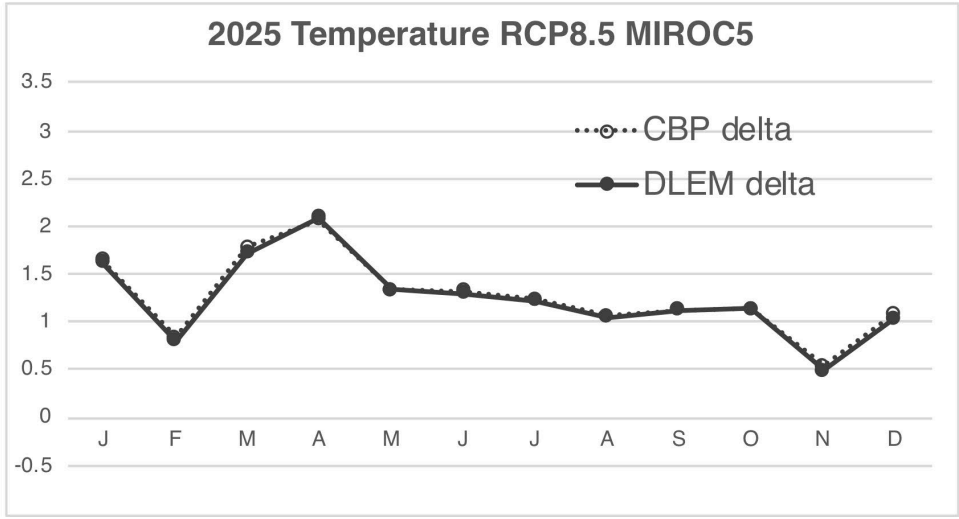
**Temperature delta change – degree Celsius**

# 2025 Watershed Average Delta Change – AFTER



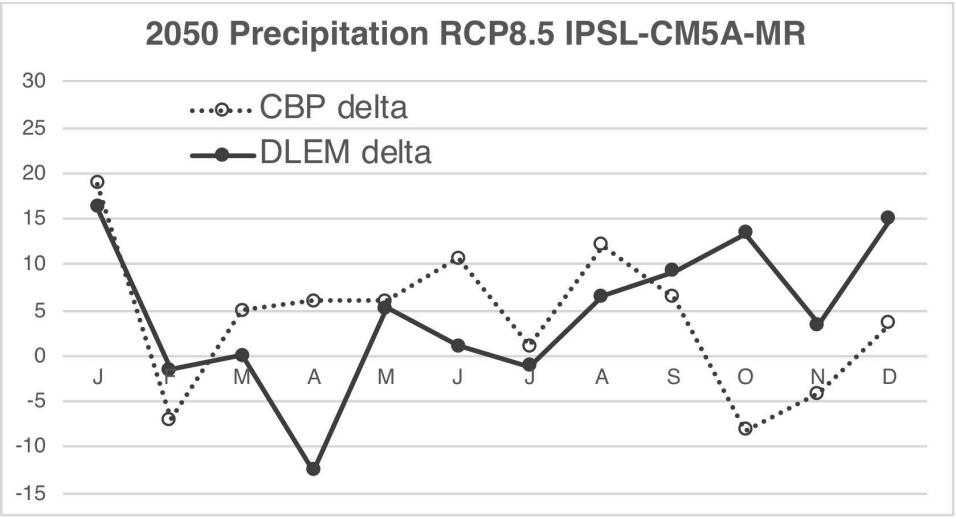



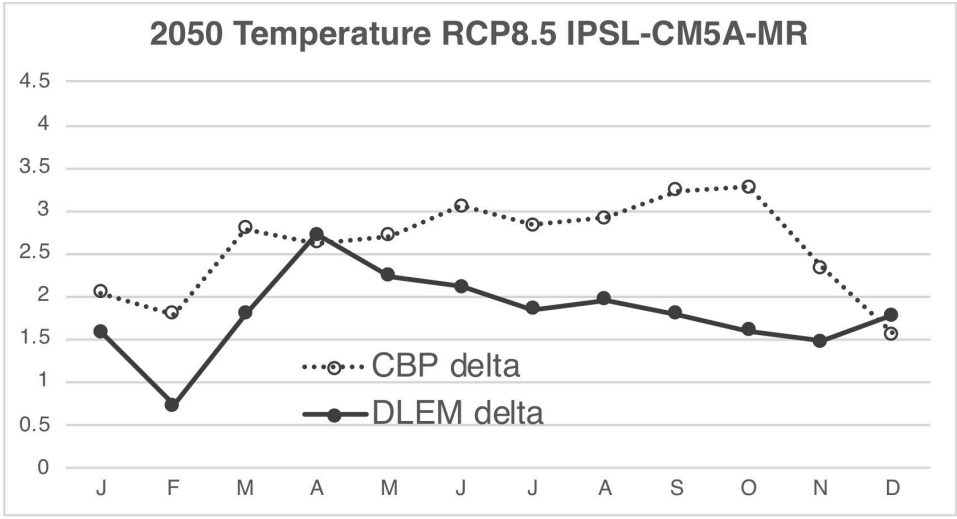



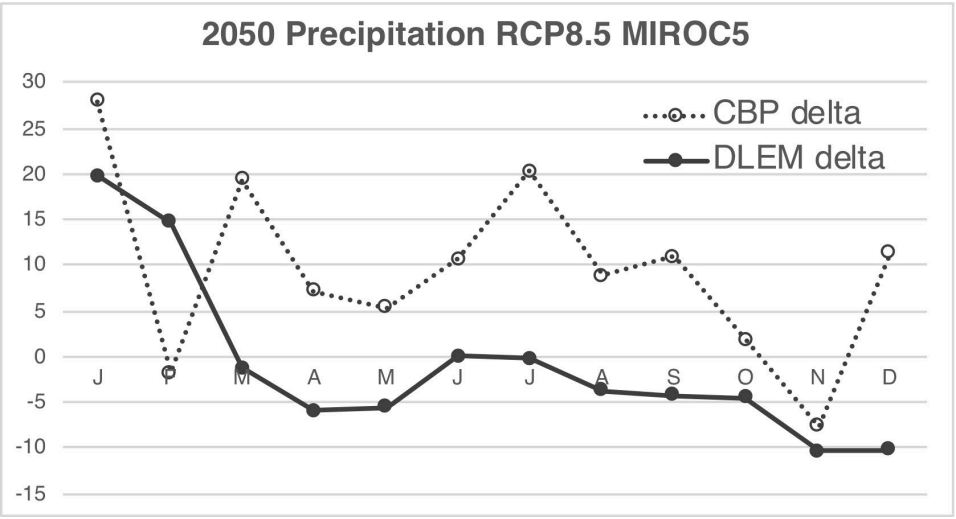



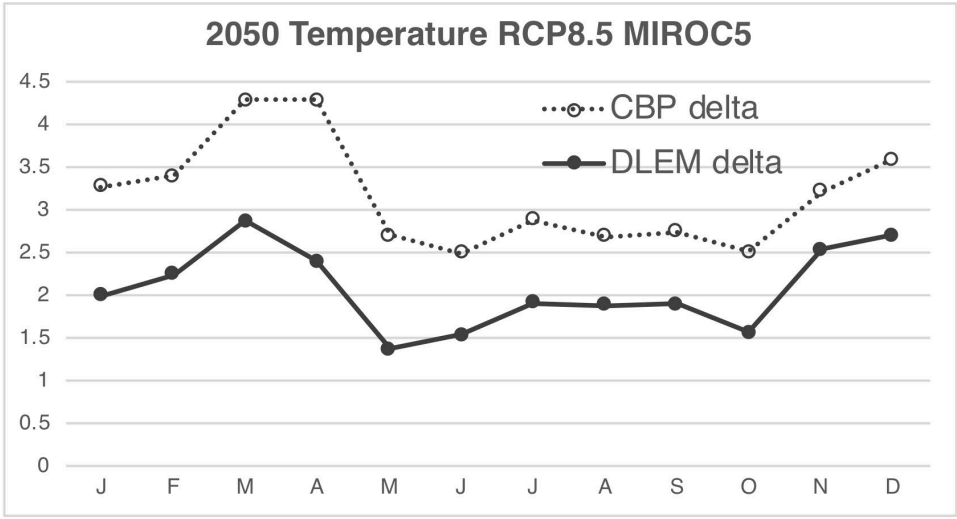

**The issue was related to inconsistency in geographic projection**

# 2050 Watershed Average Delta Change – BEFORE

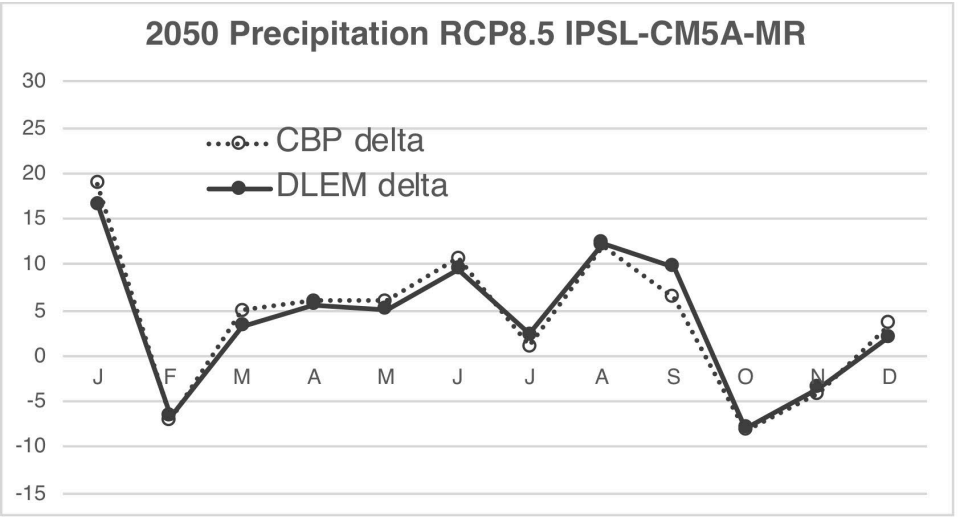


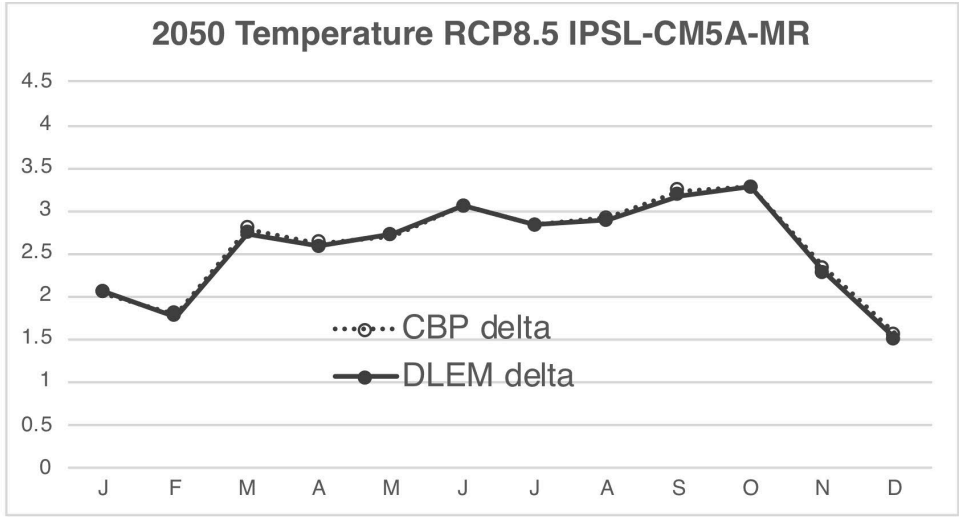



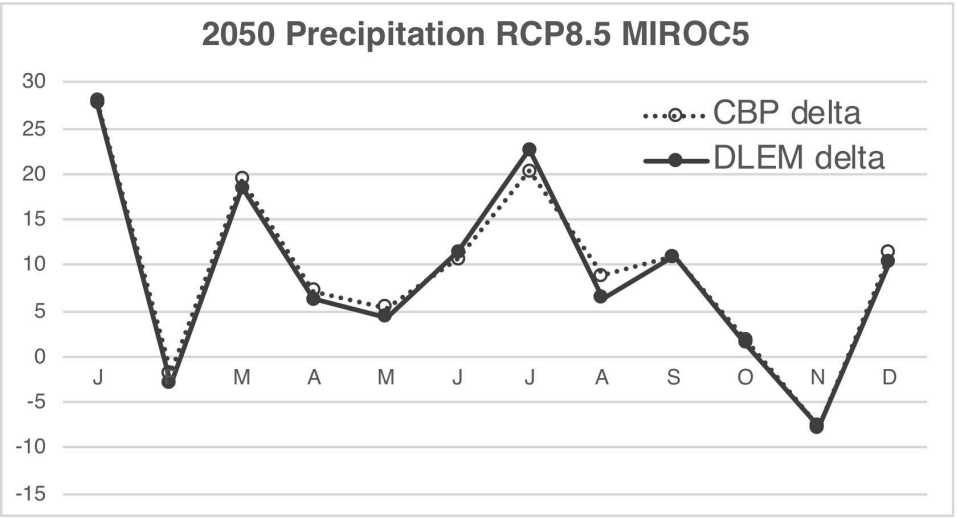



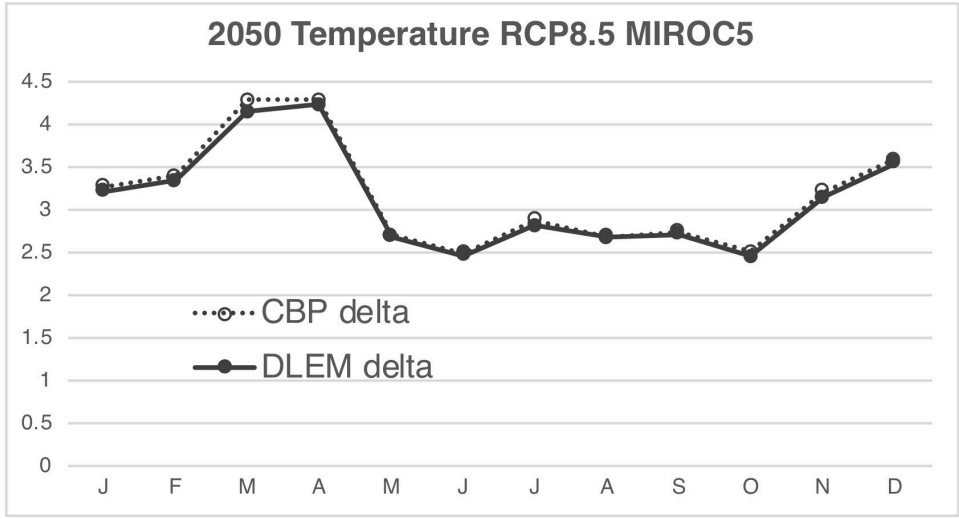



# 2050 Watershed Average Delta Change – AFTER



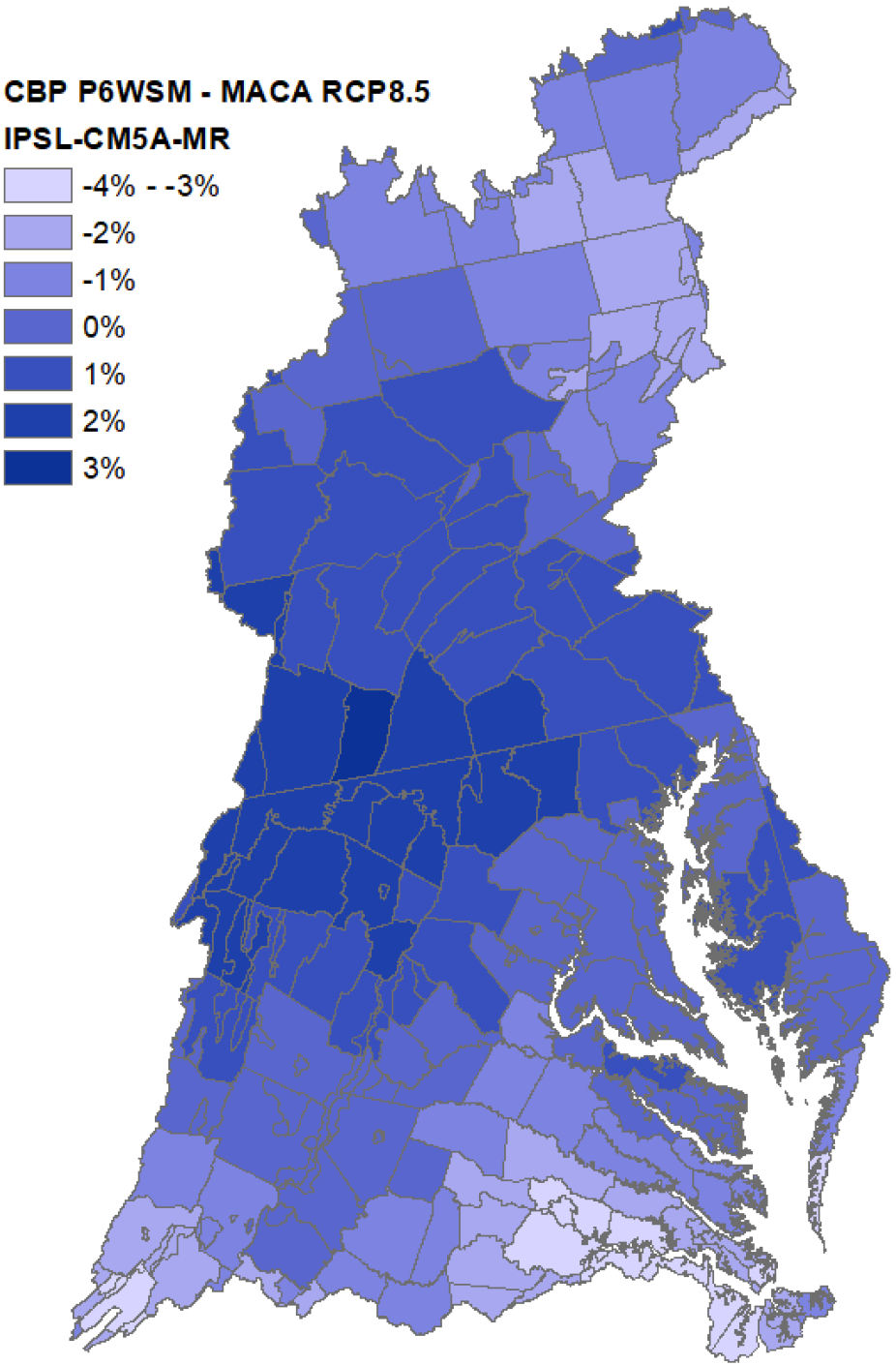



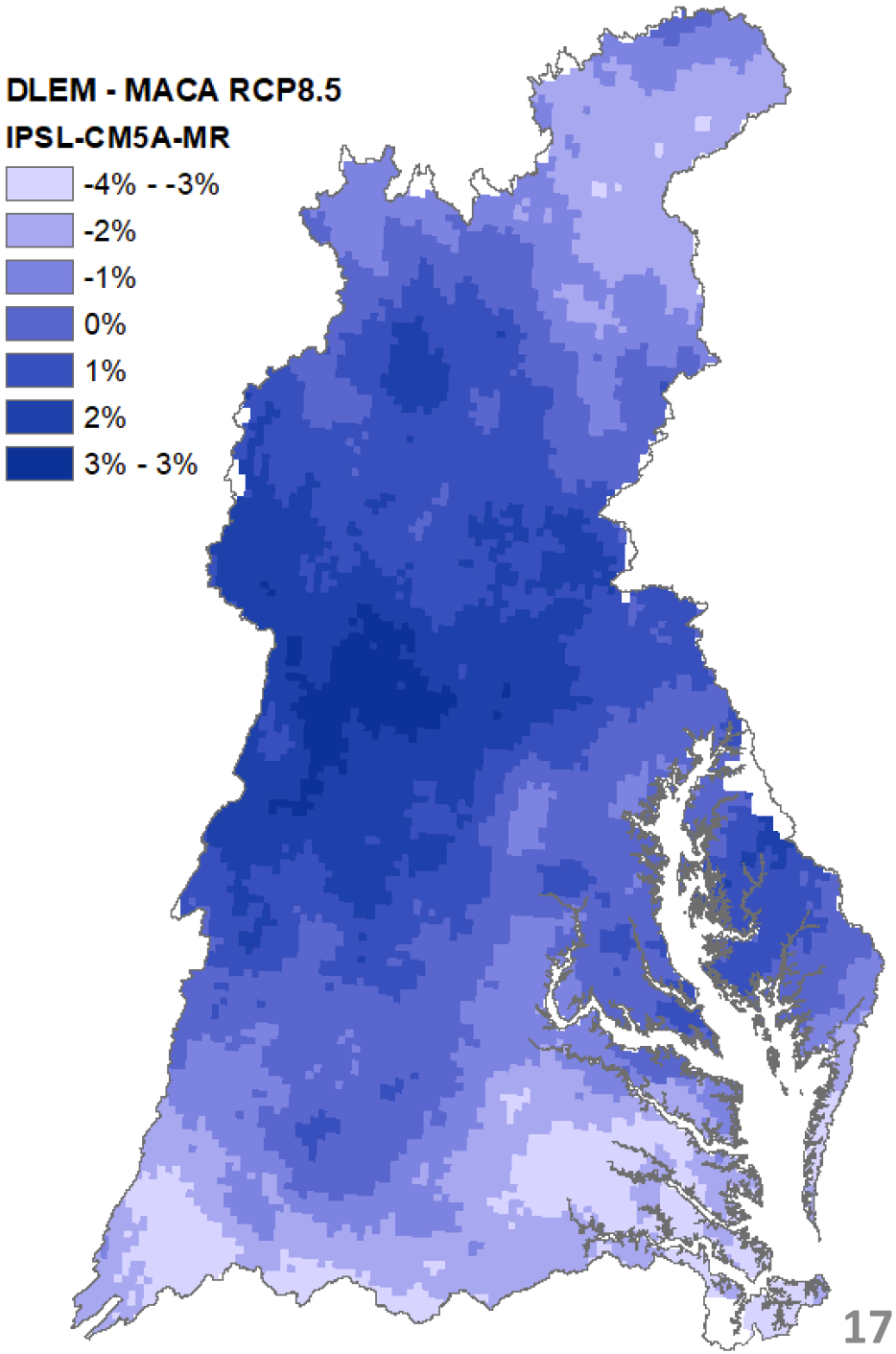



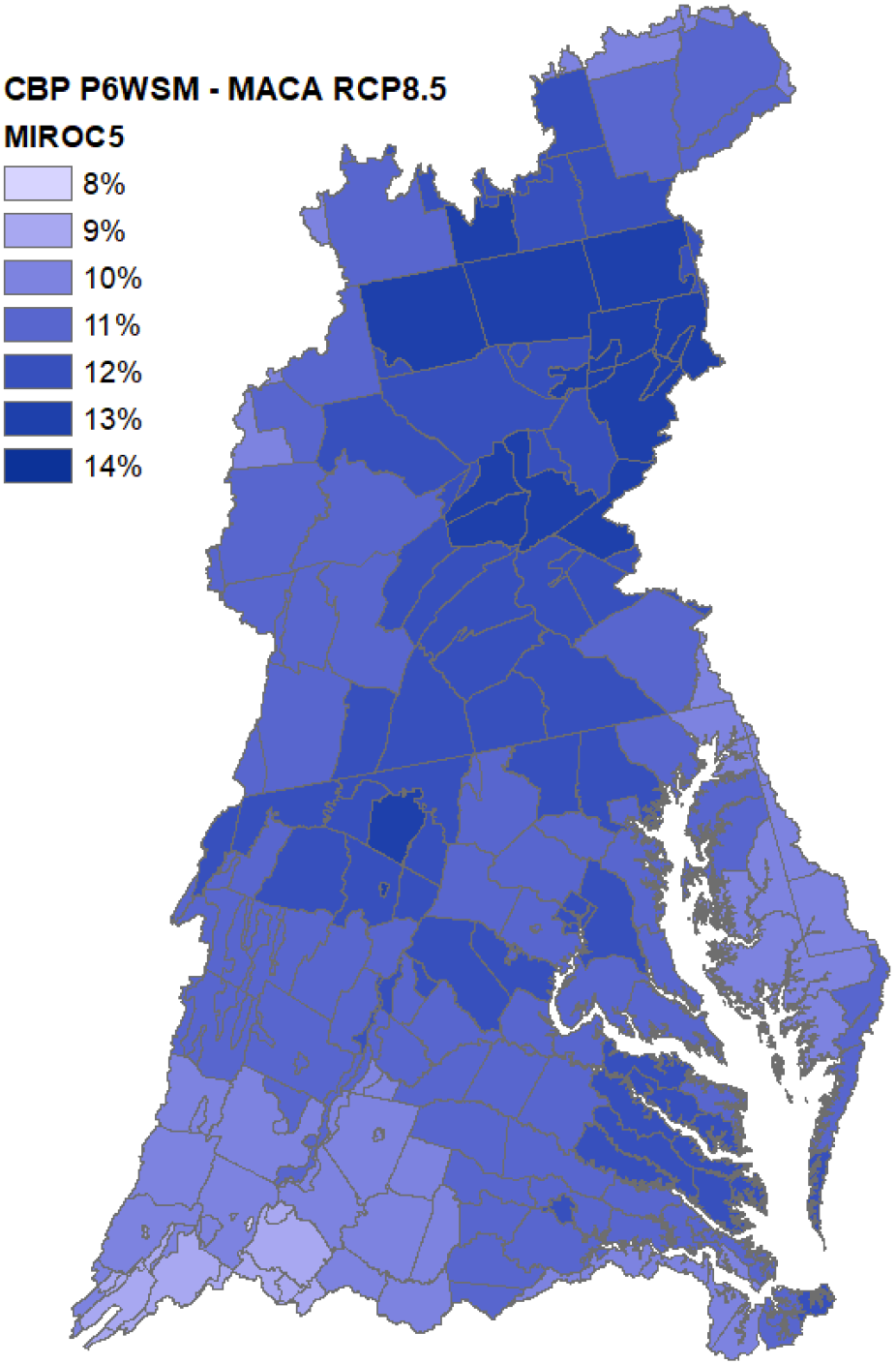



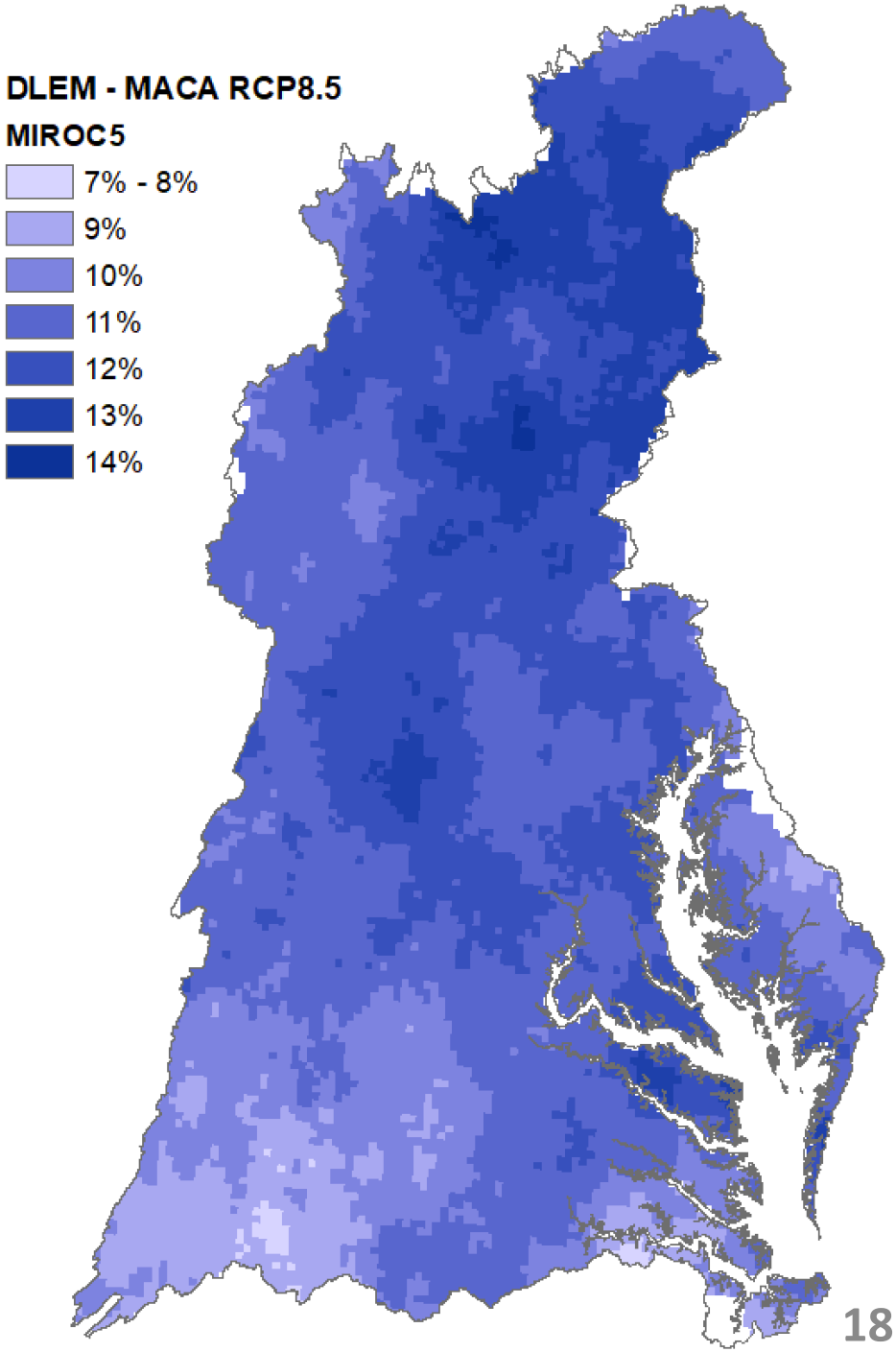

**The issue was related to periods that were used in the delta calculation**

# 2025 Precipitation

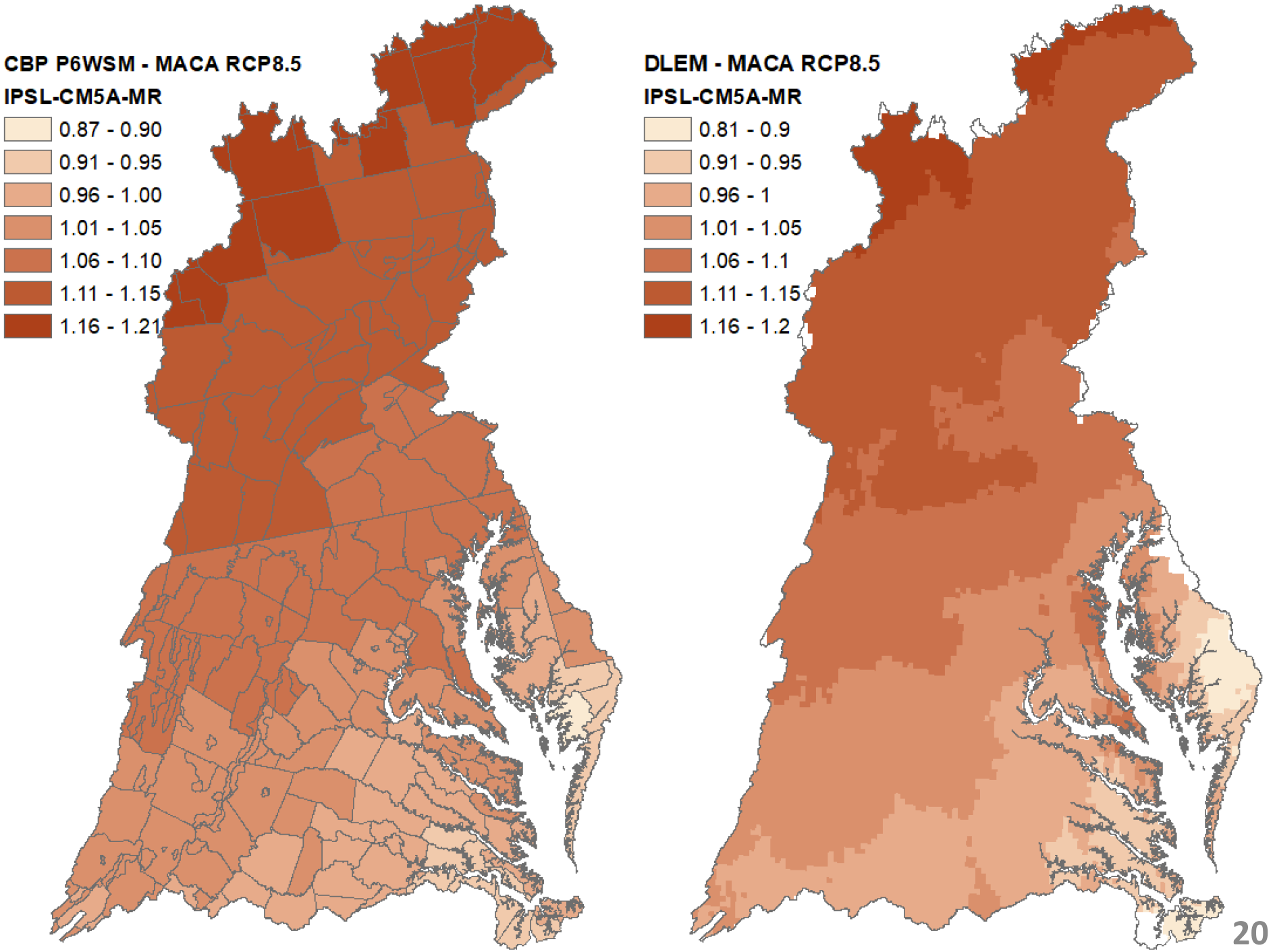

CBP P6WSM - MACA RCP8.5
IPSL-CM5A-MR
-4% - -3%
-2%
-1%
0%
1%
2%
3%

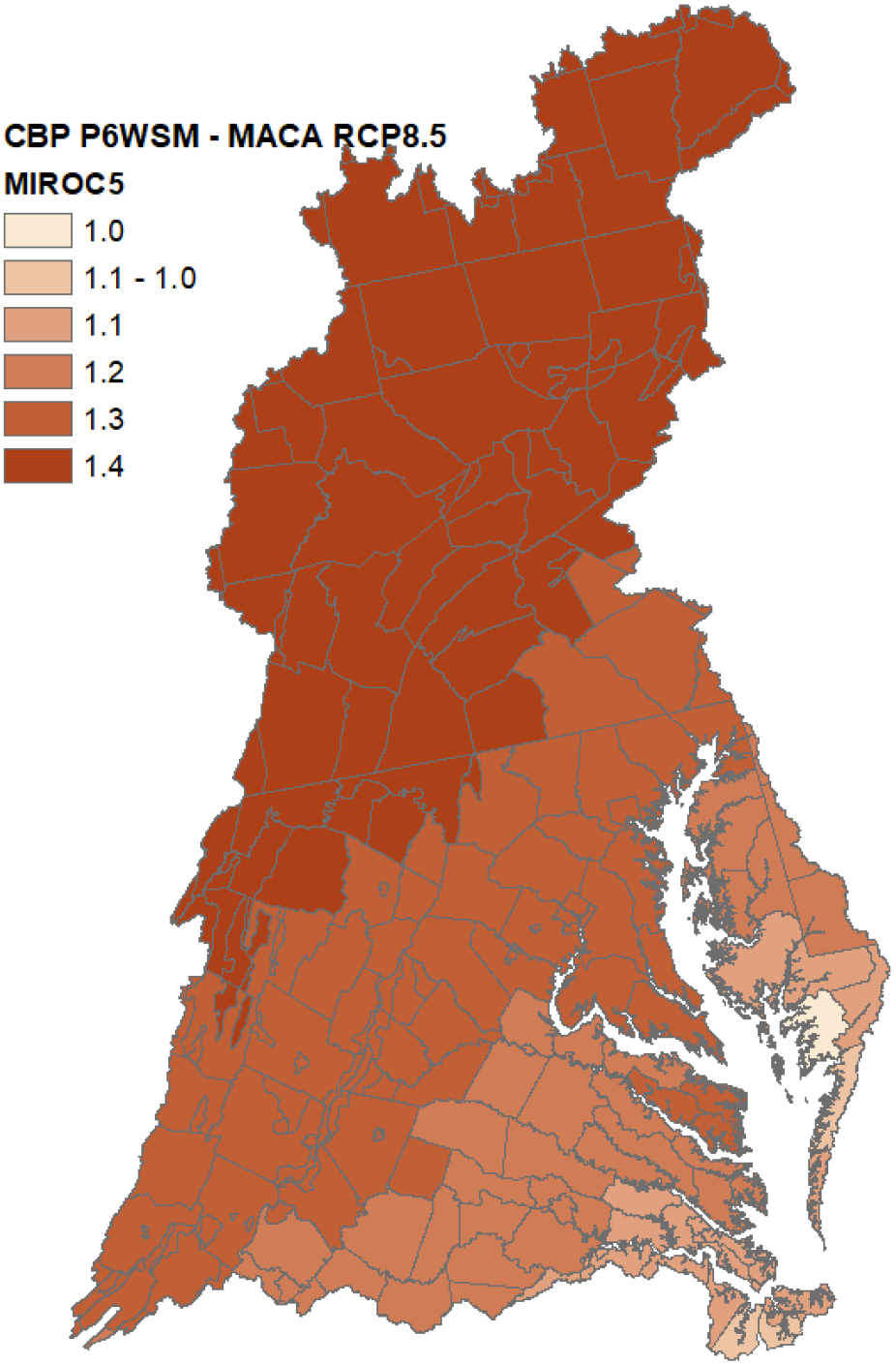

DLEM - MACA RCP8.5
IPSL-CM5A-MR
-4% - -3%
-2%
-1%
0%
1%
2%
3% - 3%

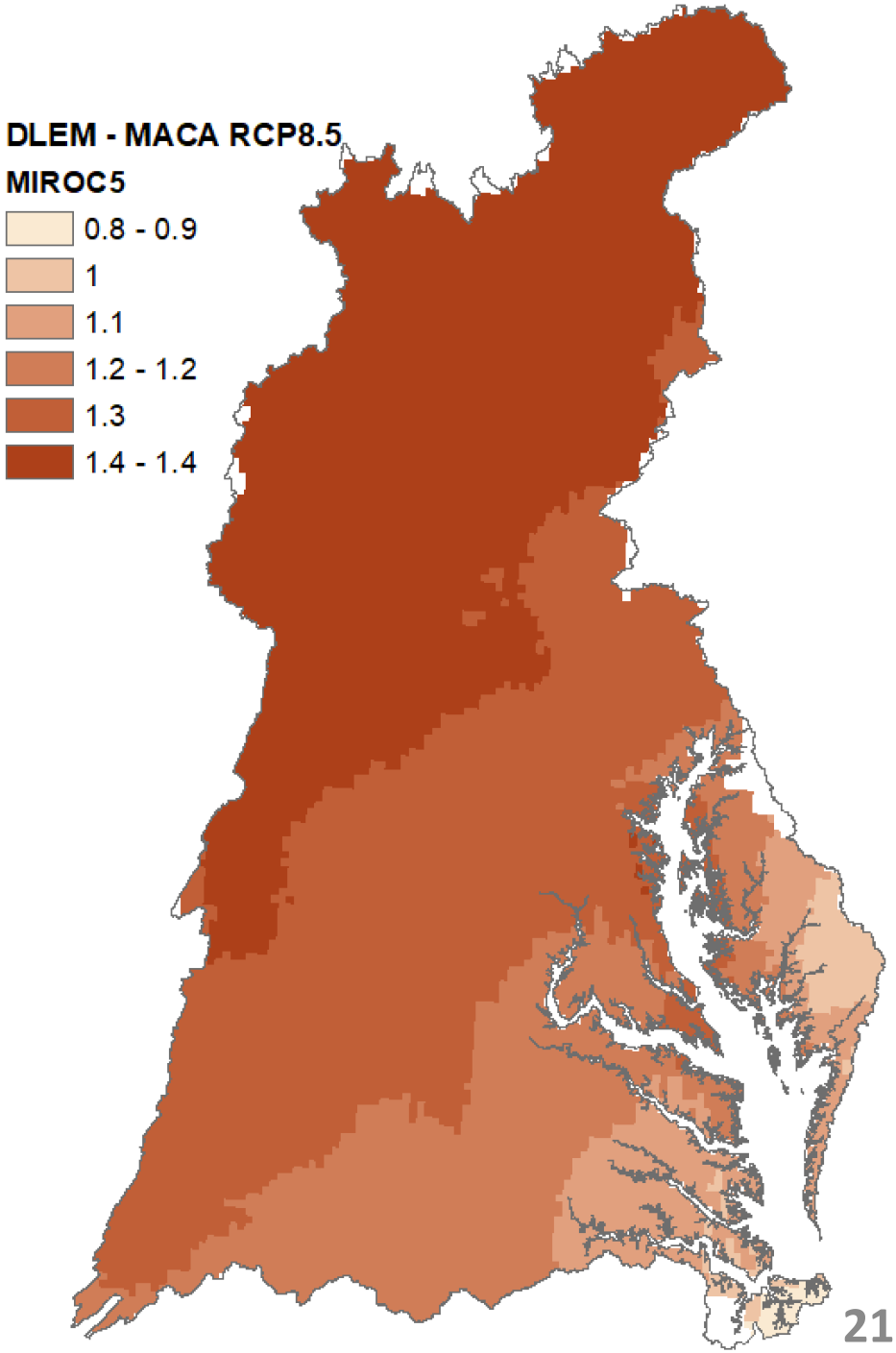

CBP P6WSM - MACA RCP8.5
MIROC5
8%
9%
10%
11%
12%
13%
14%


DLEM - MACA RCP8.5
MIROC5
7% - 8%
9%
10%
11%
12%
13%
14%

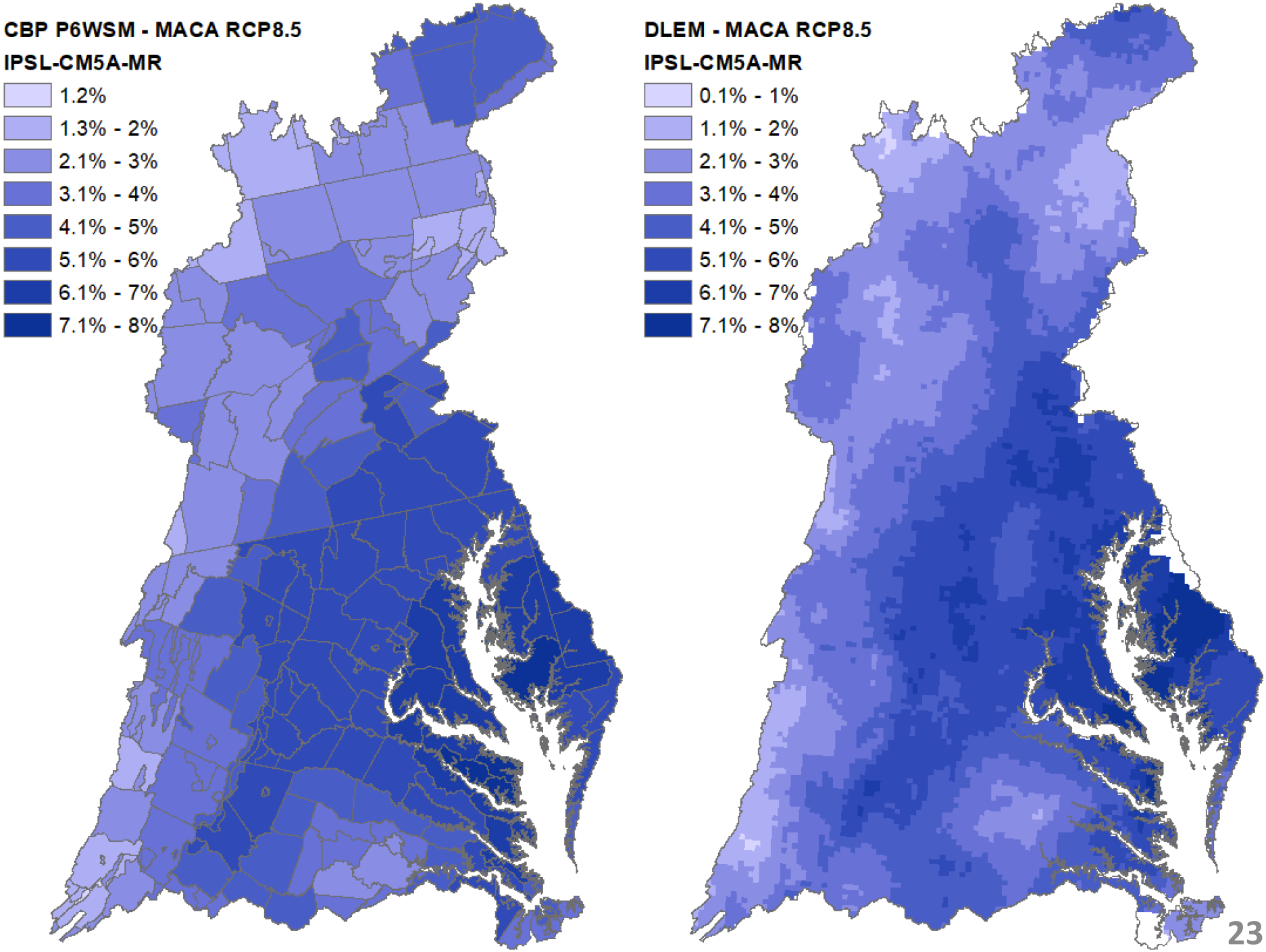
# 2025 Temperature

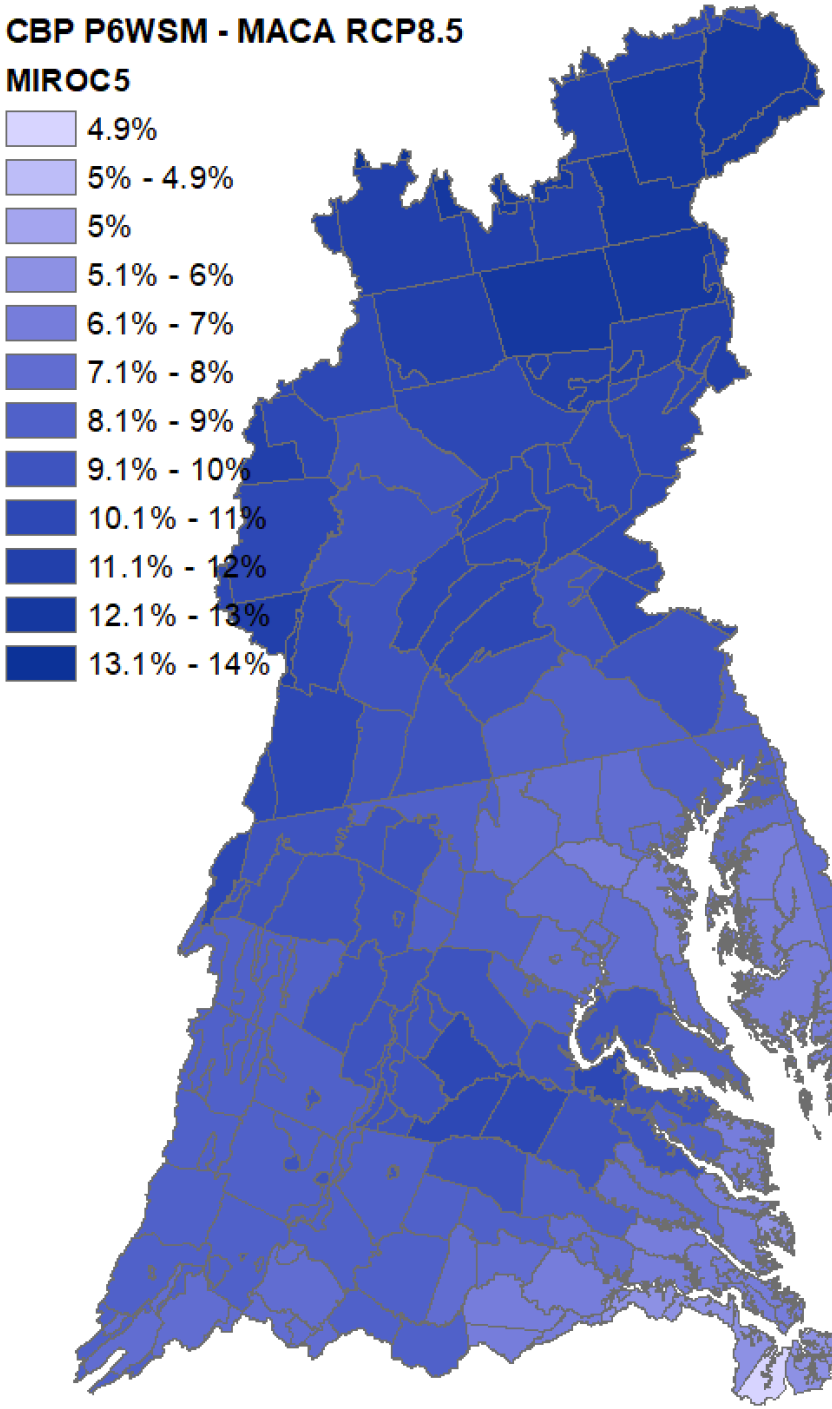

CBP P6WSM - MACA RCP8.5
IPSL-CM5A-MR
0.87 - 0.90
0.91 - 0.95
0.96 - 1.00
1.01 - 1.05
1.06 - 1.10
1.11 - 1.15
1.16 - 1.21
DLEM - MACA RCP8.5
IPSL-CM5A-MR
0.81 - 0.9
0.91 - 0.95
0.96 - 1
1.01 - 1.05
1.06 - 1.1
1.11 - 1.15
1.16 - 1.2

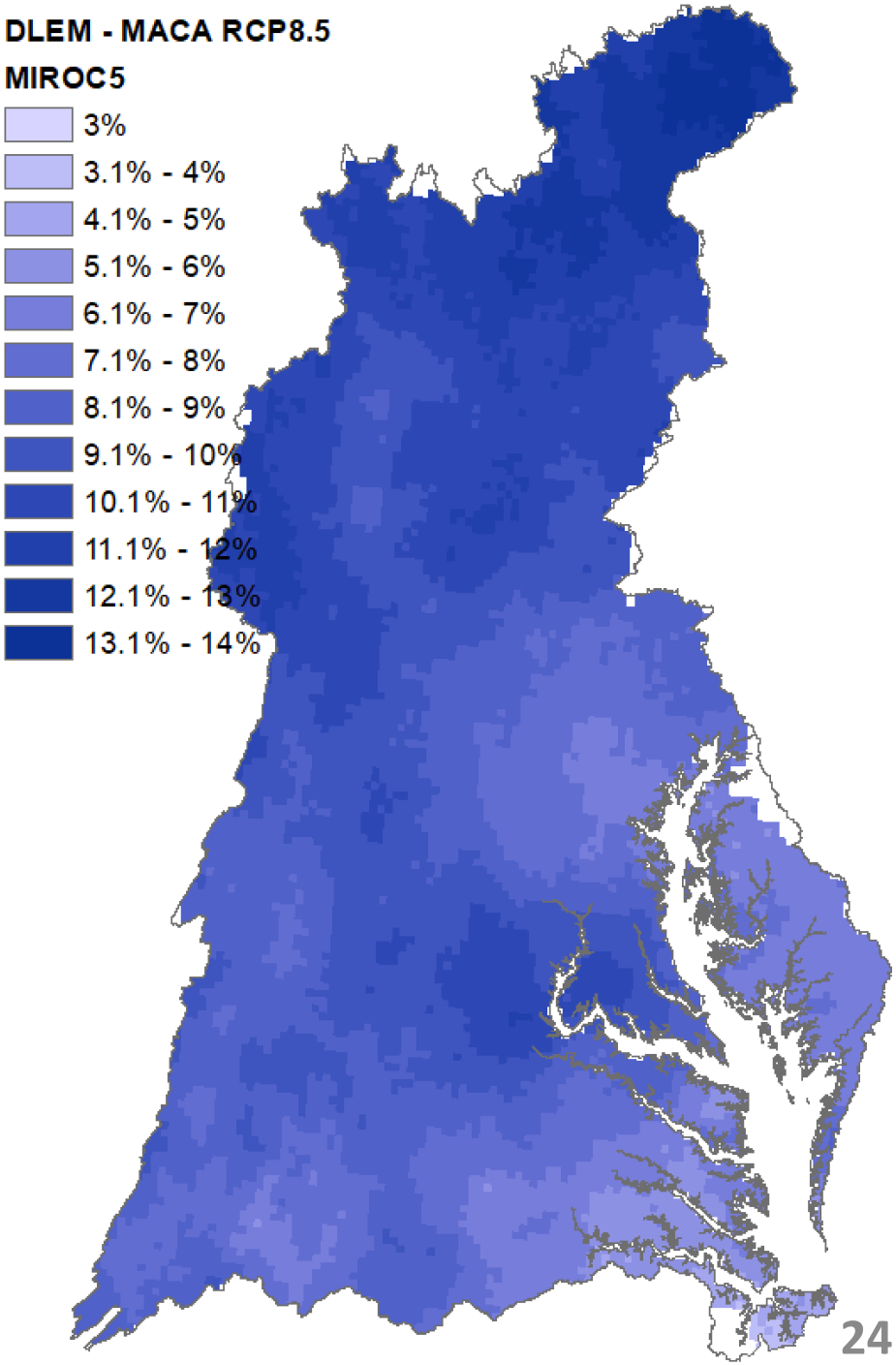

CBP P6WSM - MACA RCP8.5
MIROC5
1.0
1.1 - 1.0
1.1
1.2
1.3
1.4


DLEM - MACA RCP8.5
MIROC5
0.8 - 0.9
1
1.1
1.2 - 1.2
1.3
1.4 - 1.4

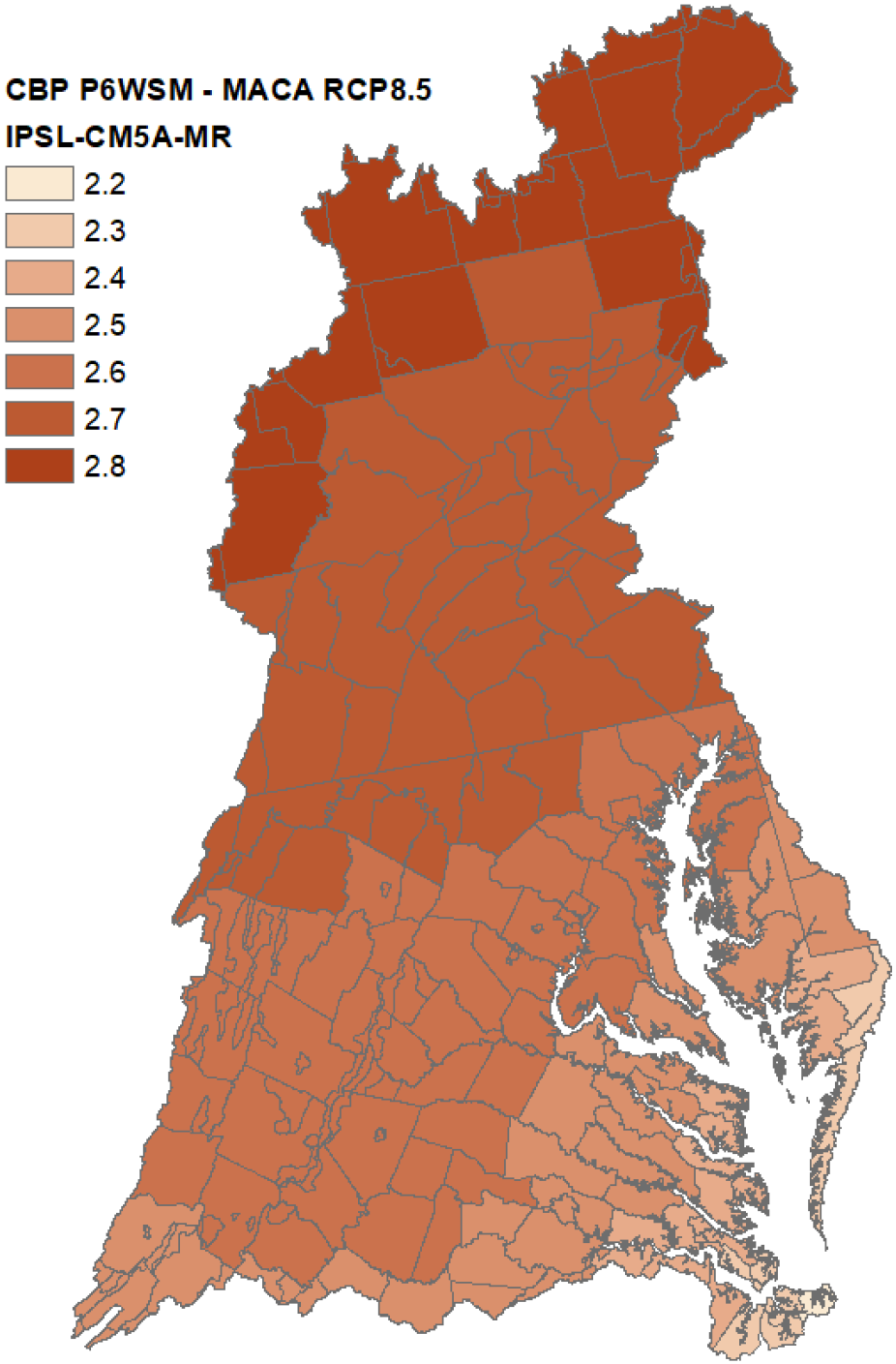
# 2050 Precipitation

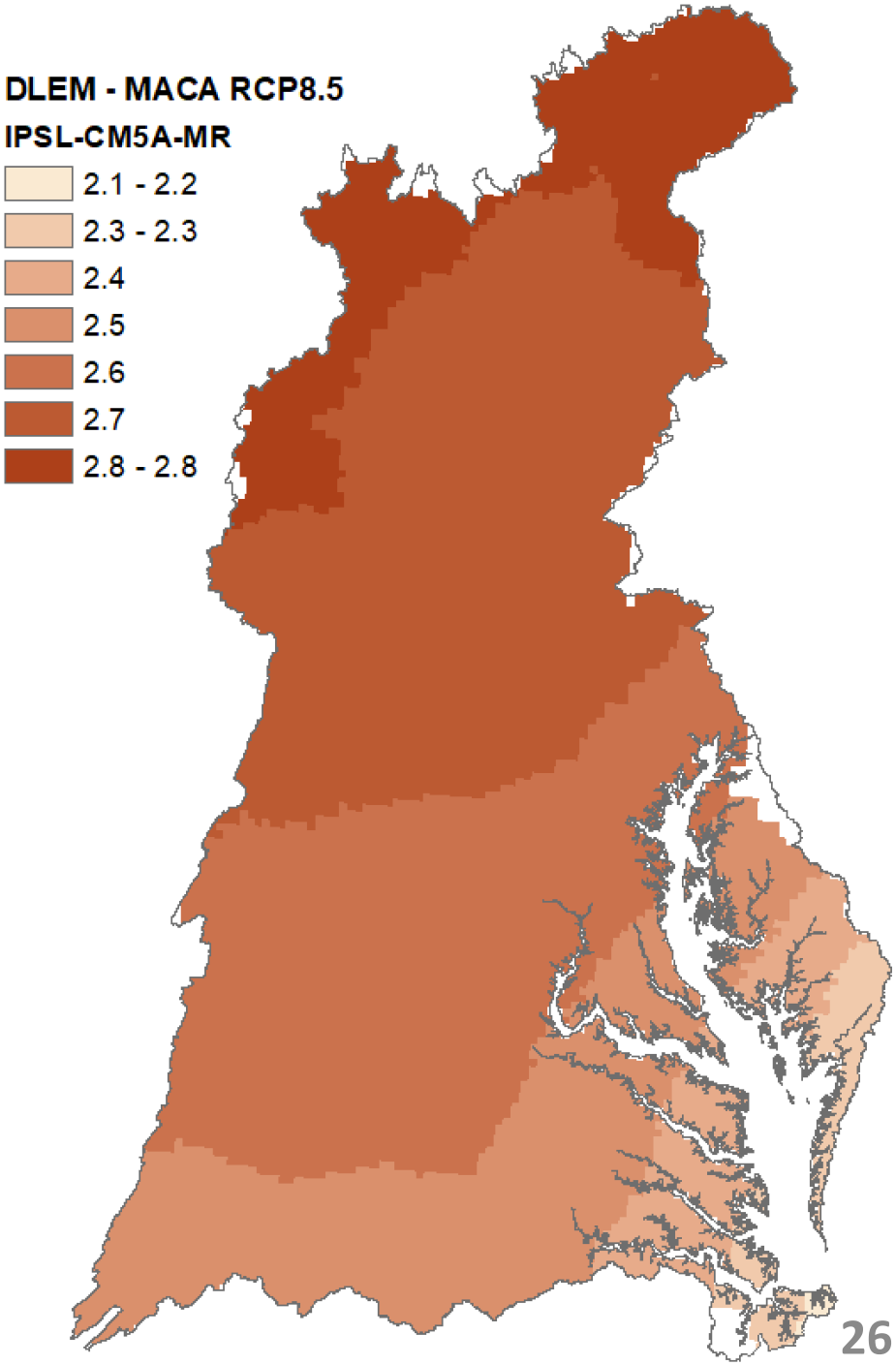

CBP P6WSM - MACA RCP8.5
IPSL-CM5A-MR
1.2%
1.3% - 2%
2.1% - 3%
3.1% - 4%
4.1% - 5%
5.1% - 6%
6.1% - 7%
7.1% - 8%
DLEM - MACA RCP8.5
IPSL-CM5A-MR
0.1% - 1%
1.1% - 2%
2.1% - 3%
3.1% - 4%
4.1% - 5%
5.1% - 6%
6.1% - 7%
7.1% - 8%

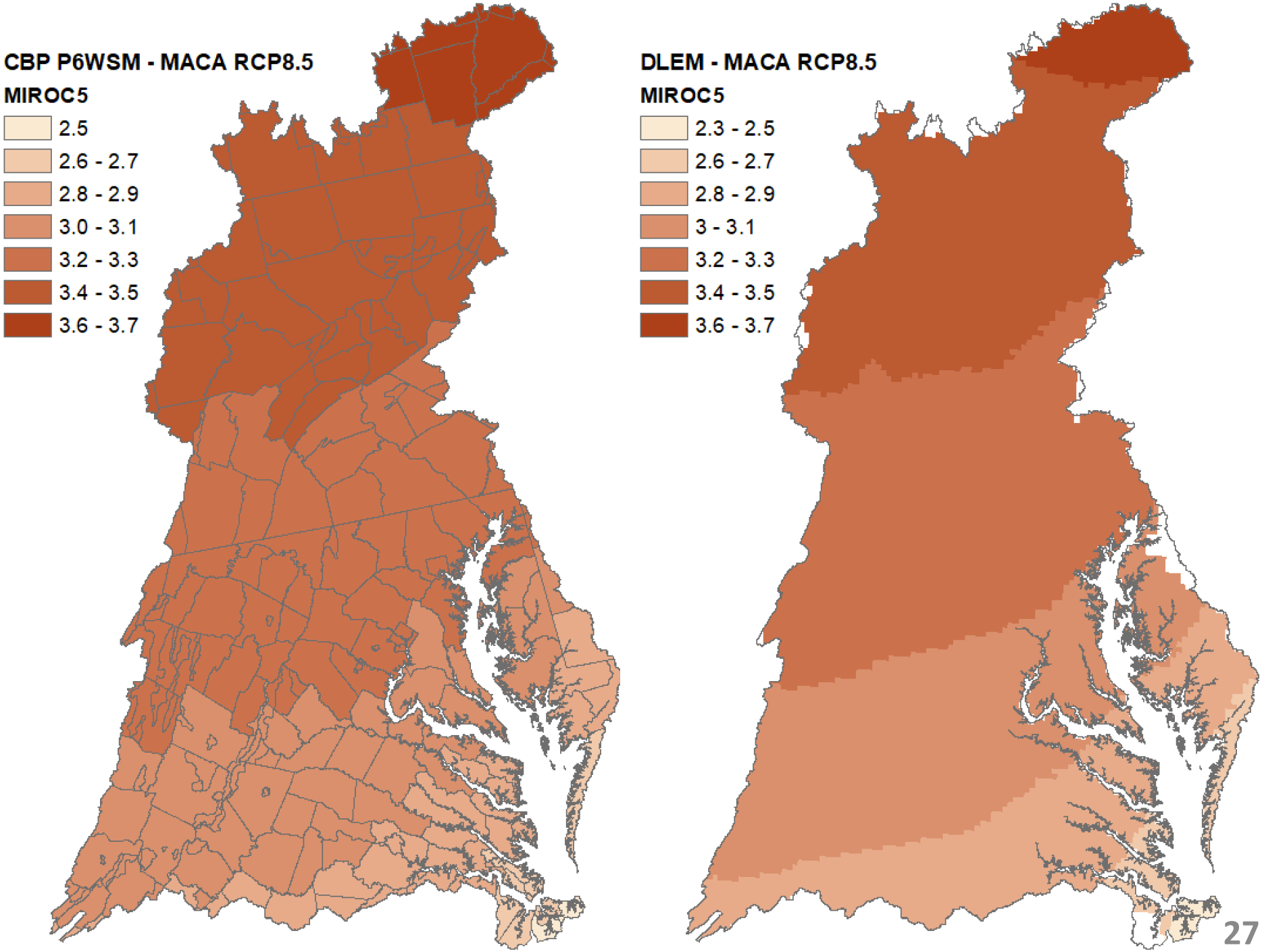

CBP P6WSM - MACA RCP8.5
MIROC5
4.9%
5% - 4.9%
5%
5.1% - 6%
6.1% - 7%
7.1% - 8%
8.1% - 9%
9.1% - 10%
10.1% - 11%
11.1% - 12%
12.1% - 13%
13.1% - 14%


DLEM - MACA RCP8.5
MIROC5
3%
3.1% - 4%
4.1% - 5%
5.1% - 6%
6.1% - 7%
7.1% - 8%
8.1% - 9%
9.1% - 10%
10.1% - 11%
11.1% - 12%
12.1% - 13%
13.1% - 14%

# 2050 Temperature


CBP P6WSM - MACA RCP8.5
IPSL-CM5A-MR
2.2
2.3
2.4
2.5
2.6
2.7
2.8

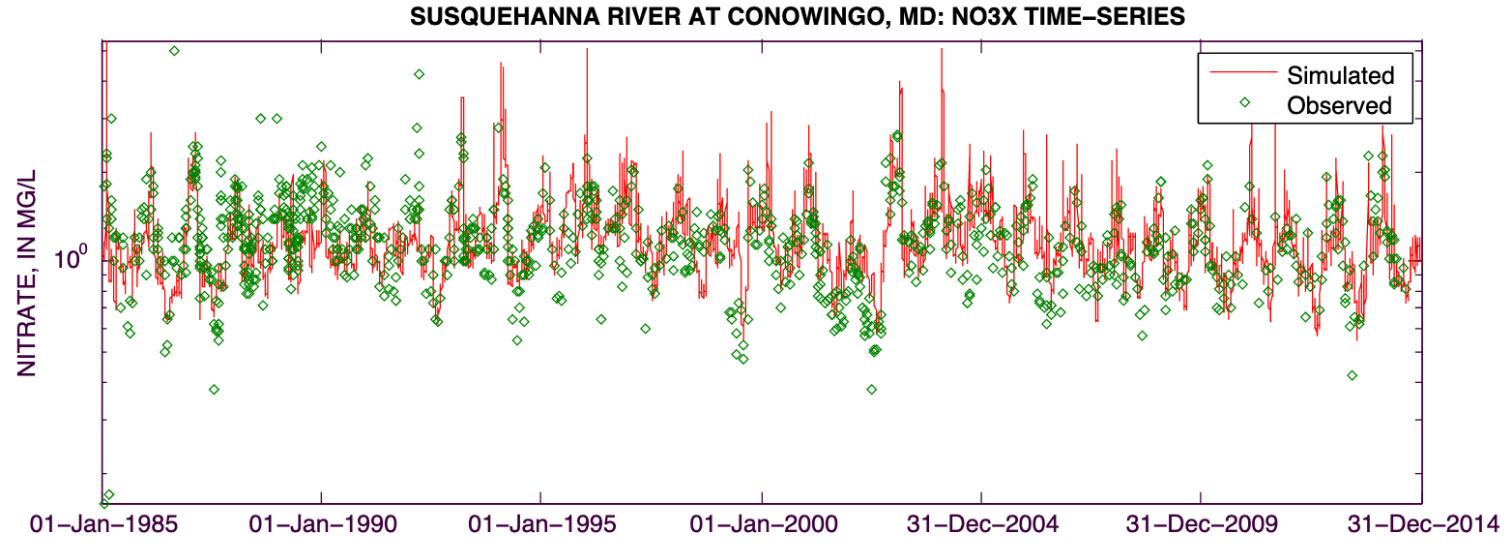

DLEM - MACA RCP8.5
IPSL-CM5A-MR
2.1 - 2.2
2.3 - 2.3
2.4
2.5
2.6
2.7
2.8 - 2.8

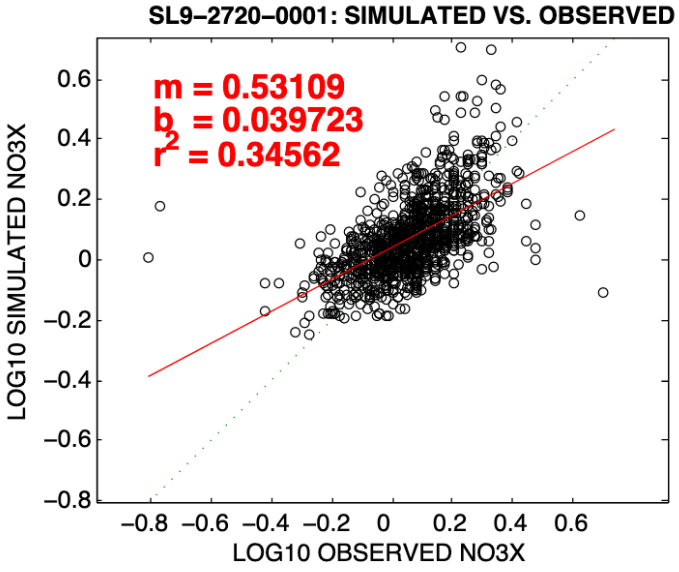

CBP P6WSM - MACA RCP8.5
MIROC5
2.5
2.6 - 2.7
2.8 - 2.9
3.0 - 3.1
3.2 - 3.3
3.4 - 3.5
3.6 - 3.7
DLEM - MACA RCP8.5
MIROC5
2.3 - 2.5
2.6 - 2.7
2.8 - 2.9
3 - 3.1
3.2 - 3.3
3.4 - 3.5
3.6 - 3.7

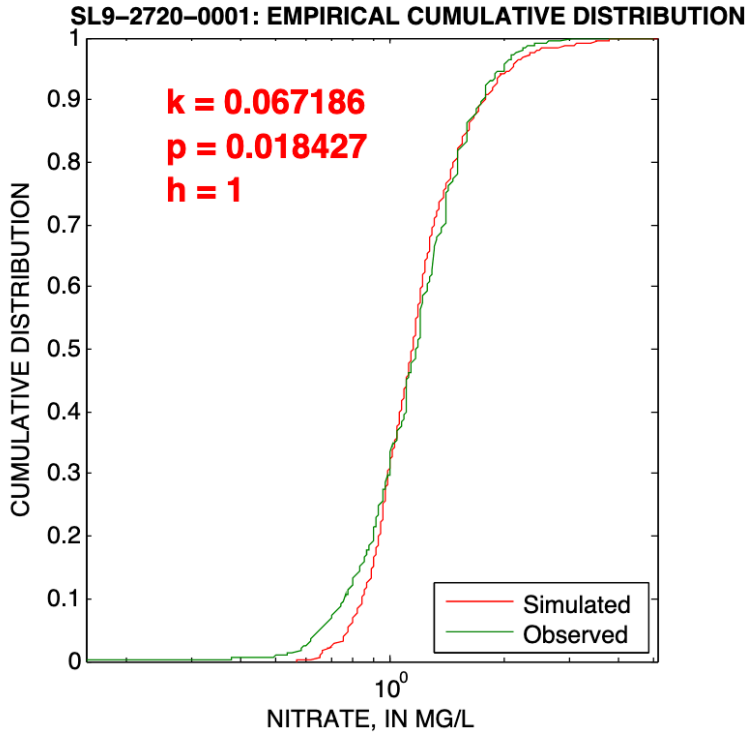
# Summary and next steps

- Now there is good agreement in delta change computed for P6WSM and DLEM applications

- DLEM group is using the delta change in preparing model inputs for climate change simulations
- Next phase will look into P6WSM and DLEM hydrologic responses for climate change simulations




**DATA SELECTION**

| scenario | file |
|---|---|
| P620171001WQ | NO3X.calib |

plot: NO3X - nitrate

Dates: 1/1/1985 – 12/31/201

| Drive | Directory | Observed |
|---|---|---|
| N/A | model | OBS20161101 |

**STATISTICS**

| | n | observe | simulate |
|---|---|---|---|
| | | 1027 | 1027 |
| min | | 0.156 | 0.56257 |
| | | -0.806875 | -0.249823 |
| mean | | 1.22203 | 1.24604 |
| | | 0.0626557 | 0.0729989 |
| media | | 1.18 | 1.1437 |
| | | 0.071882 | 0.0583121 |
| max | | 5 | 5.0836 |
| | | 0.69897 | 0.706171 |
| varian | | 0.182034 | 0.217094 |
| | | 0.0216481 | 0.0176667 |
| JB | | 0.001 | 0.001 |
| | | 0.001 | 0.001 |
| | | ra | log |
| % | | 1.96489 | 16.5081 |
| err.va | | 0.19112 | 0.0164277 |
| rel.std.err | | 1.04992 | 0.758853 |
| mod.eff | | -0.0499155 | 0.241147 |

VERSION

ALL DATA
LOG10