Phase 7 criteria assessment based on preliminary WIP and climate change scenarios

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modeling team

Modeling Quarterly Review Meeting

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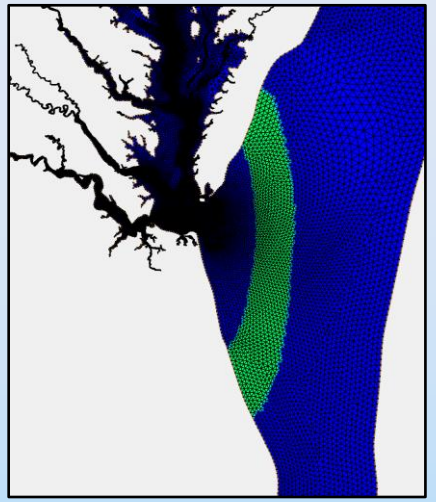
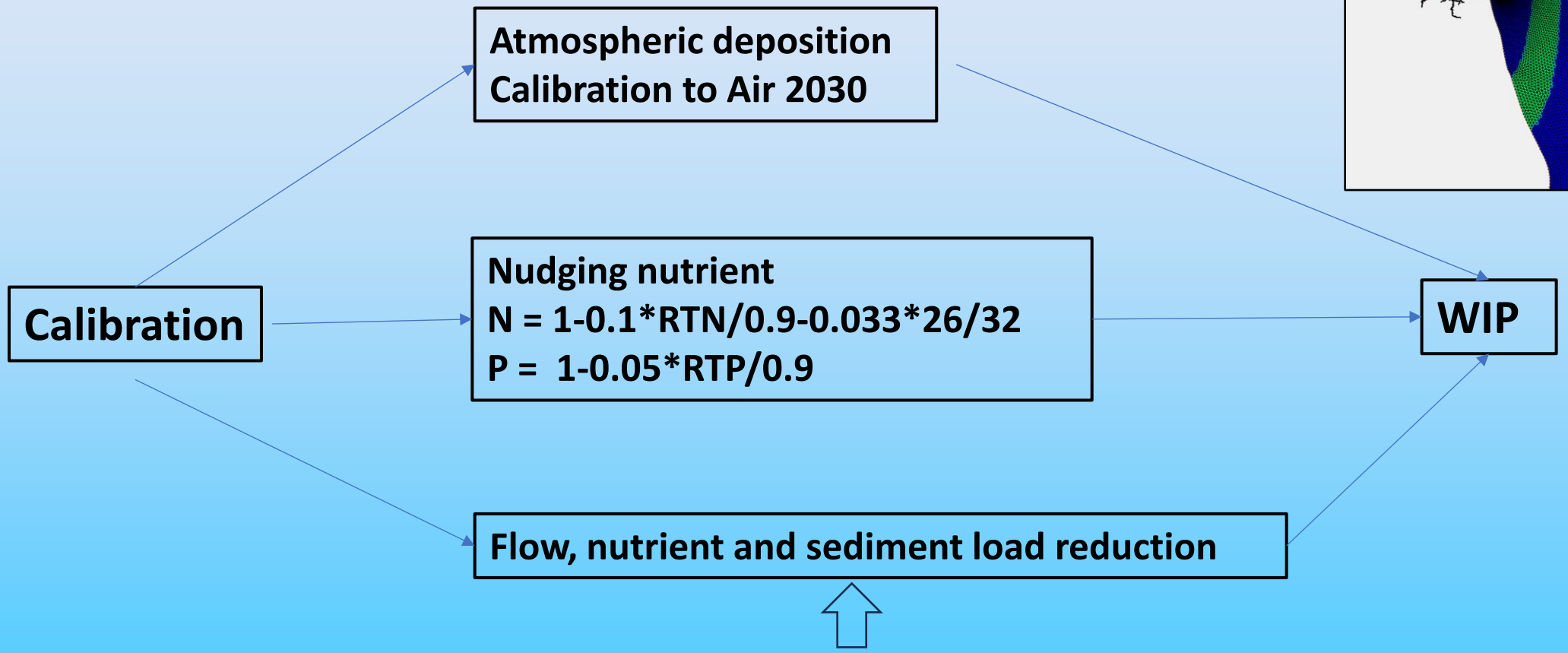
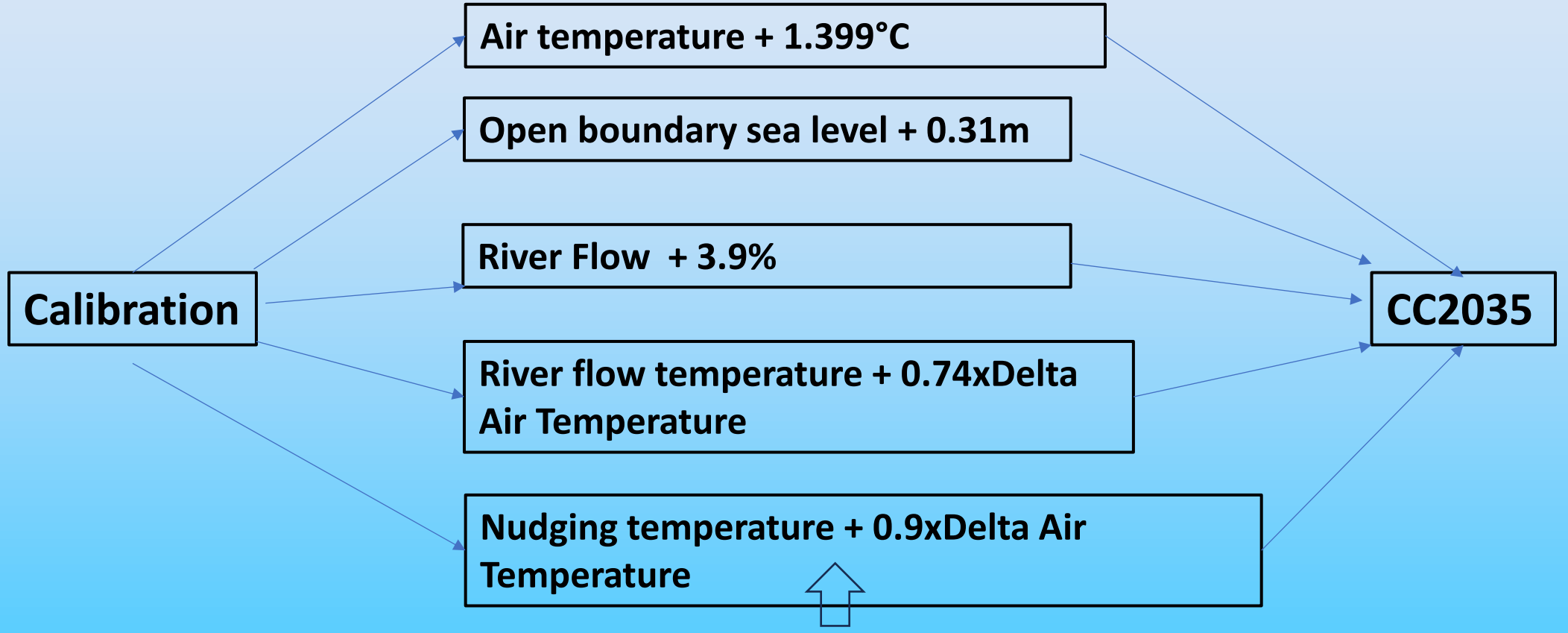
WIP scenario





flow	po4x	nh4x	no3x	totn	totp	orgp	orgn	pipx	tocx	tssx	sand	silt	clay
1.02	0.68	0.60	0.60	0.63	0.58	0.59	0.73	0.52	0.83	0.77	0.85	0.82	0.76

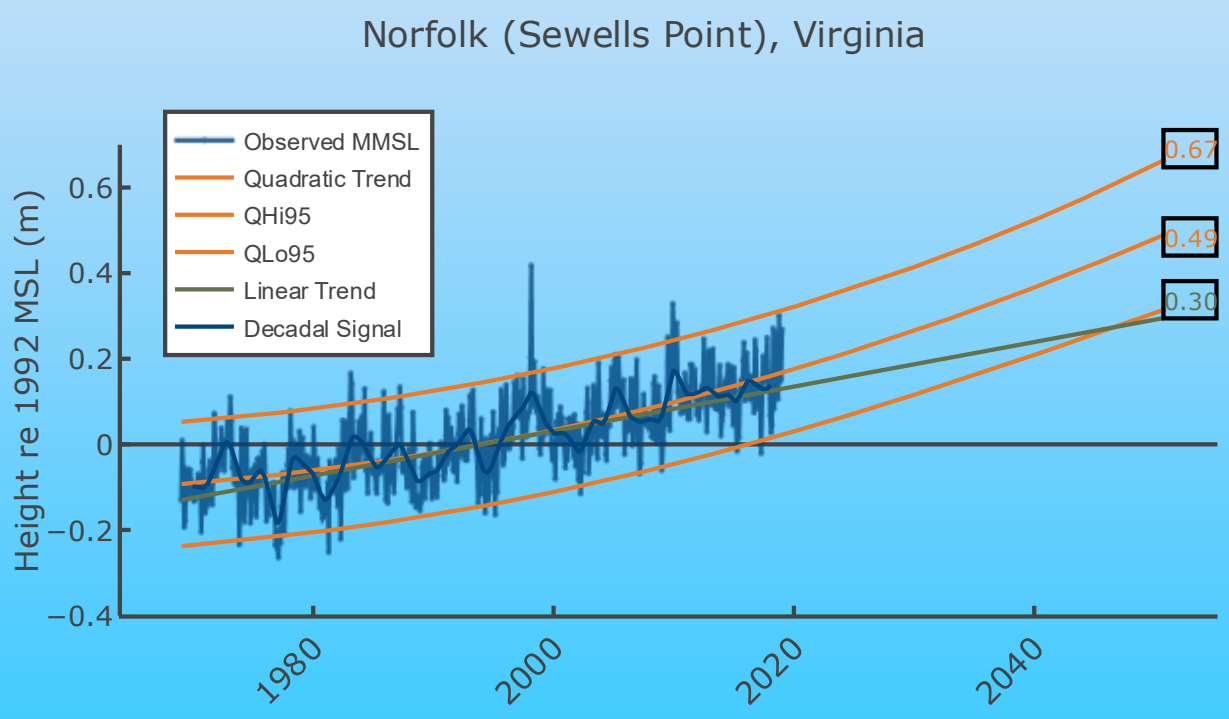
Climate change scenario 2035



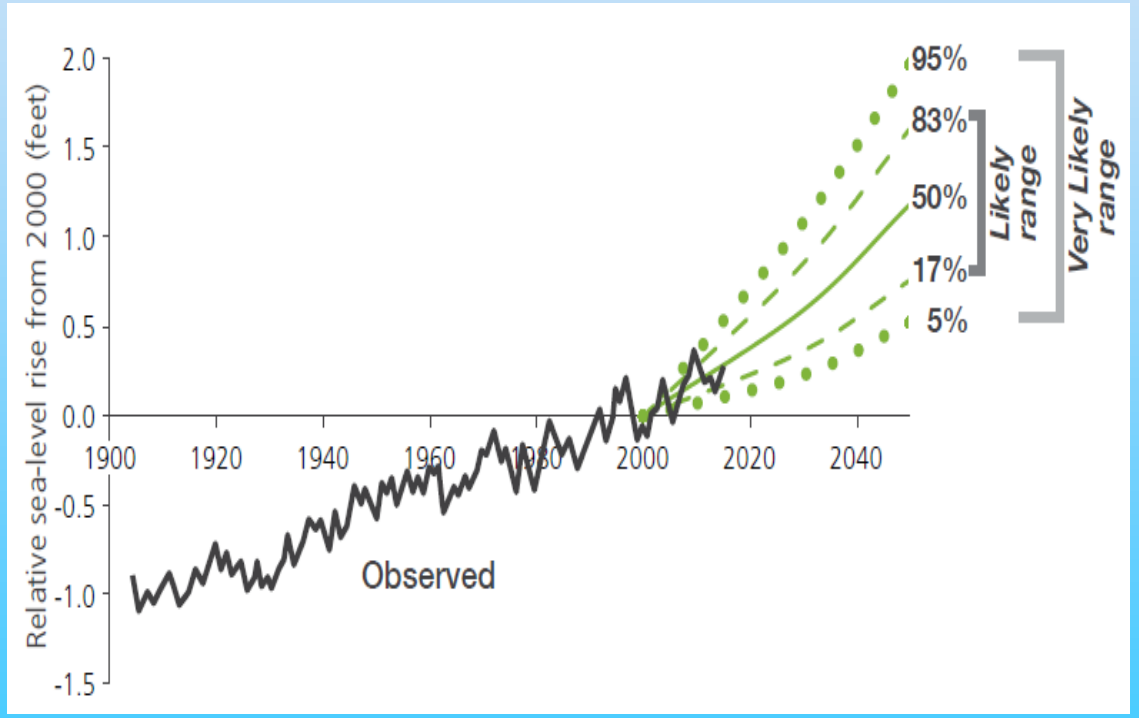
Delta air temperature from ensemble downscaling of 31 GCMs.
Delta river flow from watershed model prediction.
Delta river water temperature: Jastram & Rice 2015: WST increased 0.026/yr from 1960-2014.

Sea level rise adjustment for climate change scenarios

Quadratic function (Boon et al. 2013)



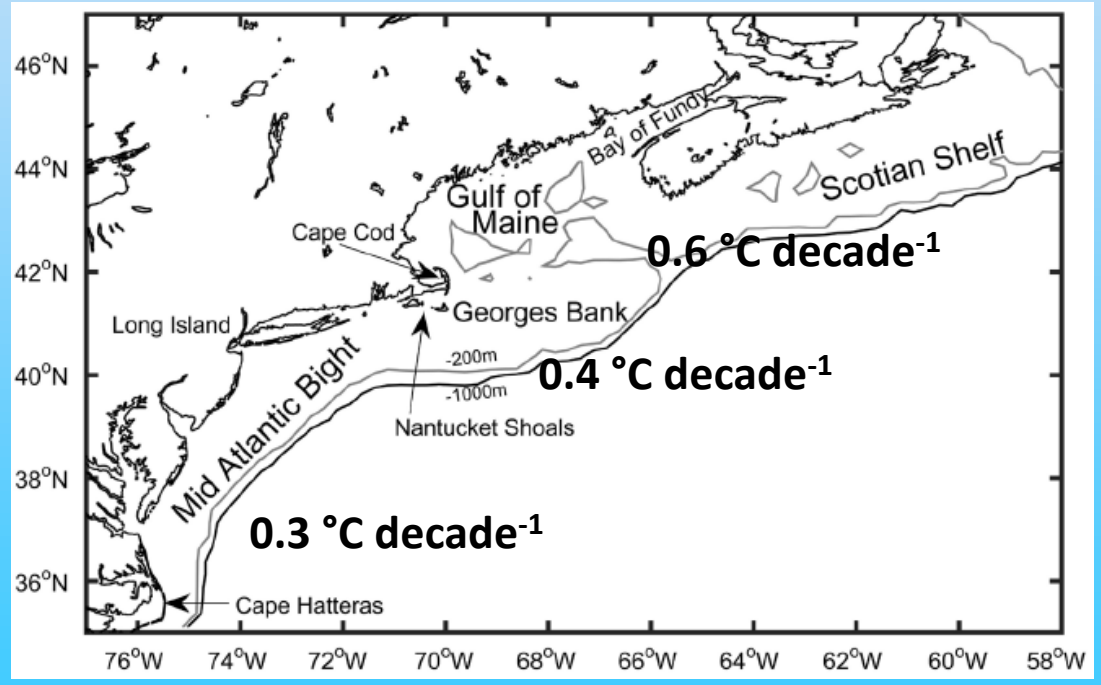
Probabilistic method (Kopp et al 2014)

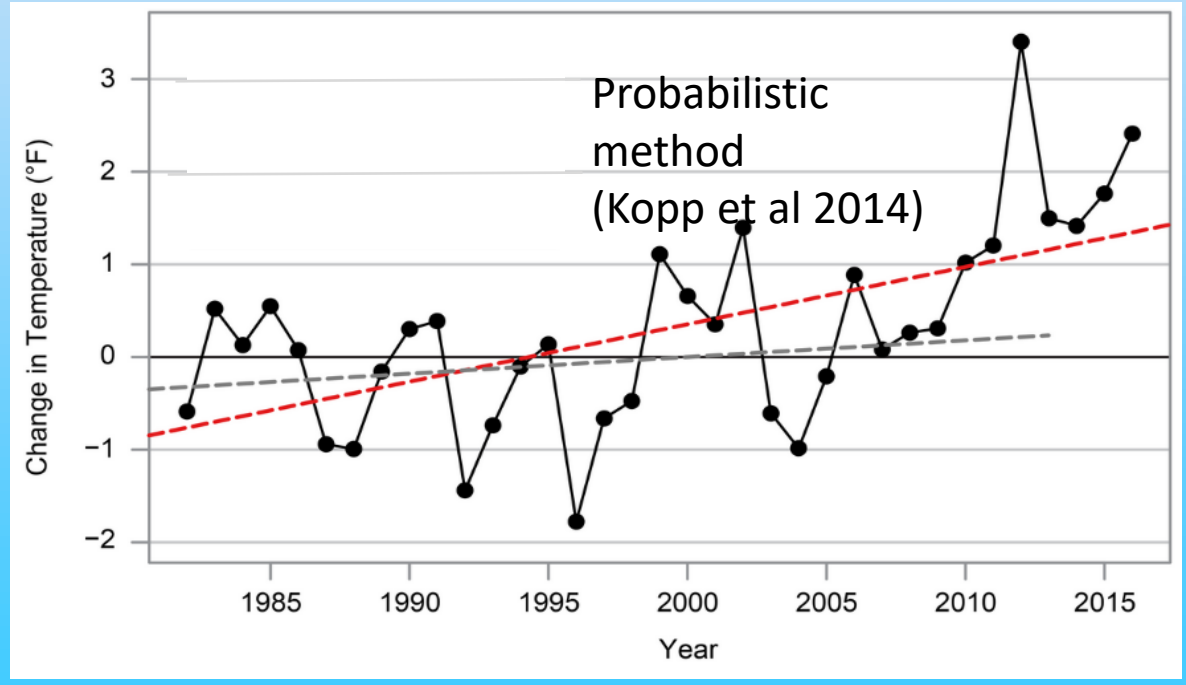


Open boundary water temperature adjustment for climate change scenarios

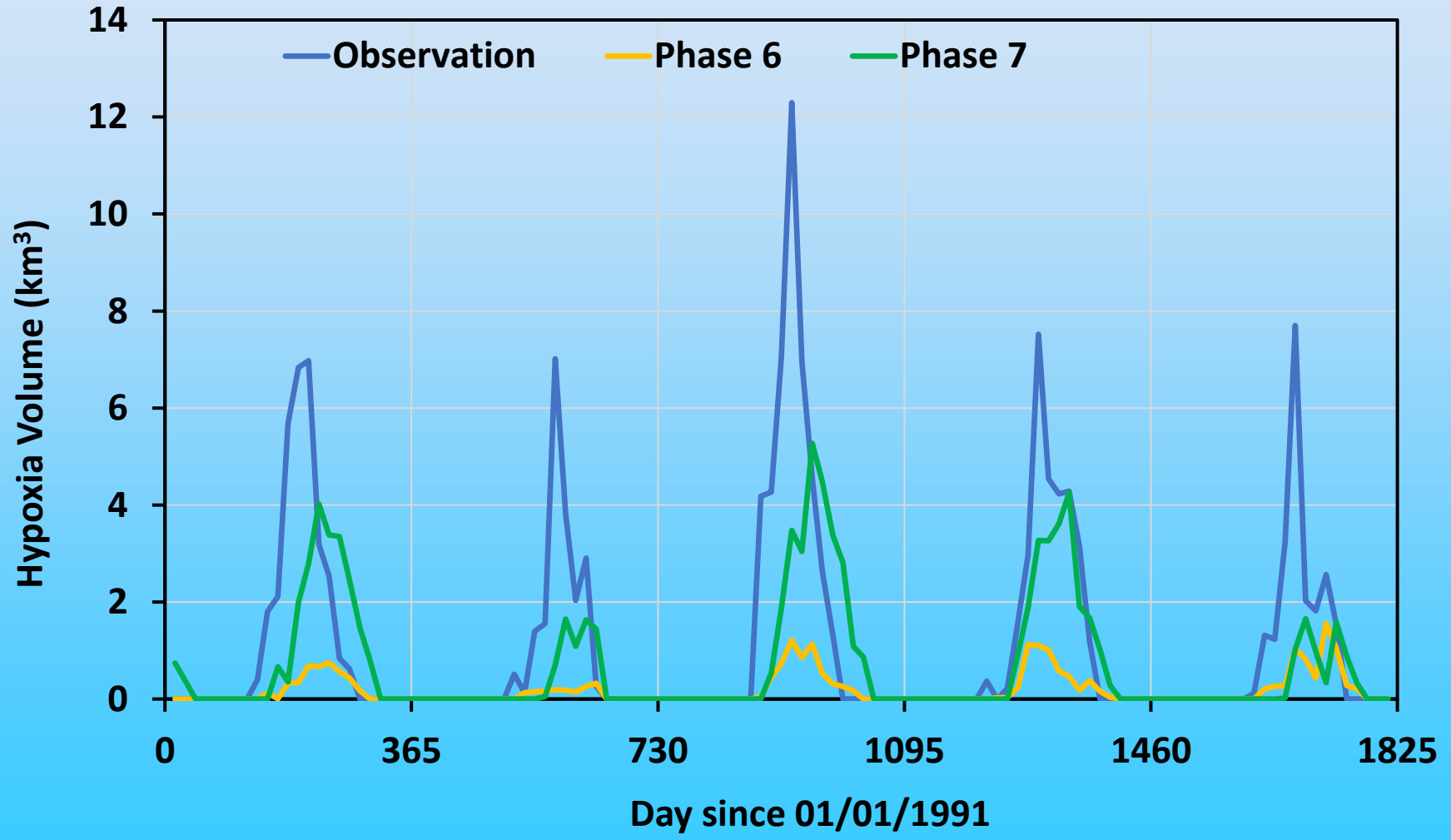
Data from 1982-2014; Thomas et al., 2017

SST increased 0.33 °C per decade from 1982 to 2016 (NOAA, Dupigny-Giroux et al., 2018).

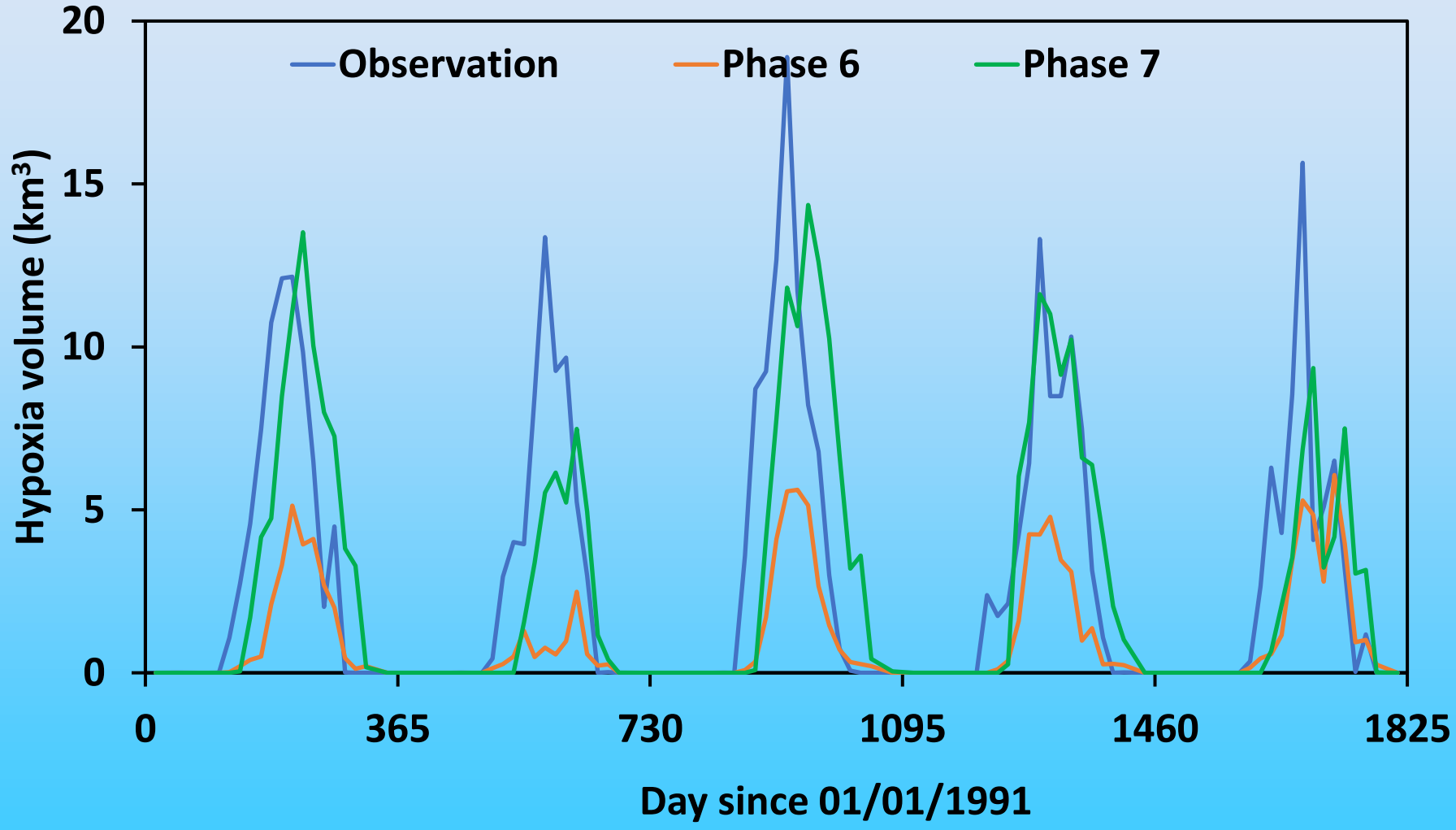




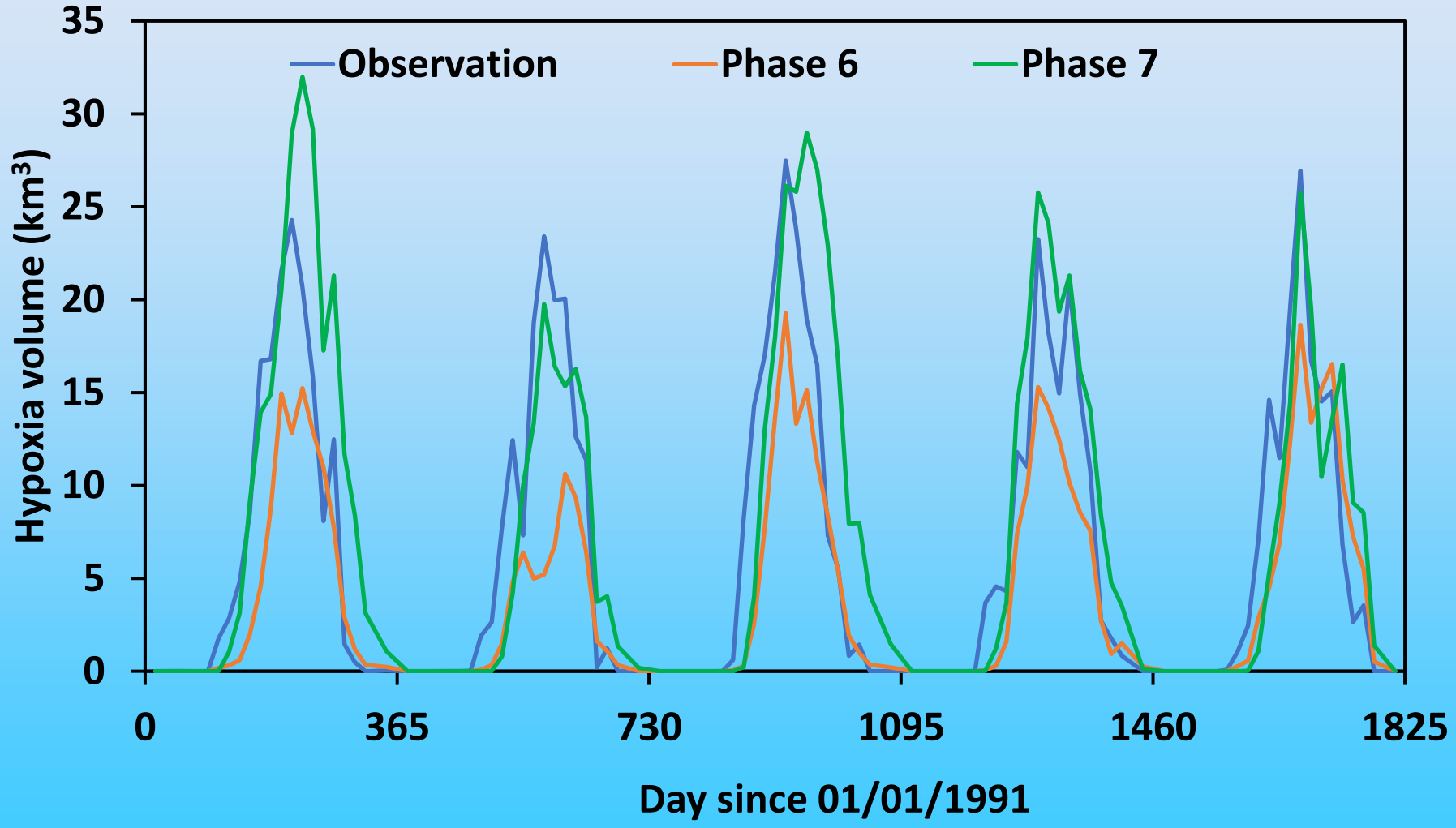
Comparison of Deep-Channel hypoxia volume between observation and calibration (< 1 mg/l)



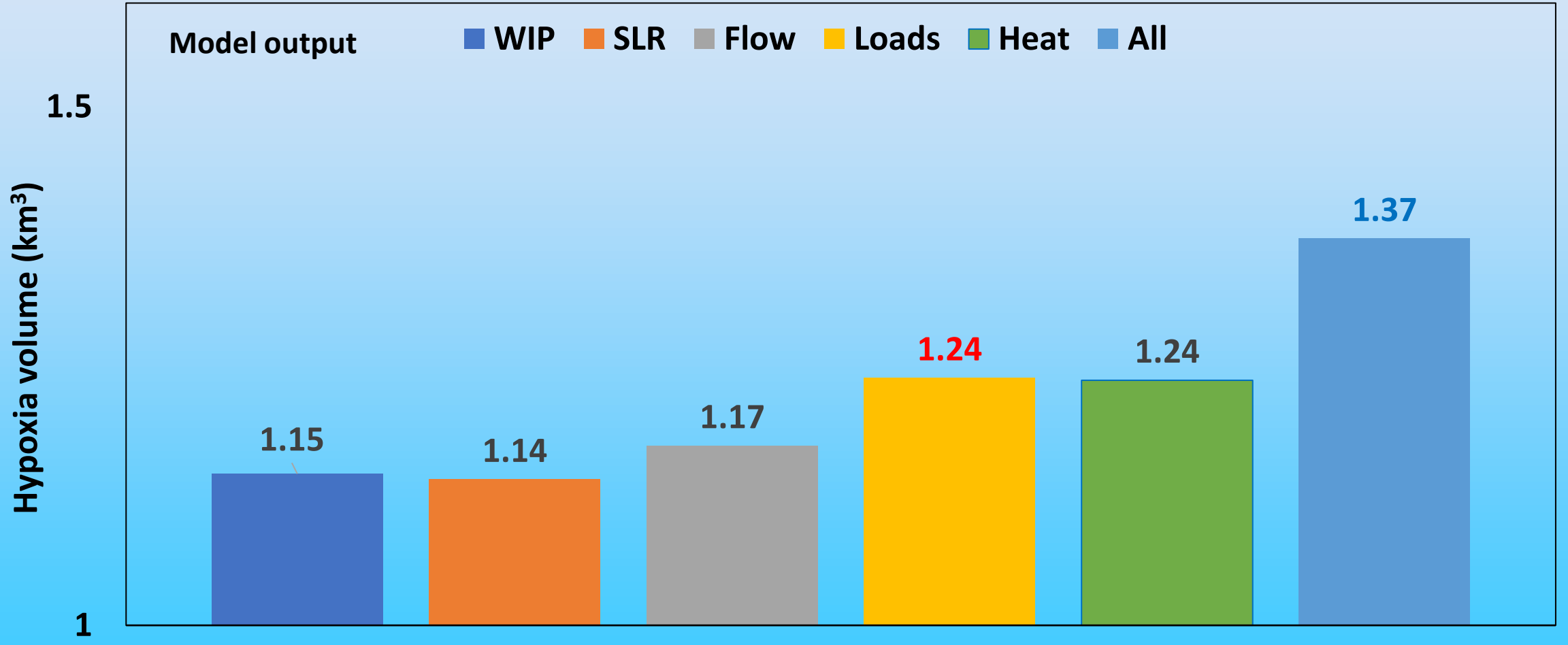
Comparison of Deep-Water hypoxia volume between observation and calibration (< 3 mg/l)



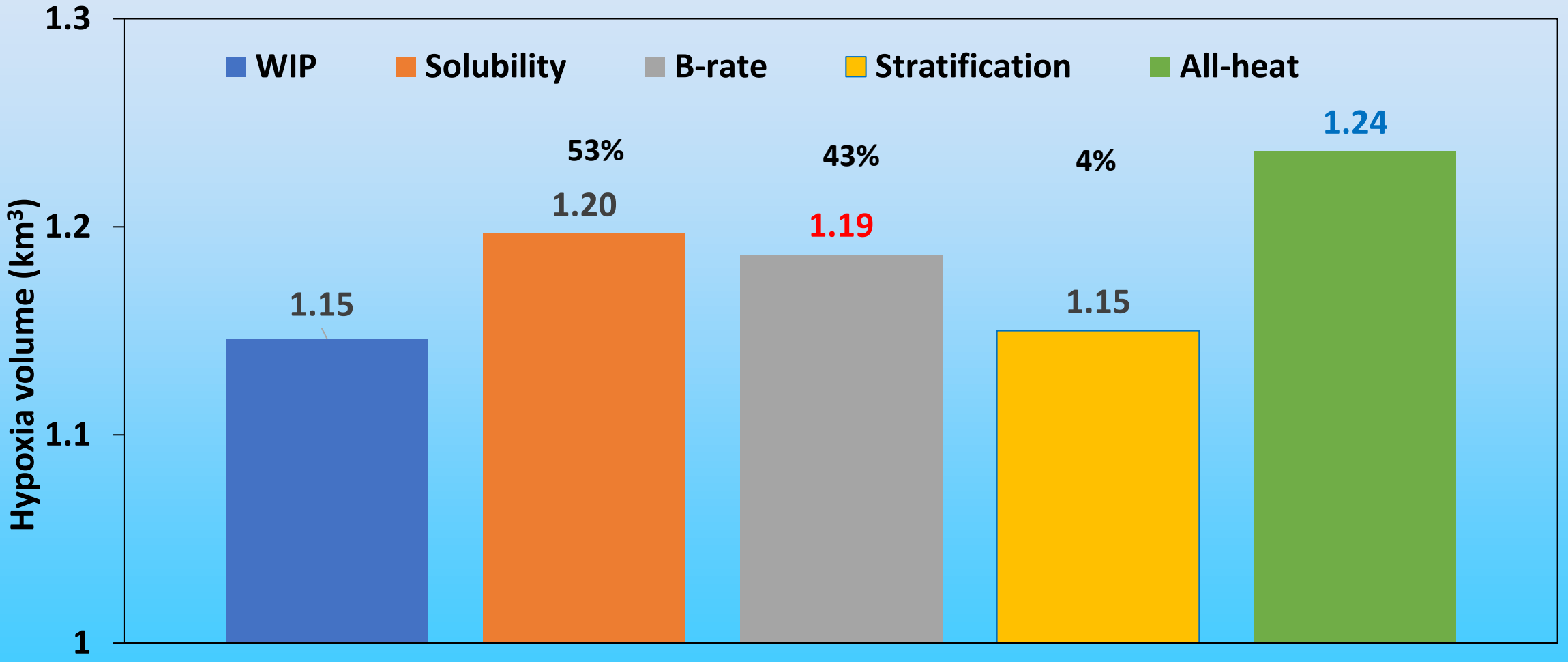
Comparison of Open-Water hypoxia volume between observation and calibration (< 5 mg/l)



2035 summer (Jun.-Sep.) average hypoxia volume (<1 mg/l) in the Whole Bay under WIP condition



2035 summer (Jun.-Sep.) average hypoxia volume (<1 mg/l) in the Whole Bay under WIP condition



Deep Chanel Criteria Assessment

Scenario	name	CALIB	CH3D_WIP	CH3D_35WIP	CC2035	P7_WIP	WIP_2035	WIP2035-vs-CALIB
CB3MH	MD	7.23%	0.00%	0.00%	7.55%	0.06%	1.26%	0.75%
CB4MH	MD	45.21%	5.02%	10.02%	47.08%	17.31%	27.26%	27.27%
CB5MH_MD	MD	20.92%	0.00%	0.00%	22.49%	0.31%	5.65%	4.53%
CB5MH_VA	VA	4.23%	0.00%	0.00%	7.19%	0.00%	0.00%	0.00%
POTMH_MD	MD	15.75%	0.00%	0.00%	17.22%	0.00%	1.69%	1.23%
RPPMH	VA	13.98%	0.00%	0.00%	20.26%	0.00%	1.73%	2.06%
CHSMH	MD	16.92%	0.00%	1.09%	17.87%	0.00%	3.51%	1.36%
EASMH	MD	18.26%	5.62%	6.51%	19.61%	5.09%	11.61%	10.30%
PATMH	MD	22.41%	0.00%	0.00%	28.23%	0.00%	0.00%	0.00%

Deep Water Criteria Assessment

Scenario	name	CALIB	CH3D_WIP	CH3D_35WIP	CC2035	P7_WIP	WIP_2035	WIP2035-vs-CALIB
CB3MH	MD	2.39%	0.05%	0.20%	2.61%	0.61%	0.88%	0.97%
CB4MH	MD	24.02%	4.82%	7.39%	26.04%	11.19%	14.49%	15.06%
CB5MH_MD	MD	10.15%	0.67%	2.32%	11.38%	3.56%	5.57%	5.61%
CB5MH_VA	VA	0.68%	0.00%	0.00%	1.07%	0.00%	0.00%	0.00%
CB6PH	VA	1.28%	0.00%	0.00%	2.71%	0.00%	0.22%	0.31%
CB7PH	VA	0.06%	0.00%	0.00%	0.75%	0.00%	0.00%	0.00%
PATMH	MD	9.00%	0.43%	0.00%	14.85%	0.00%	0.49%	0.48%
MAGMH	MD	55.63%	0.00%	1.66%	55.63%	27.63%	31.80%	47.87%
SOUMH	MD	23.68%	0.00%	0.00%	23.68%	20.28%	20.34%	15.99%
SEVMH	MD	8.03%	0.00%	0.00%	8.03%	2.52%	2.55%	7.80%
PAXMH	MD	12.89%	0.00%	0.00%	16.42%	0.00%	1.90%	1.94%
POTMH_MD	MD	6.81%	0.00%	0.24%	9.11%	0.74%	2.47%	2.43%
RPPMH	VA	10.63%	0.00%	0.24%	13.71%	1.78%	5.49%	5.94%
YRKPH	VA	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
SBEMH	VA	0.77%	0.00%	0.00%	2.02%	0.00%	0.00%	0.00%
CHSMH	MD	6.14%	0.00%	0.00%	7.92%	0.87%	2.60%	1.39%
EASMH	MD	3.35%	0.45%	0.05%	6.29%	0.97%	1.85%	1.78%

Open Water DO Criteria Assessment

Scenario	name	CALIB	CH3D_WIP	CH3D_35WIP	CC2035	P7_WIP	WIP_2035	WIP2035-vs-CALIB
CB6PH	VA	2.43%	0.01%	0.83%	3.93%	0.84%	2.10%	2.15%
CB7PH	VA	5.52%	0.23%	2.46%	7.84%	2.61%	5.09%	4.92%
GUNOH	MD	4.59%	4.59%	4.59%	4.59%	4.59%	4.59%	4.59%
PAXTF	MD	9.11%	7.76%	11.95%	9.41%	0.00%	0.45%	0.00%
WBRTF	MD	4.59%	4.59%	32.27%	4.59%	0.00%	0.00%	4.59%
PAXOH	MD	20.70%	0.00%	9.77%	27.97%	0.07%	0.22%	2.33%
PAXMH	MD	2.10%	0.00%	0.00%	4.28%	0.00%	0.00%	0.00%
ANATF_DC	DC	18.12%	0.00%	20.94%	19.76%	14.83%	16.79%	13.62%
ANATF_MD	MD	28.06%	1.81%	39.17%	31.68%	21.16%	24.28%	24.50%
PISTF	MD	4.42%	0.63%	4.65%	4.54%	4.28%	4.42%	4.34%
CRRMH	VA	24.53%	5.75%	17.30%	27.67%	1.26%	3.10%	4.60%
MPNTF	VA	4.59%	0.00%	41.33%	4.59%	0.00%	1.31%	4.59%
PMKTF	VA	11.01%	8.62%	81.74%	11.01%	1.54%	6.90%	5.71%
YRKMH	VA	24.62%	0.67%	1.70%	31.45%	0.19%	6.83%	7.61%
WBEMH	VA	15.29%	7.80%	8.13%	15.29%	5.50%	7.80%	5.50%
SBEMH	VA	34.77%	17.82%	43.18%	38.33%	21.48%	28.89%	26.75%
EBEMH	VA	22.74%	7.72%	21.63%	23.81%	21.46%	21.63%	21.63%
WICMH	MD	11.22%	4.96%	22.97%	19.27%	0.00%	5.12%	11.01%
TANMH_VA	VA	2.05%	0.00%	0.00%	4.95%	0.00%	0.98%	1.15%

Summer Chlorophyll Criteria Assessment

Segment	State	CALIB	CC2035	P7_WIP	WIP_2035	WIP2035-vs-CALIB
JMSMH	VA	0.00%	0.00%	0.00%	0.00%	0.00%
JMSOH	VA	0.00%	0.00%	0.00%	0.00%	0.00%
JMSPH	VA	4.79%	0.78%	0.00%	0.00%	0.00%
JMSTF	VA	47.06%	40.50%	33.89%	32.10%	30.87%
JMSTFU	VA	17.09%	19.25%	1.85%	2.44%	1.85%
JMSTFL	VA	38.19%	35.99%	19.73%	14.33%	16.59%
DCPTF	DC	58.42%	57.33%	0.00%	0.00%	0.00%

Spring Chlorophyll Criteria Assessment

Segment	State	CALIB	CC2035	P7_WIP	WIP_2035	WIP2035-vs-CALIB
JMSMH	VA	0.00%	0.00%	0.00%	0.00%	0.00%
JMSOH	VA	0.00%	0.00%	0.00%	0.00%	0.00%
JMSPH	VA	7.04%	8.17%	0.17%	4.79%	4.04%
JMSTFL	VA	5.63%	5.43%	1.48%	2.01%	1.61%
JMSTFU	VA	0.00%	0.00%	0.00%	0.00%	0.00%

Mesohaline KD Criteria Assessment

Scenario	name	CALIB	CC2035	P7_WIP	WIP_2035	WIP2035-vs-CALIB
CB1TF	MD	87.34%	87.34%	82.74%	65.04%	78.01%
CB2OH	MD	2.05%	2.26%	0.00%	1.26%	0.00%
CB3MH	MD	3.63%	5.33%	0.00%	3.04%	0.00%
CB4MH	MD	83.53%	84.46%	79.88%	73.26%	80.57%
CB5MH	MD_VA	76.76%	79.17%	63.60%	61.30%	66.62%
CHOMH1	MD	82.10%	82.80%	70.71%	71.82%	75.25%
CHOMH2	MD	62.73%	69.95%	39.98%	50.21%	46.37%
CHOOH	MD	19.78%	8.91%	0.89%	0.13%	0.01%
CHSTF	MD	78.27%	87.34%	64.74%	73.75%	73.75%
CHSOH	MD	65.73%	74.59%	37.43%	54.45%	49.99%
CHSMH	MD	26.27%	28.18%	21.06%	25.33%	25.33%
EASMH	MD	80.81%	81.16%	74.41%	67.60%	80.43%
JMSMH	VA	6.36%	7.47%	2.31%	4.41%	2.25%
JMSOH	VA	27.31%	13.62%	6.20%	9.19%	1.38%
JMSTF	VA	0.00%	0.00%	0.00%	0.00%	0.00%
JMSTFL	VA	0.00%	0.00%	0.00%	0.00%	0.00%
JMSTFU	VA	0.00%	0.00%	0.00%	0.00%	0.00%
MPNOH	VA	32.89%	15.19%	15.16%	6.71%	2.01%
MPNTF	VA	0.00%	0.00%	0.00%	0.00%	0.00%

Scenario	name	CALIB	CC2035	P7_WIP	WIP_2035	WIP2035-vs-CALIB
PAXMH	MD	53.02%	53.44%	32.42%	33.98%	33.08%
PAXOH	MD	42.96%	39.18%	6.23%	11.99%	5.70%
PAXTF	MD	23.25%	23.60%	3.47%	1.08%	0.68%
PIAMH	VA	72.96%	82.44%	54.16%	58.84%	63.53%
PMKOH	VA	29.75%	20.39%	16.96%	13.17%	8.39%
PMKTF	VA	7.47%	0.00%	0.00%	0.00%	0.00%
POCMH	MD_VA	60.80%	61.94%	34.06%	47.81%	40.15%
MPCMH	MD	66.41%	67.23%	47.37%	54.46%	50.93%
VPCMH	VA	58.13%	59.43%	27.74%	44.67%	35.03%
POTMH	MD_VA	29.41%	28.09%	15.45%	20.50%	18.49%
POTOH	MD_VA	87.34%	87.34%	87.31%	87.31%	87.34%
POTTF	MD_VA_D	87.06%	87.06%	85.80%	85.26%	85.90%
RPPMH	VA	29.16%	32.49%	11.32%	22.54%	17.25%
RPPOH	VA	5.84%	17.93%	2.17%	9.55%	2.23%
RPPTF	VA	8.12%	13.25%	0.00%	5.82%	0.37%
TANMH	MD	83.39%	84.55%	73.84%	78.56%	77.86%
YRKMH	VA	25.09%	26.36%	11.53%	23.47%	16.15%
VA5MH	VA	70.41%	73.79%	58.98%	49.74%	57.67%
MD5MH	MD	82.23%	83.81%	67.65%	71.26%	0.00%

Polyhaline KD Criteria Assessment

Scenario	name	CALIB	CC2035	P7_WIP	WIP_2035	WIP2035-vs-CALIB
CB6PH	VA	0.00%	0.00%	0.00%	0.00%	0.00%
CB7PH	VA	50.61%	53.25%	35.85%	40.79%	38.47%
CB8PH	VA	0.00%	0.00%	0.00%	0.00%	0.00%
JMSPH	VA	28.25%	27.05%	0.00%	16.54%	7.06%
MOBPH	VA	65.65%	73.98%	50.49%	60.51%	57.50%
YRKPH	VA	18.34%	25.06%	5.28%	20.27%	8.35%

Messages

- **The Phase 7 model reproduced the observed hypoxia volume better than Phase 6.**
- **Criteria assessment procedures have need lined up with the Phase 7 model.**
- **Preliminary results showed that the Phase 7 model tended to predict higher non-attainment than Phase 6 in the deep channel.**