Skill Assessment of Multiple Models in Chesapeake Bay

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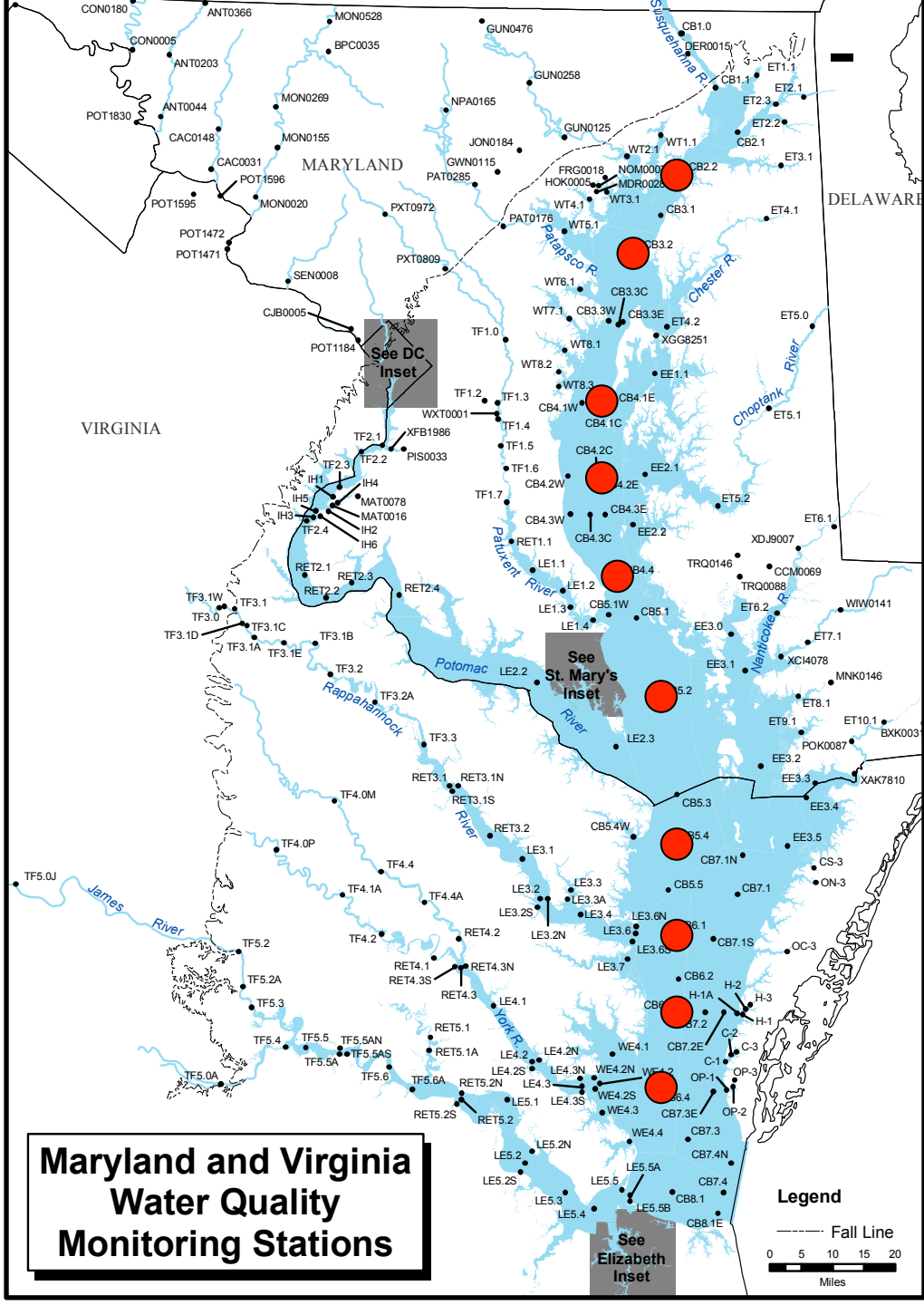
Project Objective

- Statistically compare output from four Chesapeake Bay (estuarine) models:
  - three ROMS models, varying biological complexity
  - biologically sophisticated CBP regulatory model
- How well do they reproduce the mean and seasonal variability of:
  - temperature, salinity, stratification, dissolved oxygen, chlorophyll-a, and nitrate

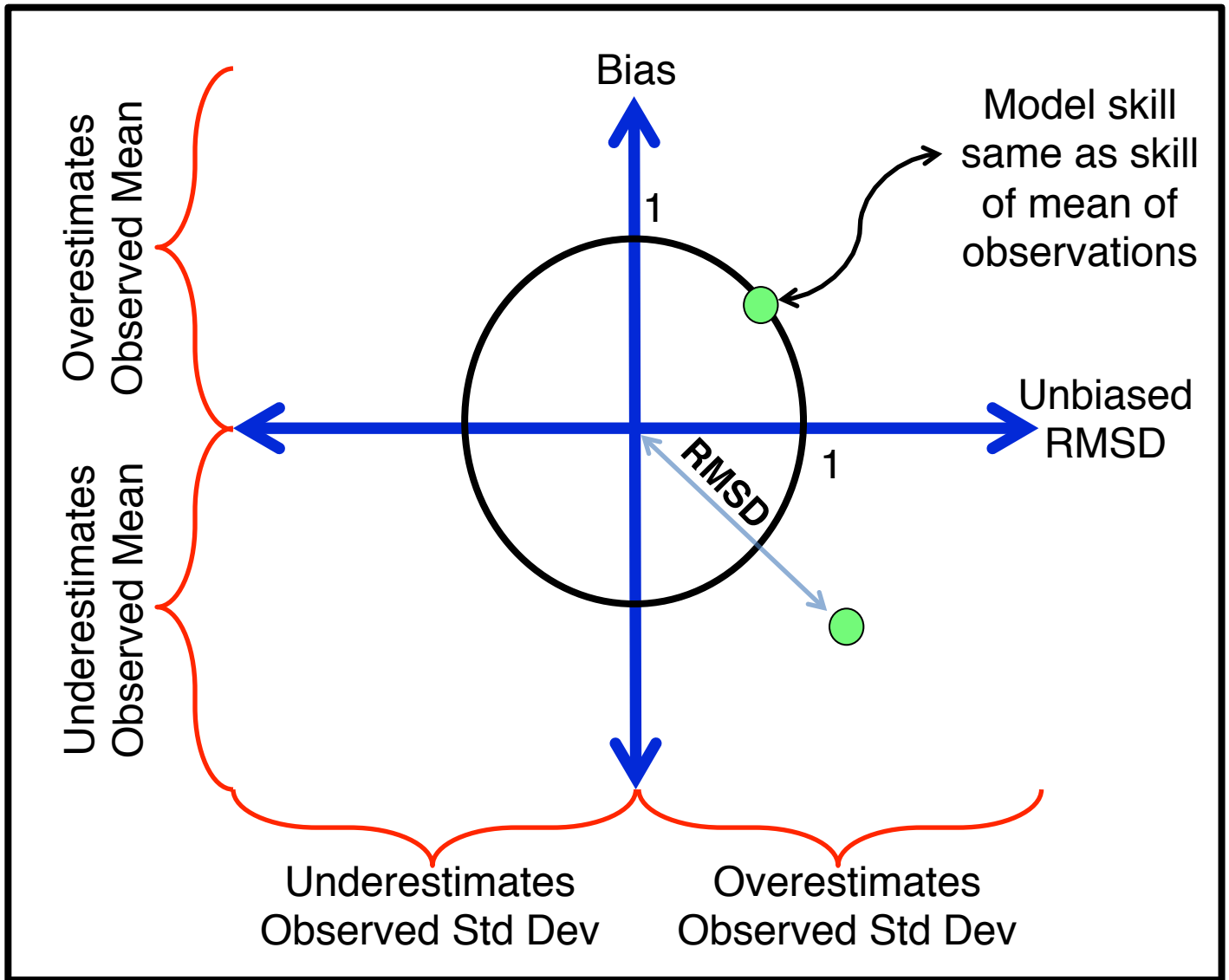
Models Utilized

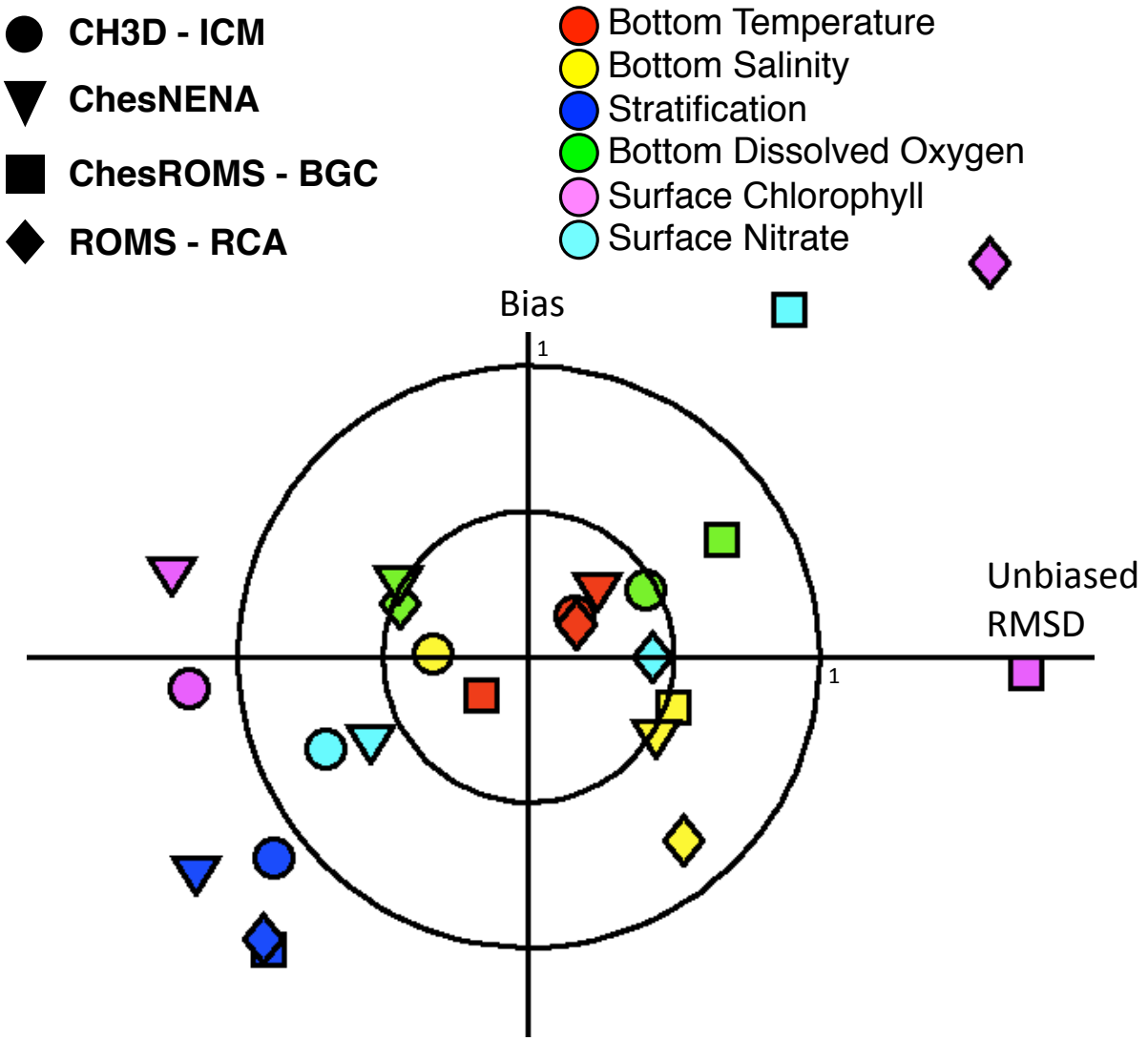
	CH3D-ICM (CBP model)	ChesNENA	ChesROMS - BGC	ROMS - RCA
Nutrients Simulated	N, P, Si	C, N	N	N, P, Si
Biogeochemical Sediment Component	Yes	No	No	Yes
Number of Algal Groups	3	1	1	2
Horizontal Resolution	0.25 - 1km^2	~ 1km^2	~ 1km^2	~ 1km^2
Vertical Grid	z: ~ 5ft	σ: 20 layers	σ: 20 layers	σ: 20 layers

Compare simulations at 10 main stem stations for ~16 cruises in 2004



Model Skill Assessment via Target Diagrams

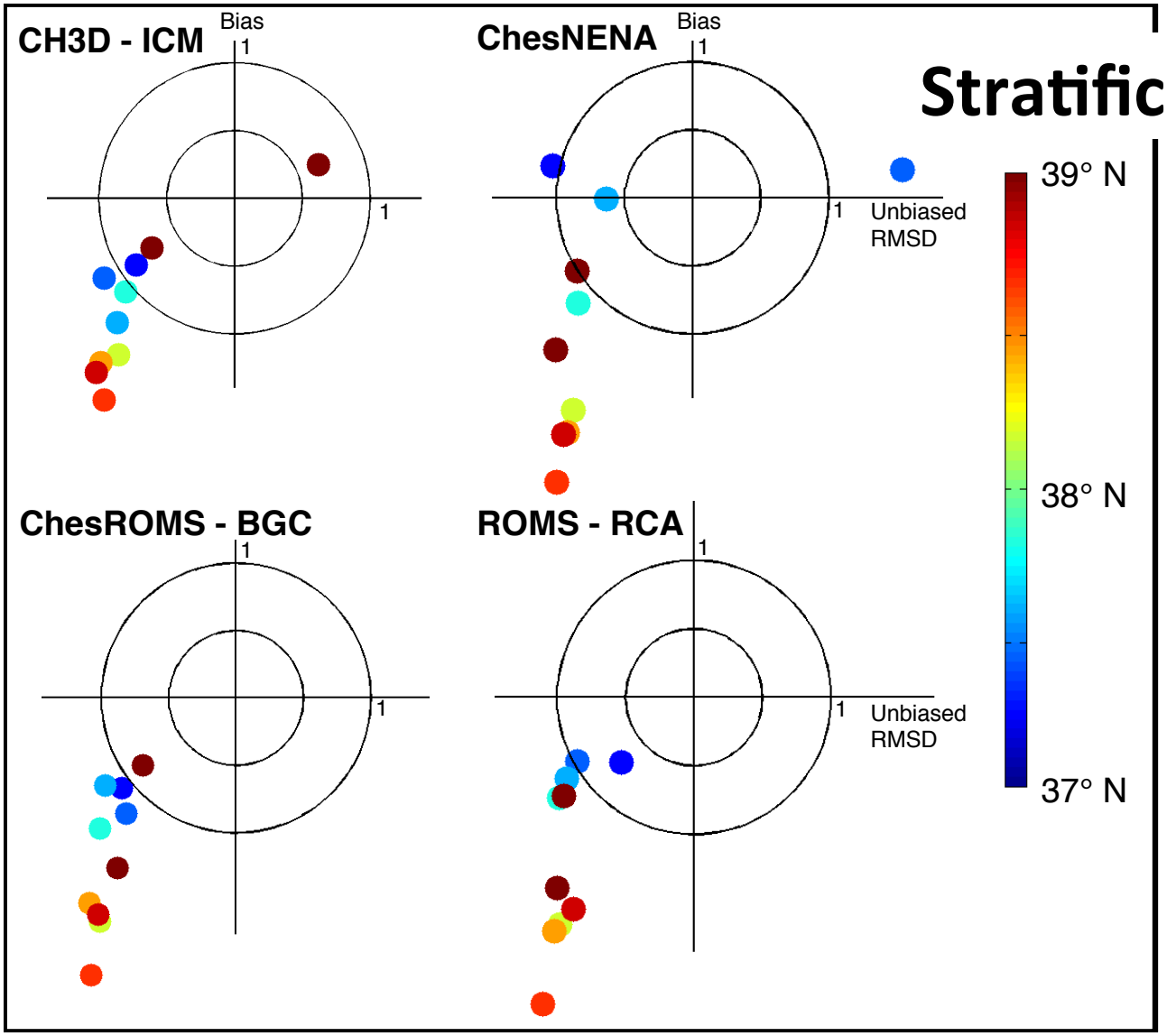




Overall skill of all four models (temporal+spatial variability):

- are **highest** in terms of **Temperature**
- are **similar** to each other in terms of **T, S, stratification** and **DO**
- are **different** in terms of **chlorophyll** and **nitrate**

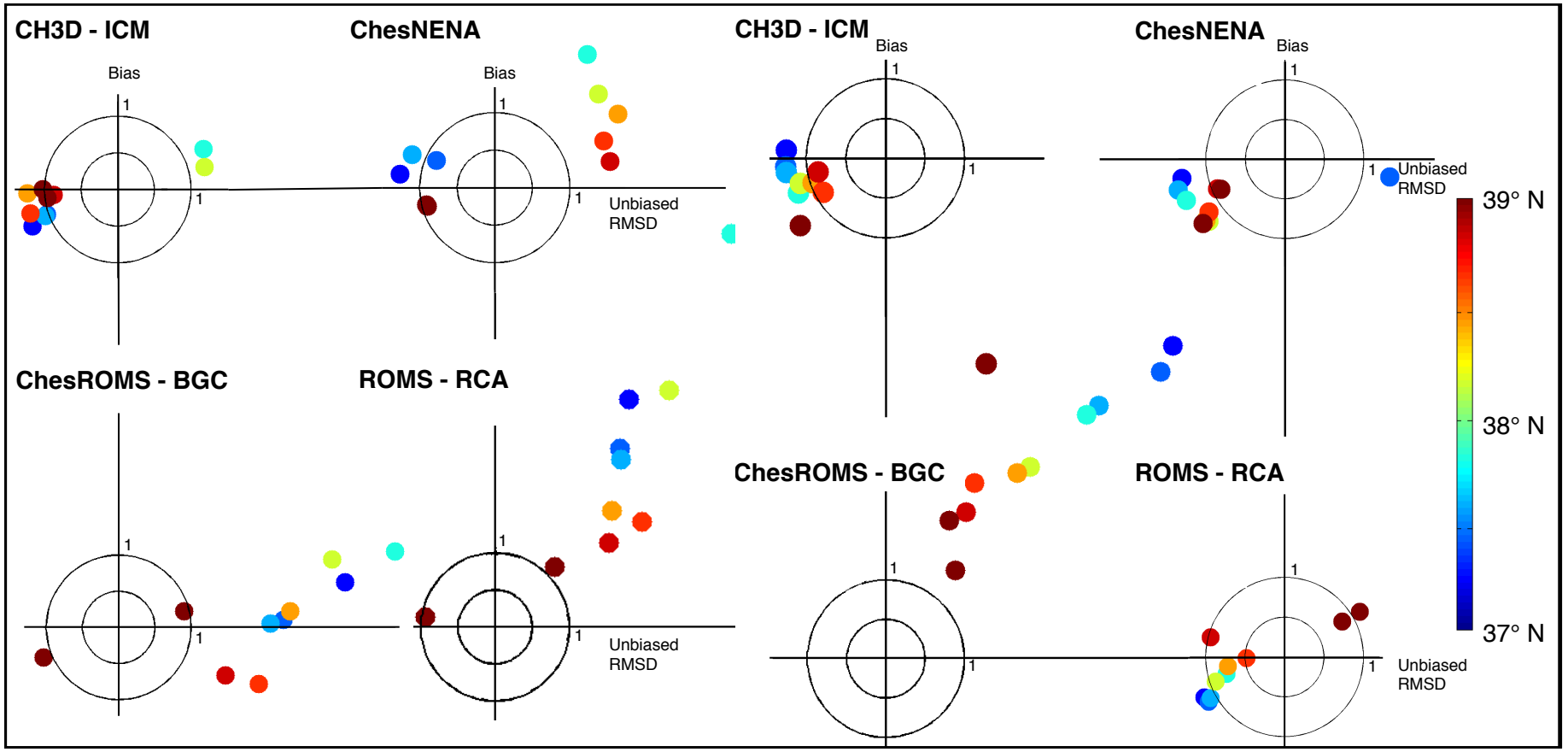
Stratification



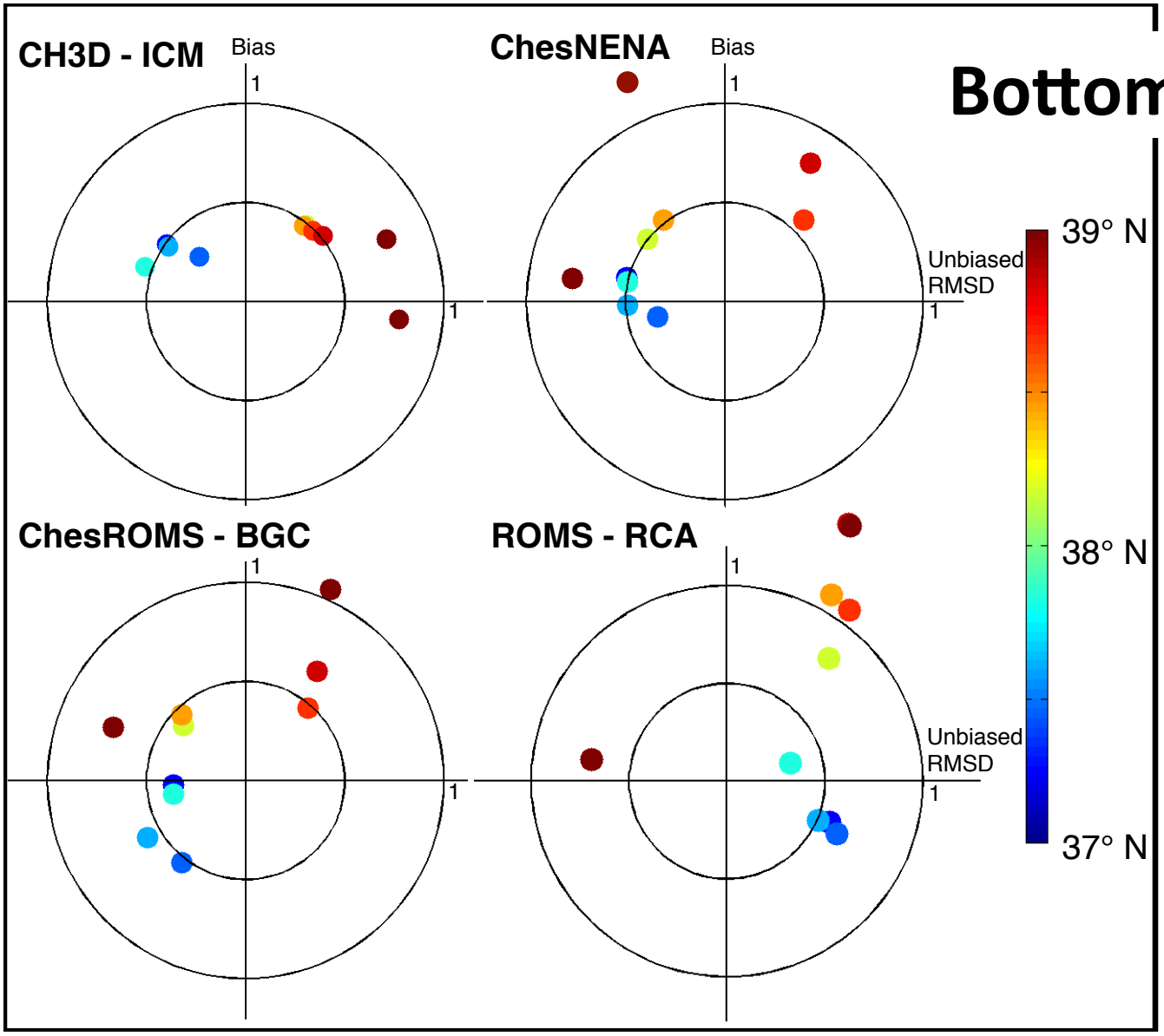
All models consistently underestimate both the mean and seasonal variability of stratification, particularly at the northern stations

Chlorophyll

Nitrate



Skill for surface chlorophyll & nitrate varies significantly between models



Bottom DO

Despite underestimation of stratification & varying performance between models for chlorophyll and nitrate, models still reproduce mean and seasonal variability of DO similarly well, particularly at southern stations

Conclusions & Implications

- Models with lower biological complexity and resolution achieve similar skill scores as CBP model in terms of seasonal variability along the main stem of Chesapeake for T, S, stratification and DO

  → More confidence in CBP model results for DO

- All models reproduce bottom DO better than variables that are primary influences on DO (stratification, chlorophyll, nitrate)

  → This is because seasonal DO variability is sensitive to temperature (solubility effect), and the models reproduce temperature very well

  → Modeled DO simulations may be very sensitive to any future increases in Bay temperature

Future Work: Similar analyses for interannual 25 year run