



National Snow and Ice Data Center
Supporting Cryospheric Research Since 1976

Snow : Obs and Models

Andrew Slater & Sean Swenson



SNOW! It's Important Stuff



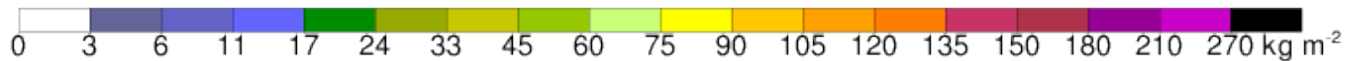
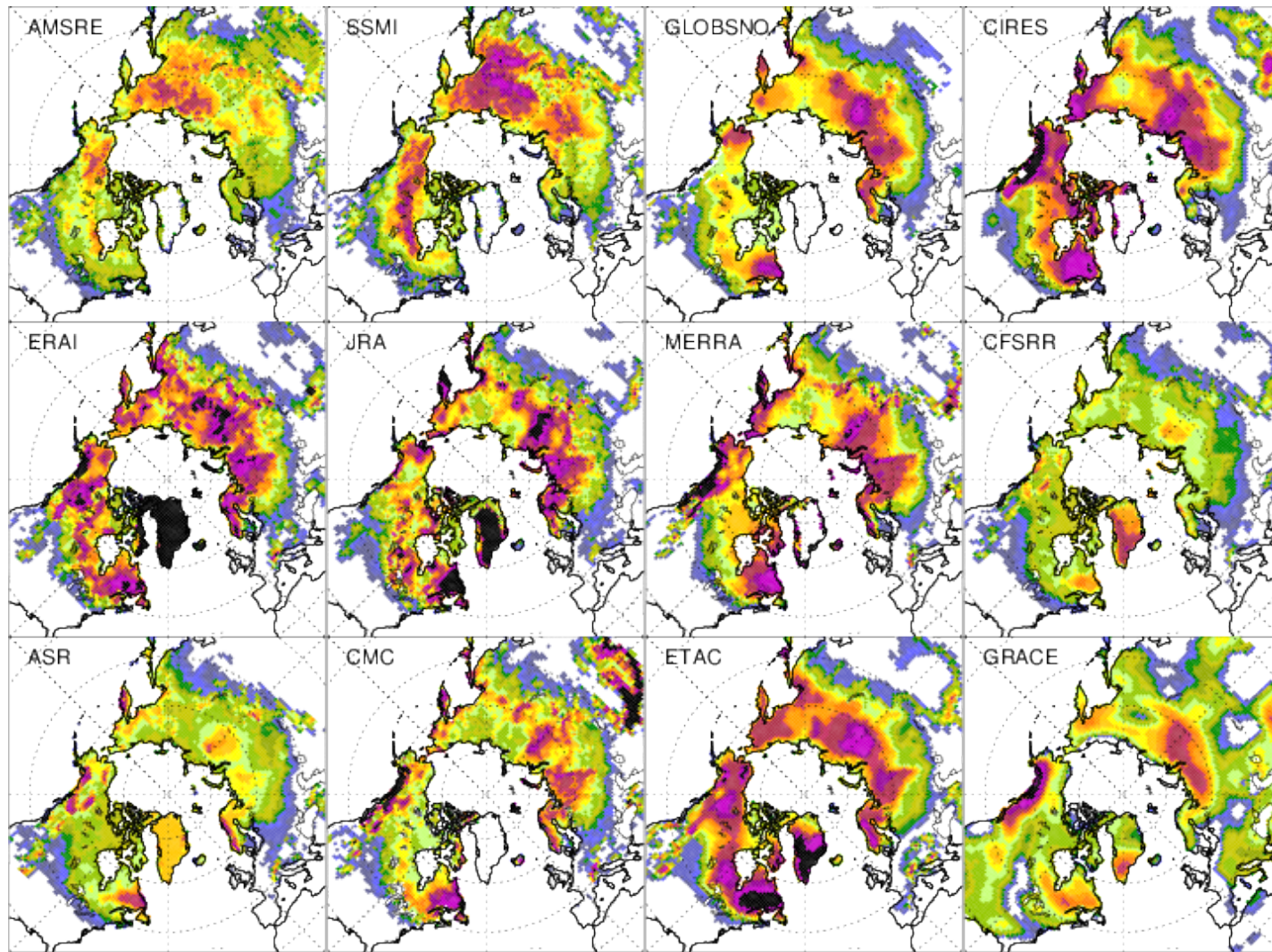
Where d'ya get your information from, huh?



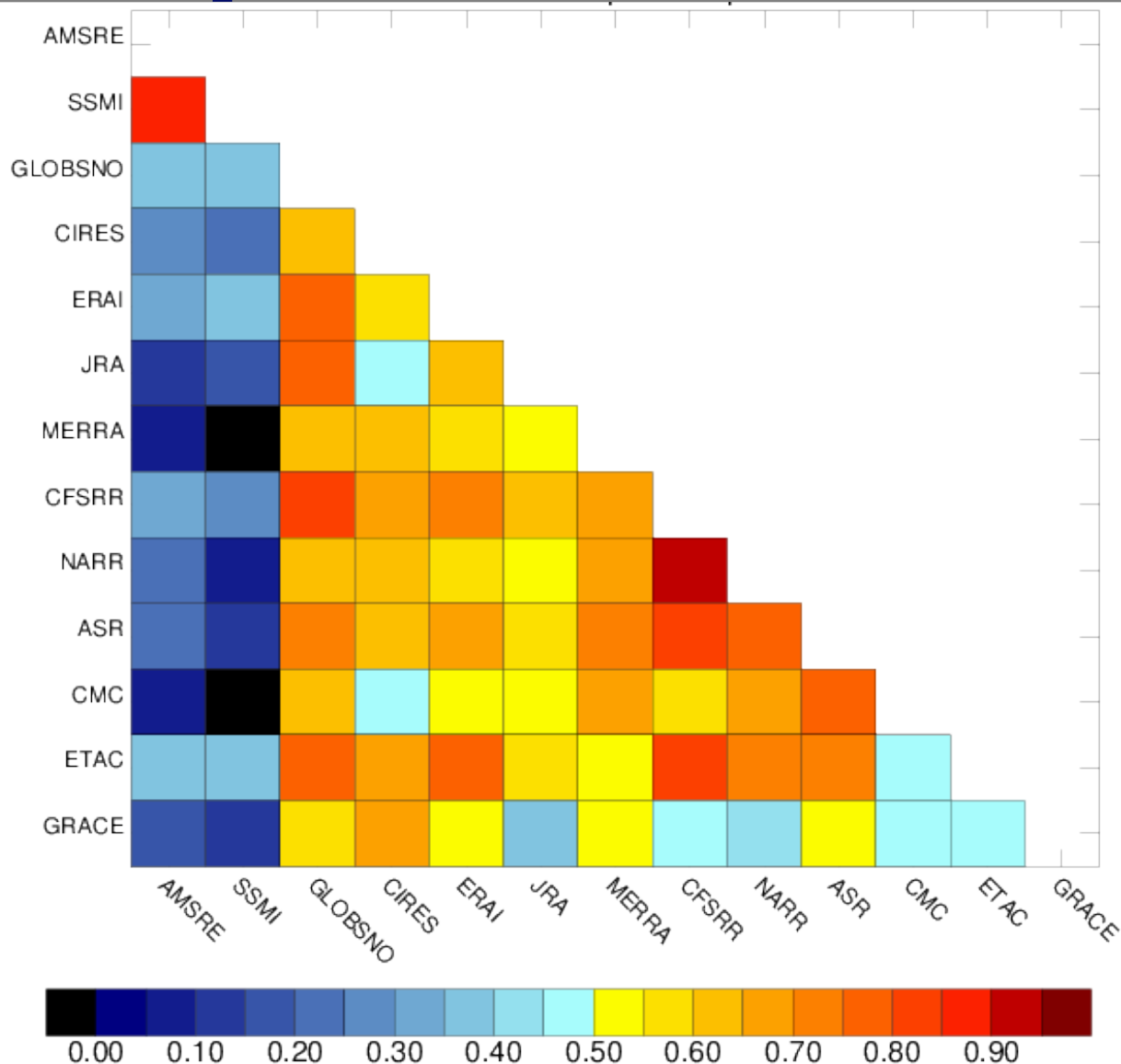
Nth Hemisphere Snow Mass/Depth Data

Product	Native Resolution	Period	Product Type	Reference
AMSR-E	25km EASE Grid	2002-2009	Passive Microwave	Tedesco et al, 2004
SSMI	25km EASE Grid	2000-2007	Passive Microwave	Armstrong & Brodzik
GlobSno	25km EASE Grid	2000-2009	Station data + Microwave	Takala et al, 2011
ERA1	0.75 x 0.75 Deg	2000-2009	Reanalysis, with depth analysis	Dee et al.
JRA	1.125 x 1.125 Deg	2000-2009	Reanalysis, with depth analysis	Onagi et al.
CFSRR	0.33 x 0.33 Deg	2000-2009	Reanalysis, with depth analysis	Saha et al
NARR	32km (NCEP 221)	2000-2009	Reanalysis, with depth analysis	Messinger et al
ASR	30km WRF grid	2000-2009	Reanalysis, with depth analysis	Bromwich et al.
MERRA	0.5 x 0.666 Deg	2000-2009	Reanalysis, forecast	Reinecker et al.
CIRES	2.5 x 2.5 Degrees	2000-2009	Reanalysis, forecast	Compo et al.
CMC	~24km IMS grid	2000-2009	Station interpolation/analysis	Ross Brown
ETAC	1.0 x 1.0 degree	Pre-1988	Station interpolation	Foster & Davey
GRACE	Big (ask Sean)	2002-2008	Gravity anomaly	Sean Swenson

Mean March SWE (~2000-2009)



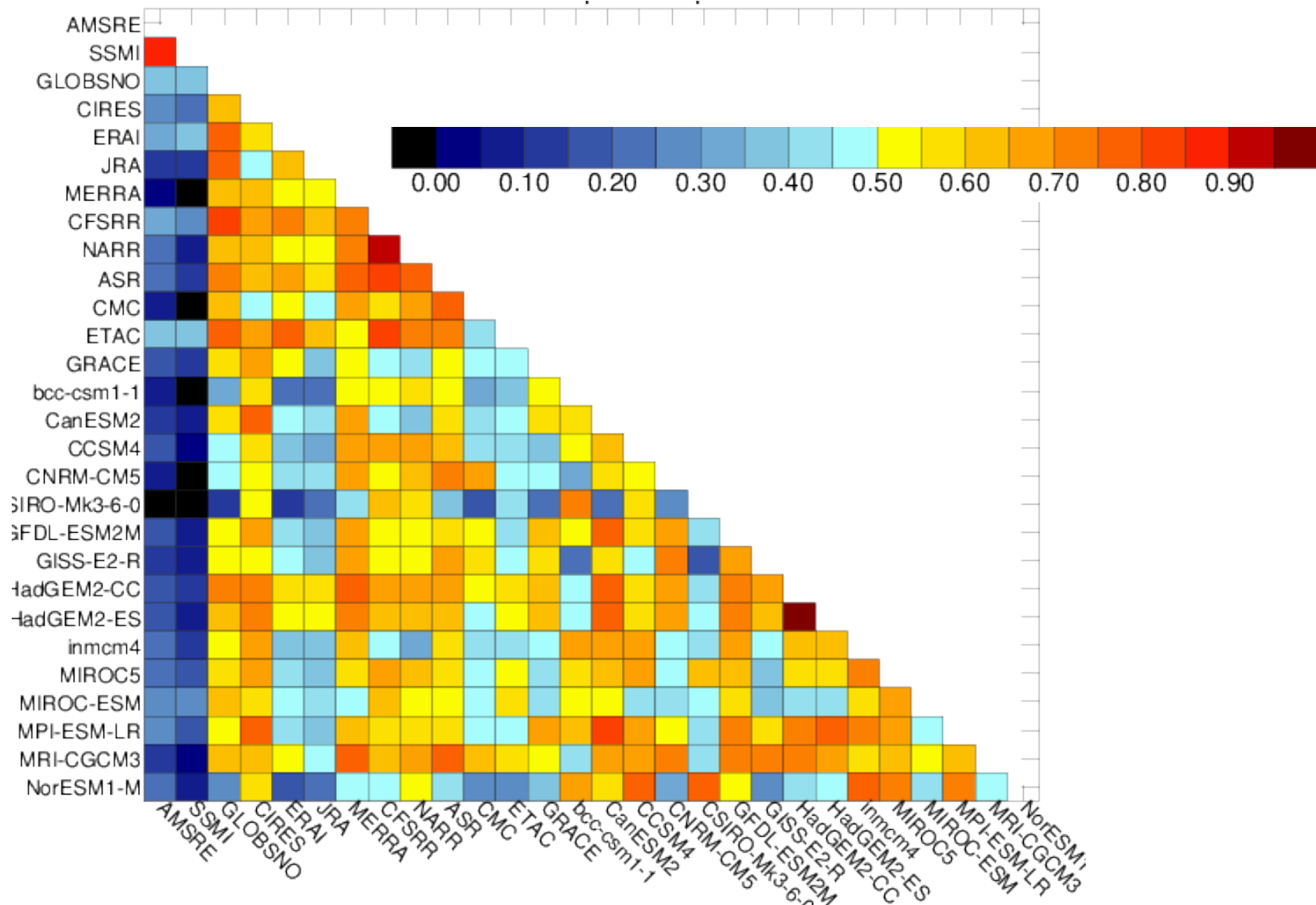
March SWE : Spatial Correlation (2000-2009)



Satellite SWE: Beastie Boys are Unimpressed!



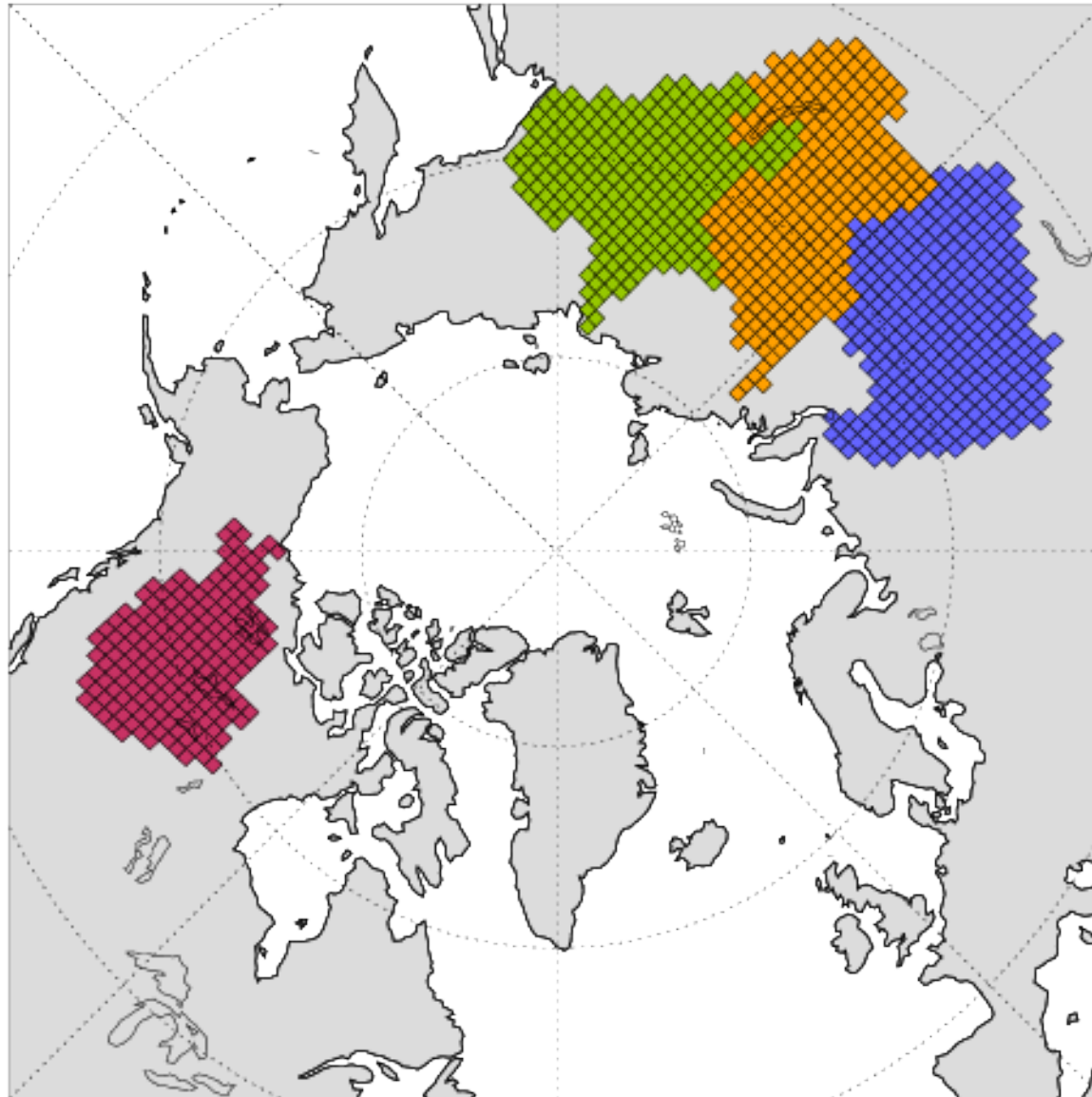
March SWE : Spatial Correlation (2000-2009)



So the models aren't really that bad?



Arctic Basins



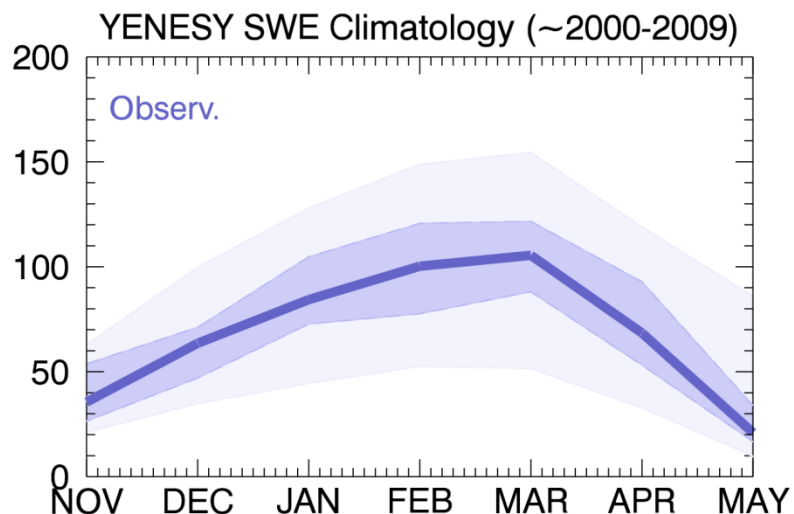
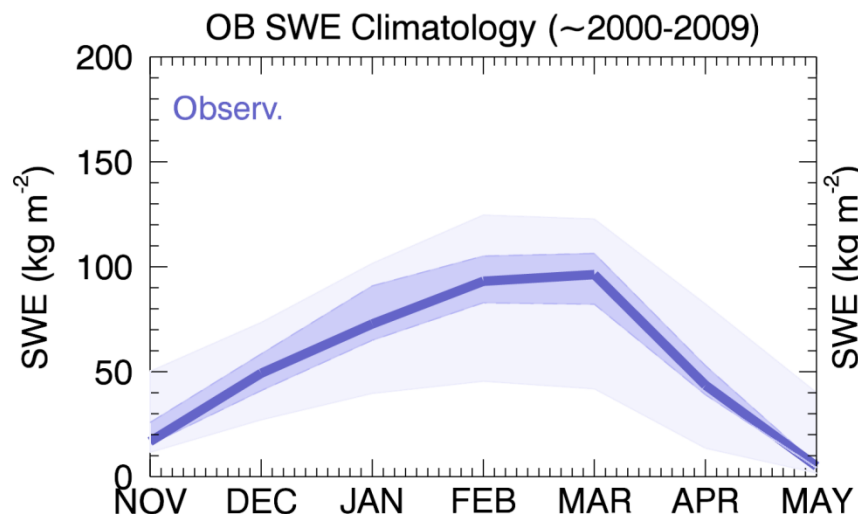
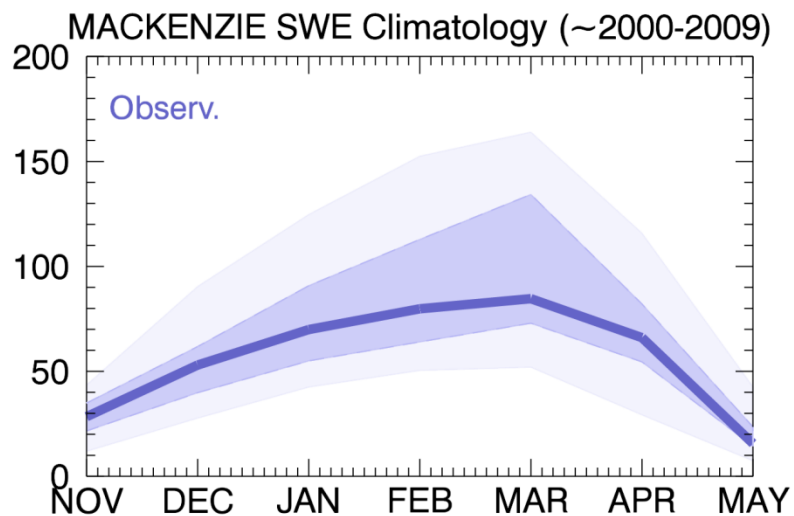
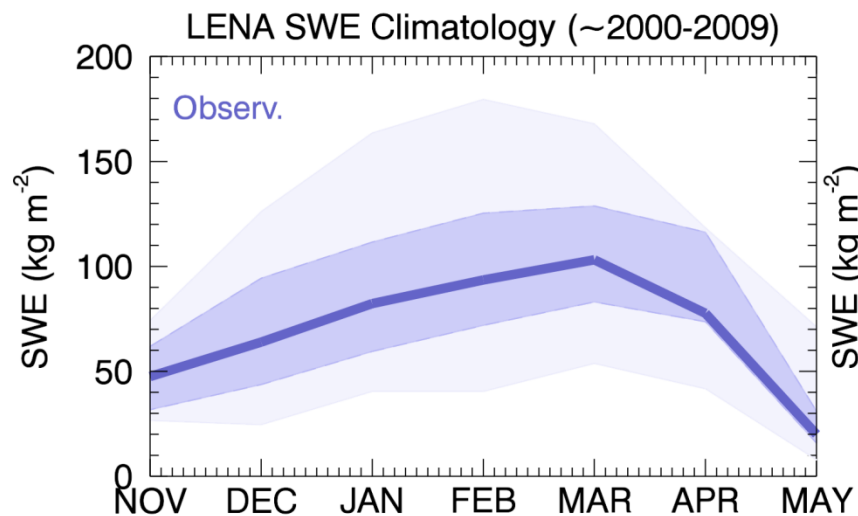
Lena

Yenese

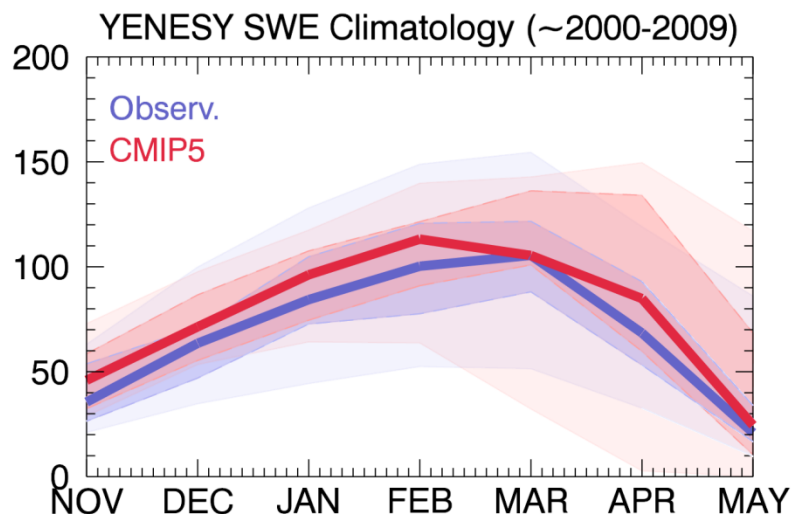
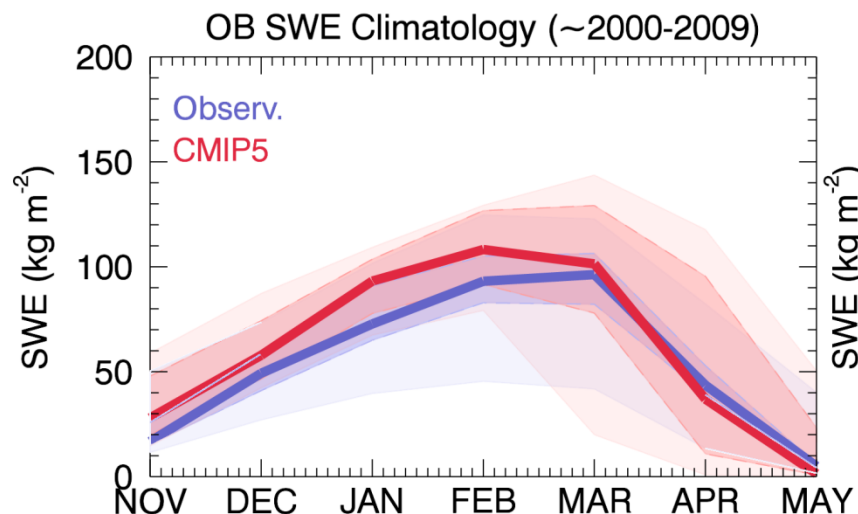
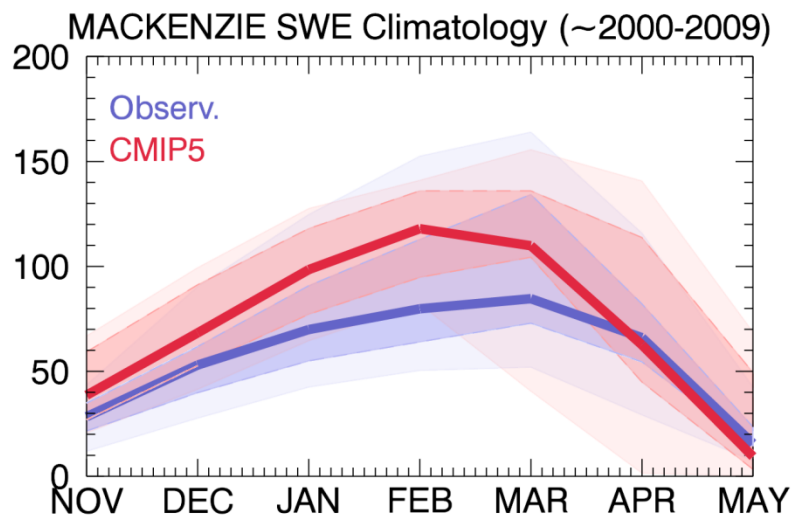
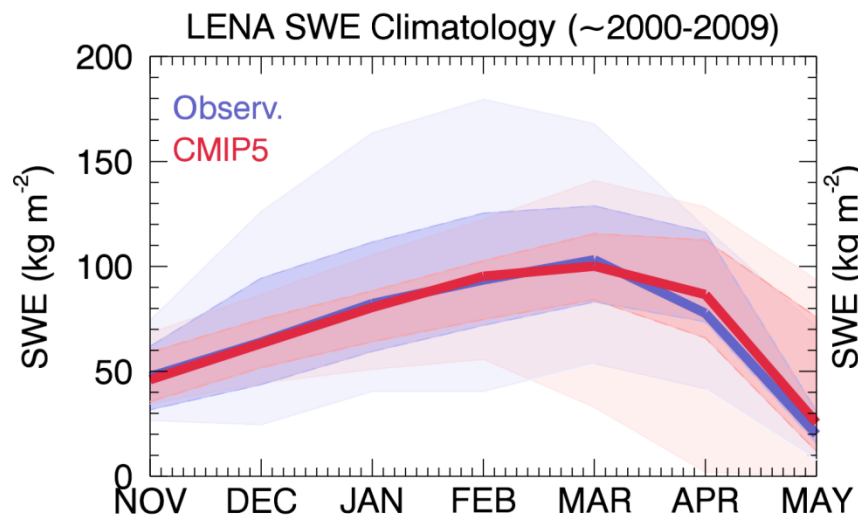
Ob

MacKenzie

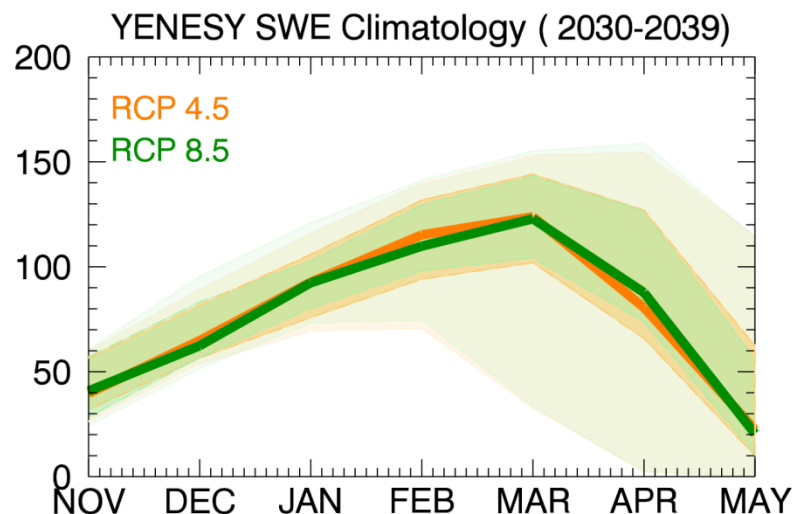
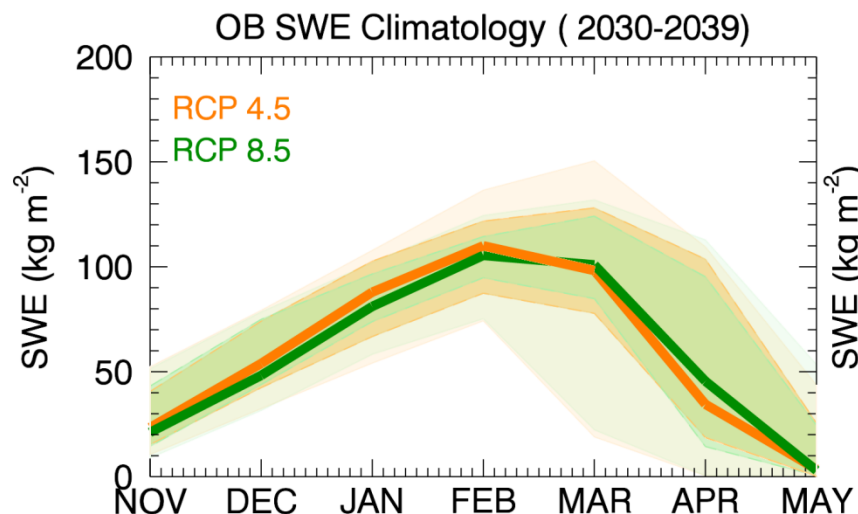
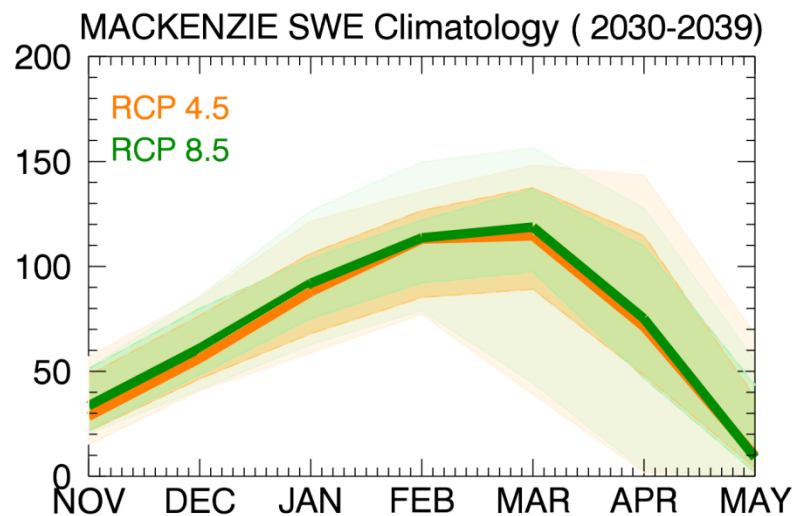
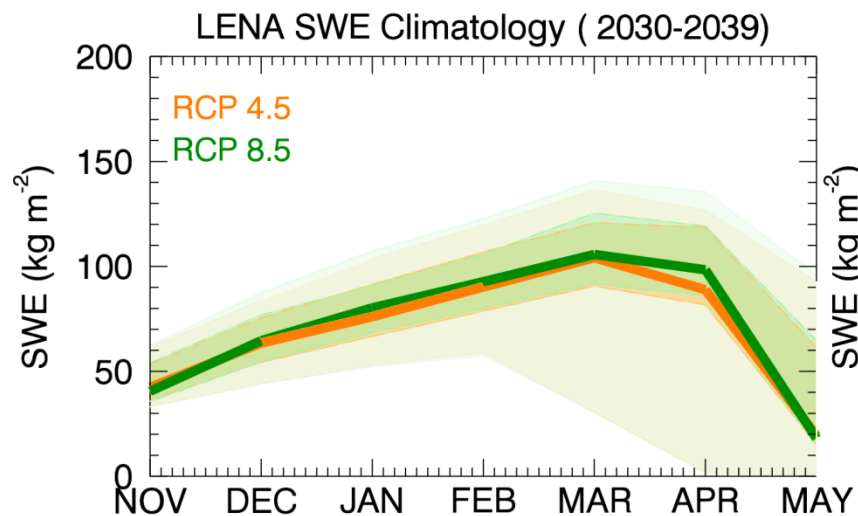
2000 – 2009 : Observations



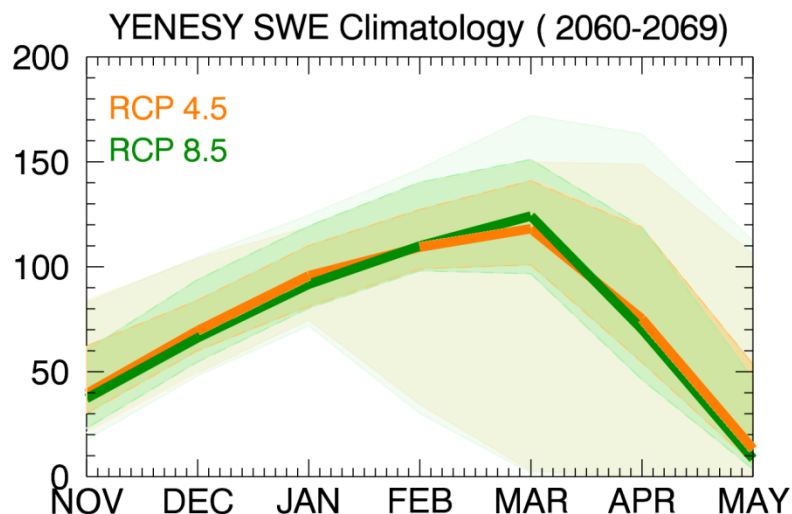
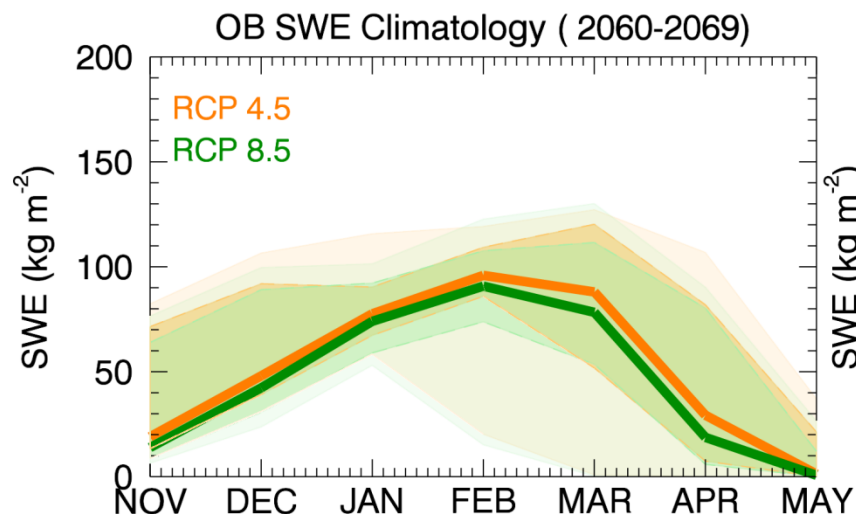
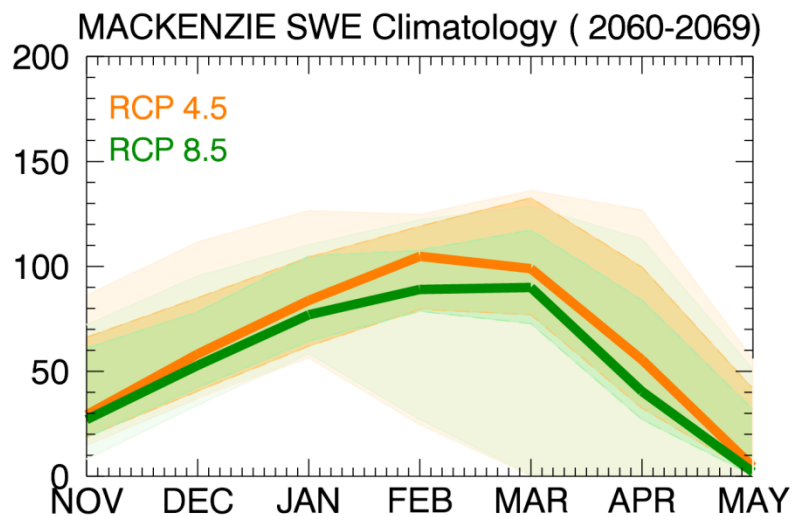
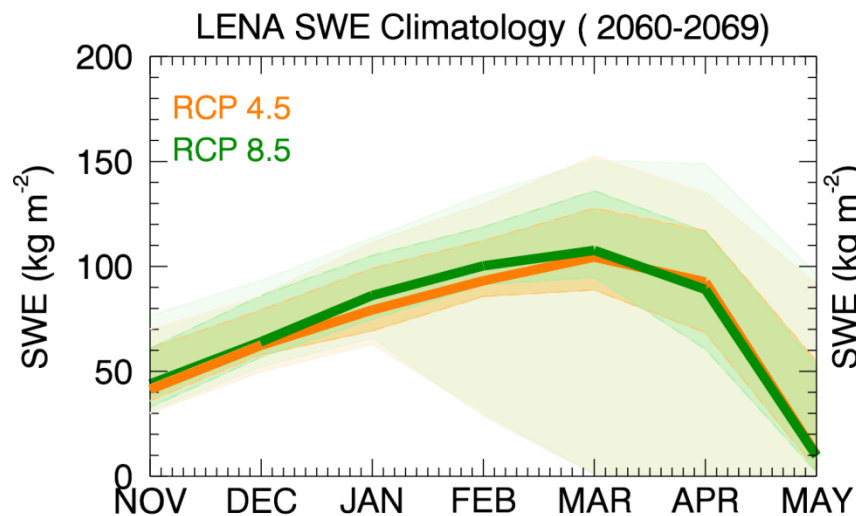
2000 – 2009 : Observations + CMIP5 Models



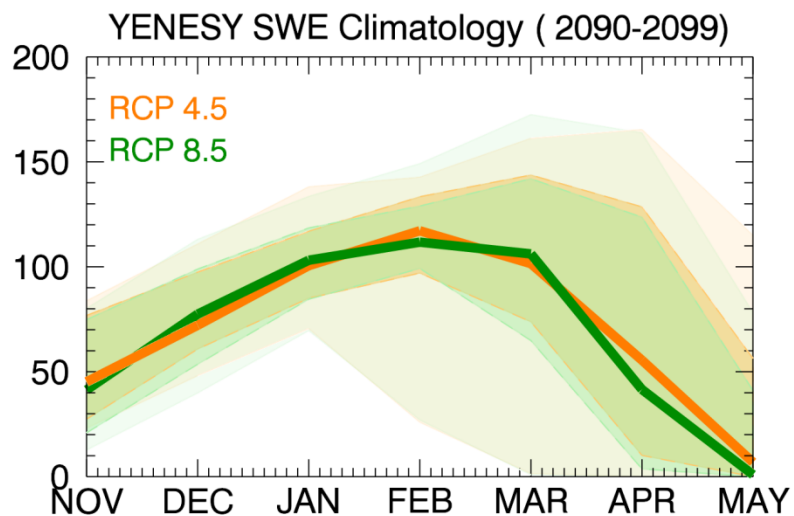
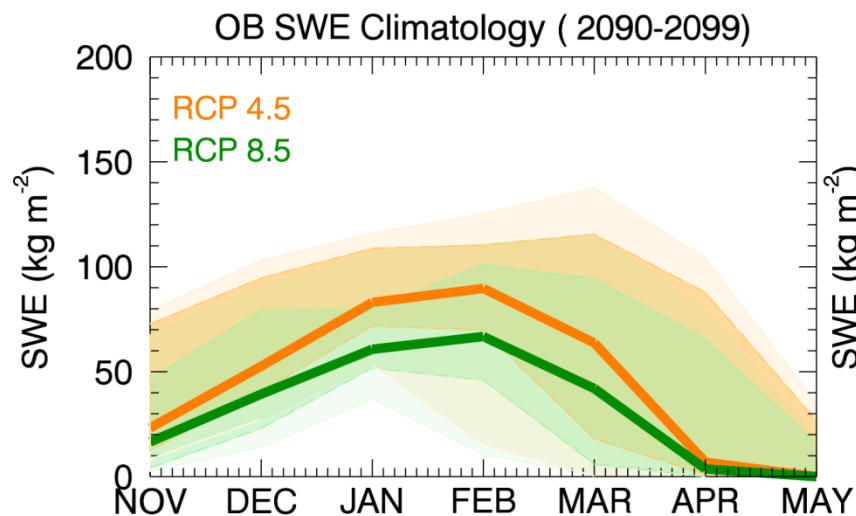
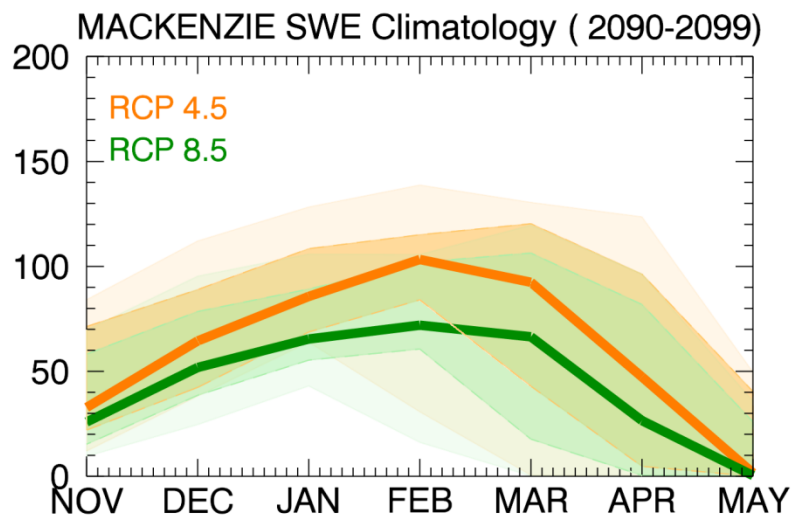
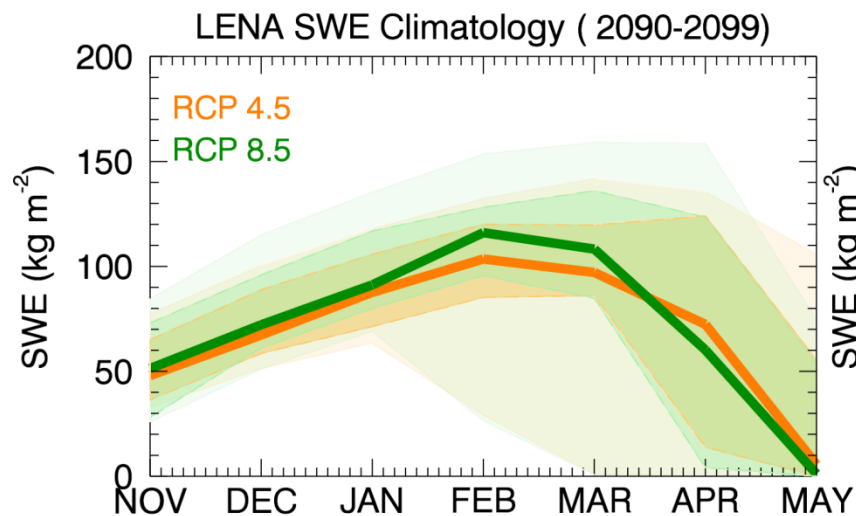
2030 – 2039 : CMIP5 Models



2060 – 2069 : CMIP5 Models

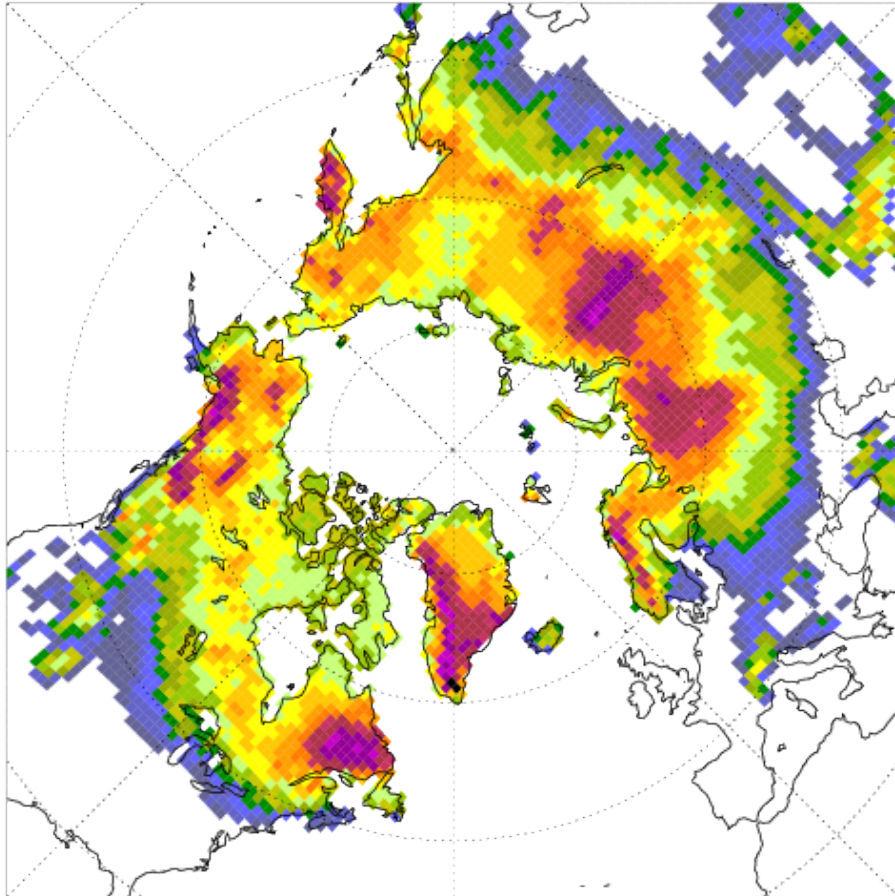


2090 – 2099 : CMIP5 Models

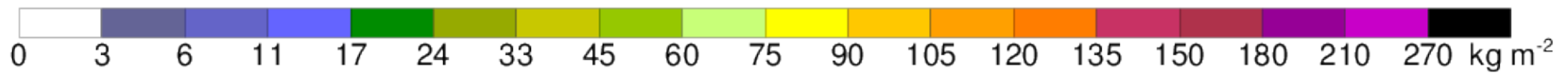
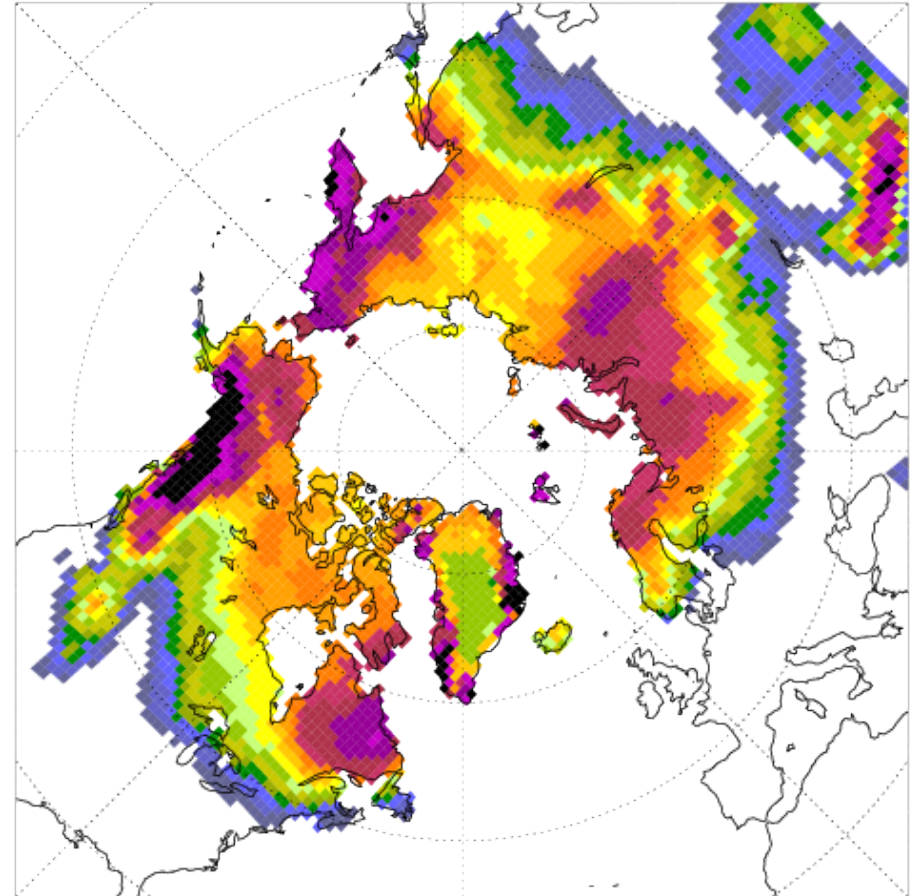


Spatial Comparison

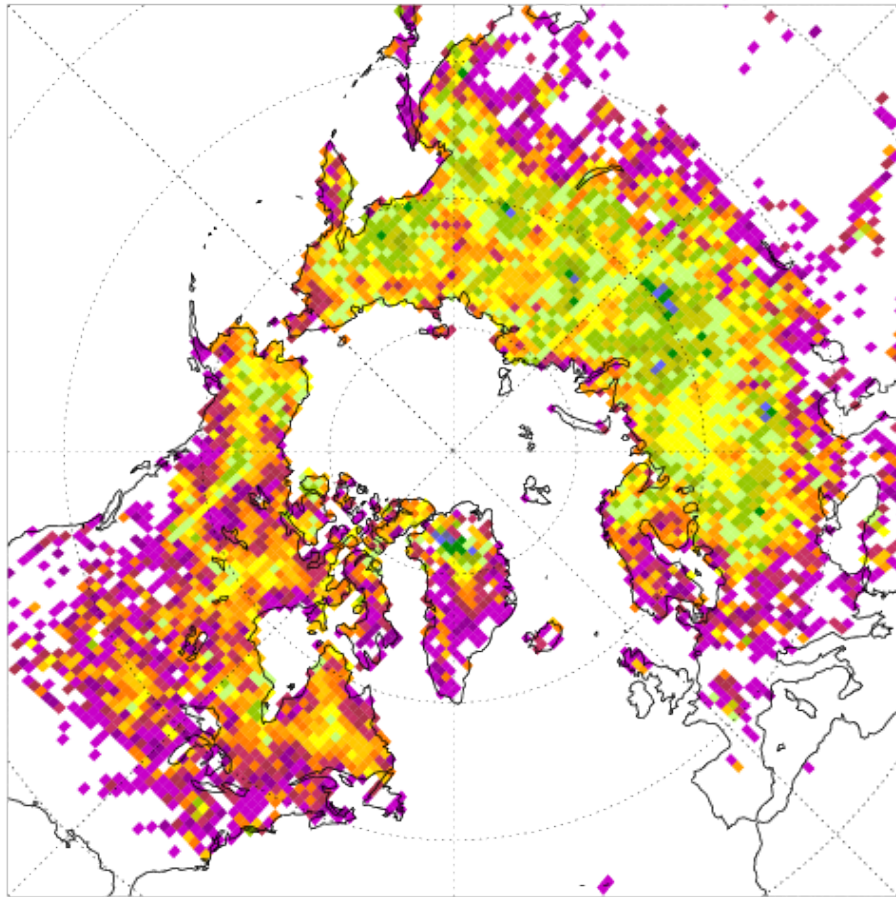
March SWE: Median Observations (2000-2009)



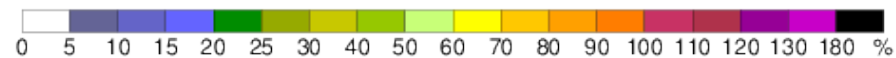
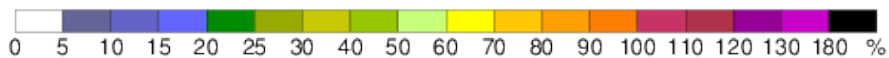
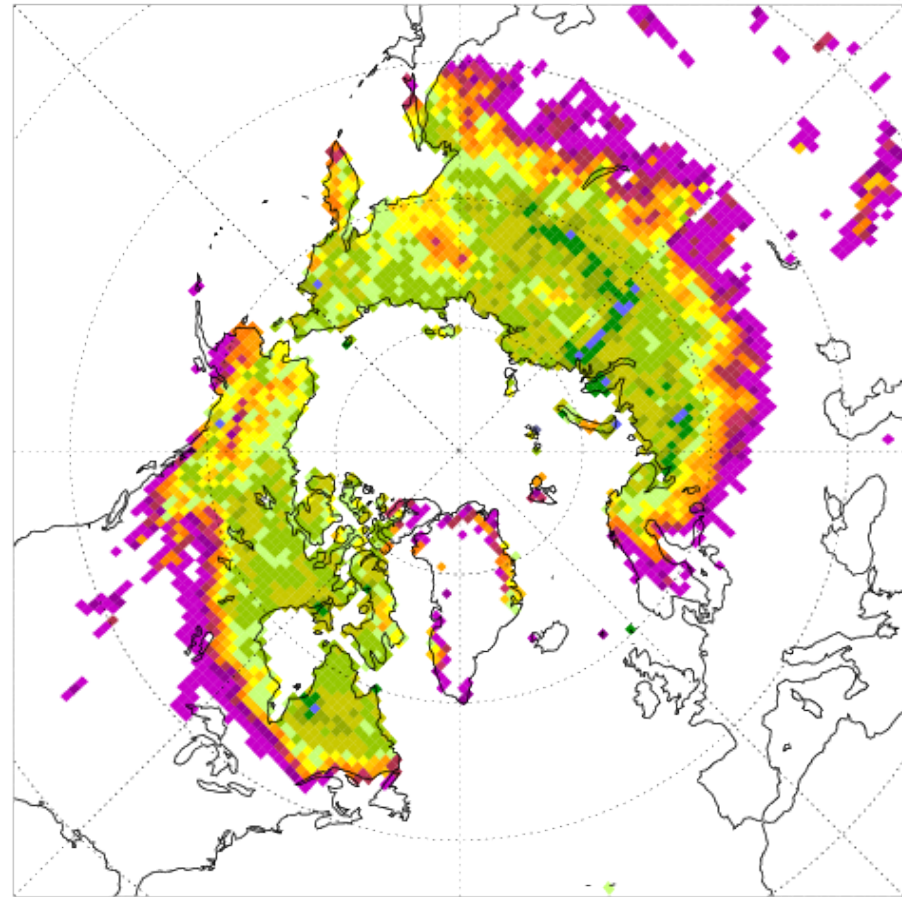
March SWE: Median CMIP5 (2000-2009)



March SWE: Observed Non-Parametric Variation (2000-2009)



March SWE: CMIP5 Non-Parametric Variation (2000-2009)



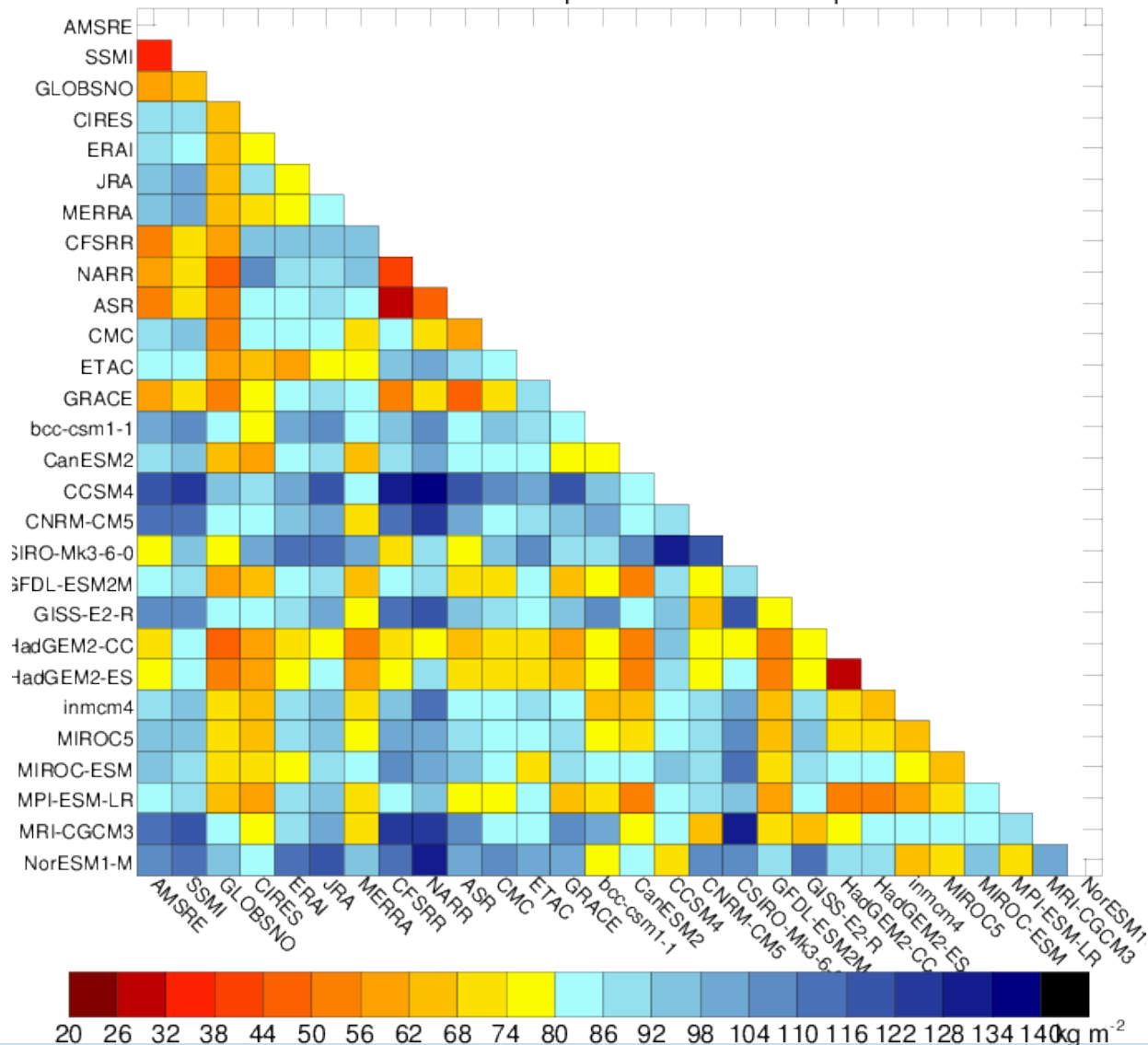
$$\text{NPV} = (\text{Inter-Quartile Range}) / \text{Median}$$

Summary

- Beware of what “observations” are used
- Arctic Basins:
 - Skewed seasonal cycle push to earlier peak
 - Snow mass increases to the north, decreases to south
- Alaska & Far East Siberia notable problem

Error (Difference) between Obs & Models

March SWE: Nth Hemisphere Root Mean Squared Error



Error Across Observations (~2000-2009)

