



Analyzing a potential upgrade of the CPC consolidated seasonal forecast tool

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Seasonal Consolidation Tool

Version 1

- ▶ Developed by Steve Baxter and Danny Barandiaran
- ▶ Consolidation of NMME + ENSO + Trend + Analog Models to produce temperature and precipitation outlooks
- ▶ Simple multiple linear regression
- ▶ Output includes tercile probability forecast for temperature, precipitation

Seasonal Consolidation Tool Version 2

- ▶ Consolidation of NMME + ENSO + Trend to produce temperature and precipitation outlooks
- ▶ Ridge Regression
 - ▶ Better accounts for co-linearities in the forecast system
 - ▶ For example, NMME and ENSO
- ▶ Output includes tercile probability forecast for temperature, precipitation, and adds full cumulative distribution function forecast

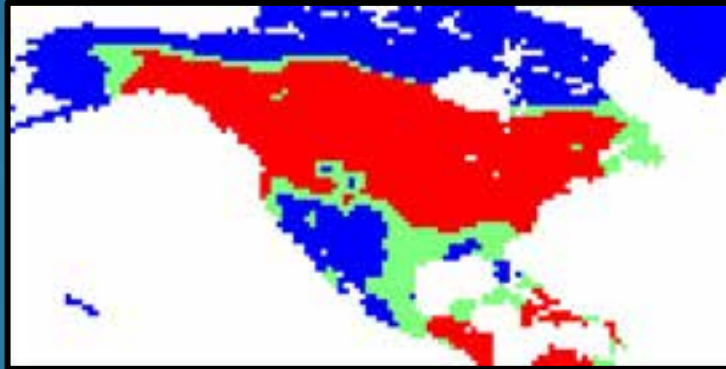
Methods

- ▶ Run both version 1 and 2 of the seasonal forecast tool for all leads and all seasons from 1982-2021 (40 years)
 - ▶ Have completed this for leads 1 to 3
- ▶ Determine the “forecast” from the output probabilities of above, normal, and below T and P
 - ▶ The “forecast” is the category with the highest probability

Heidke Skill Score Calculation for Tercile Temp./Precip. Forecasts

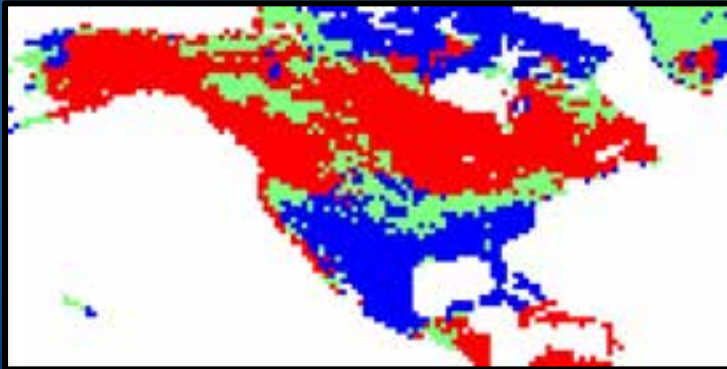
- ▶ $HSS = 100 \times \frac{n_{hits,above} + n_{hits,below} + n_{hits,neutral} - n/3}{n - n/3}$
- ▶ Easy to calculate
- ▶ Easy to interpret
 - ▶ Zero corresponds to forecasts that are no better than chance
 - ▶ One corresponds to forecasts that are always right

Three-Category Example: DJF 1997-1998 Temperatures

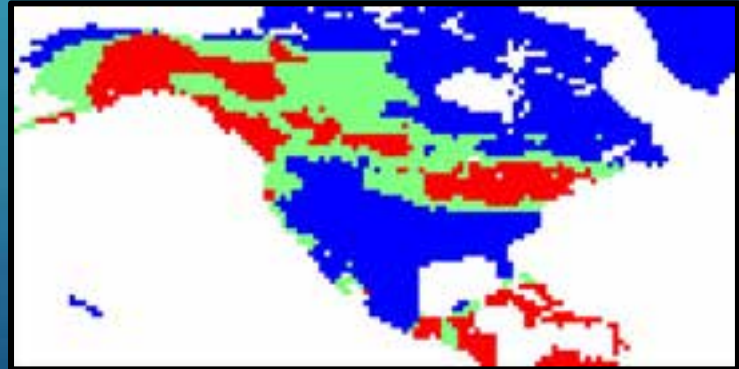


Observed

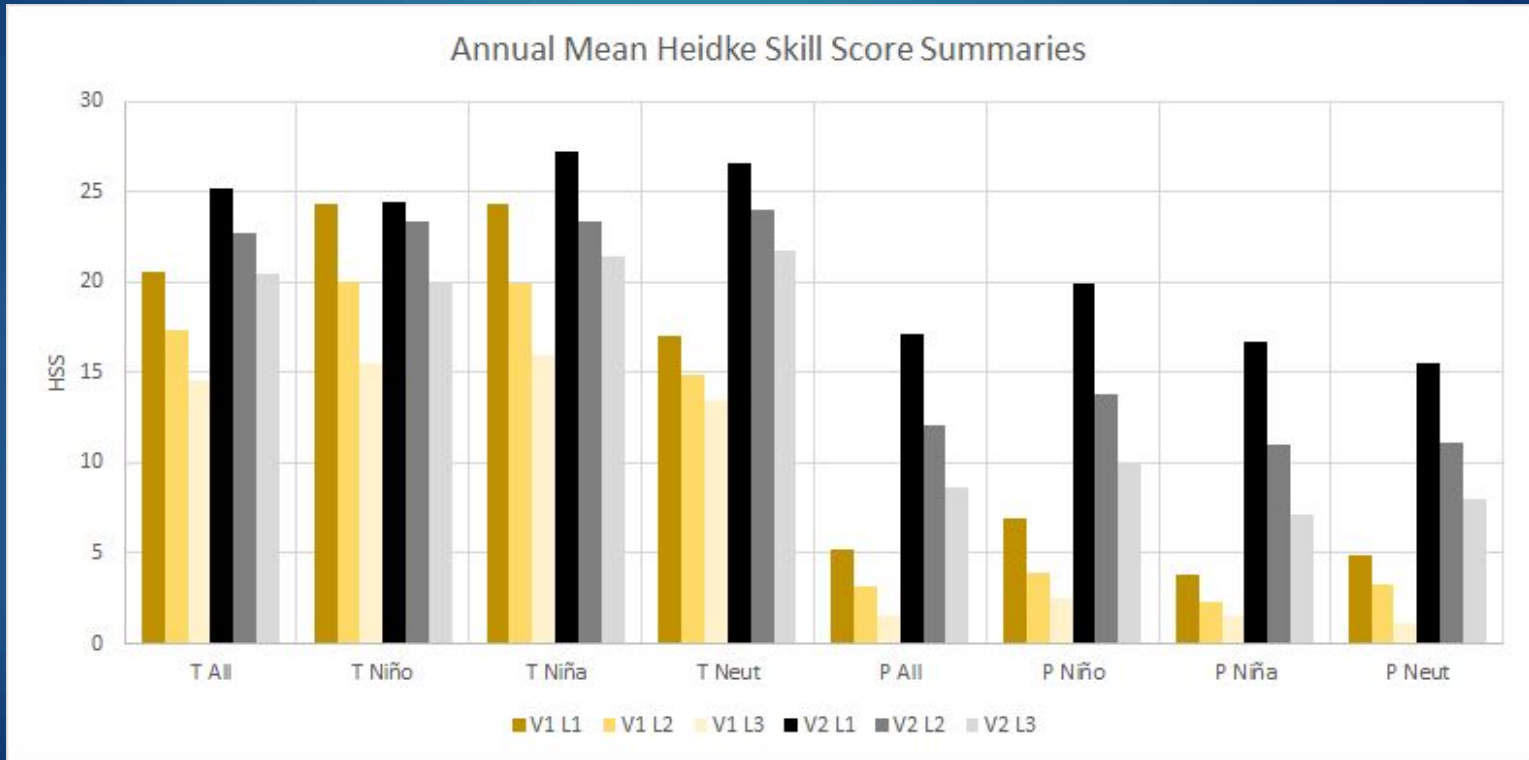
Version 1



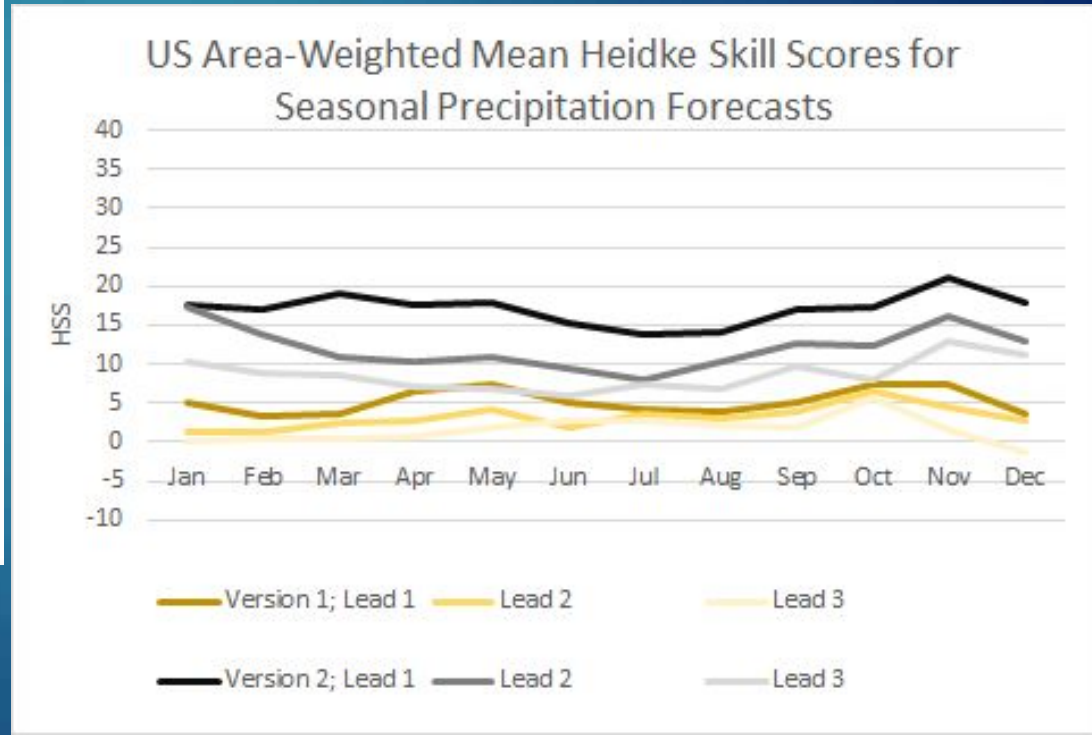
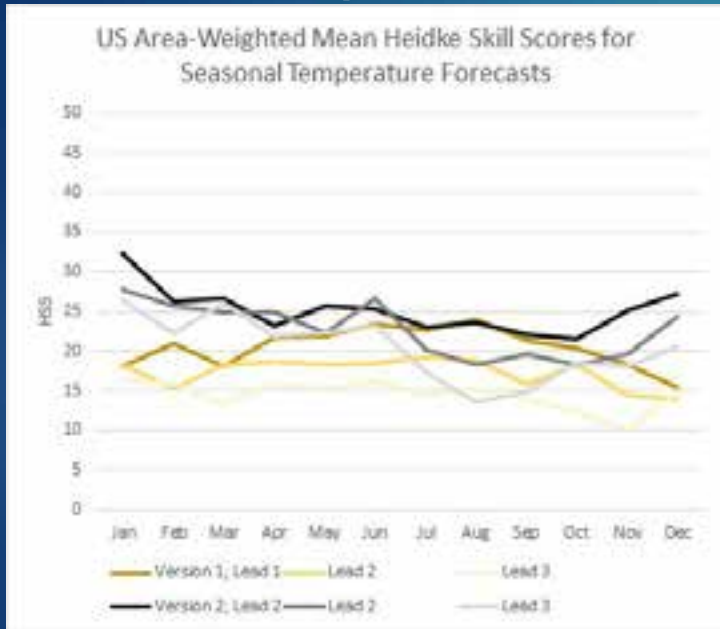
Version 2



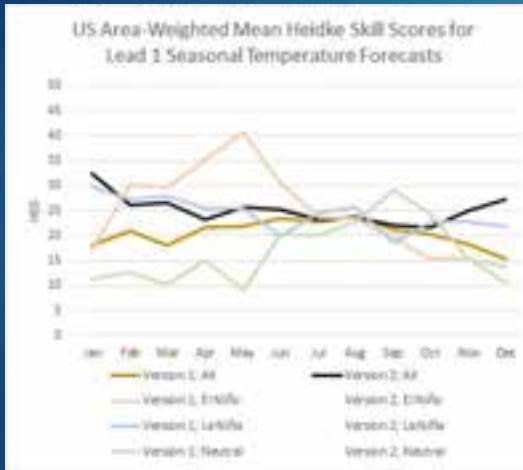
US Average Heidke Skill Scores Annual Mean Summaries



US Average Heidke Skill Scores Monthly Summary Statistics



US Average Heidke Skill Scores Lead 1 Monthly ENSO Statistics



Heidke Skill Scores Lead 1 Temperatures

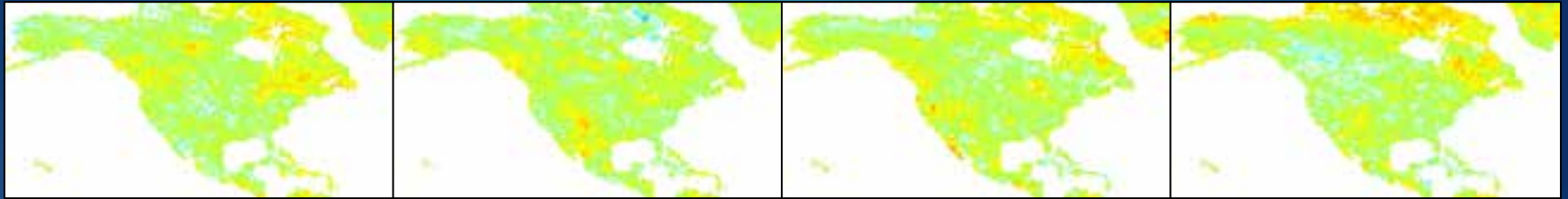
DJF

MAM

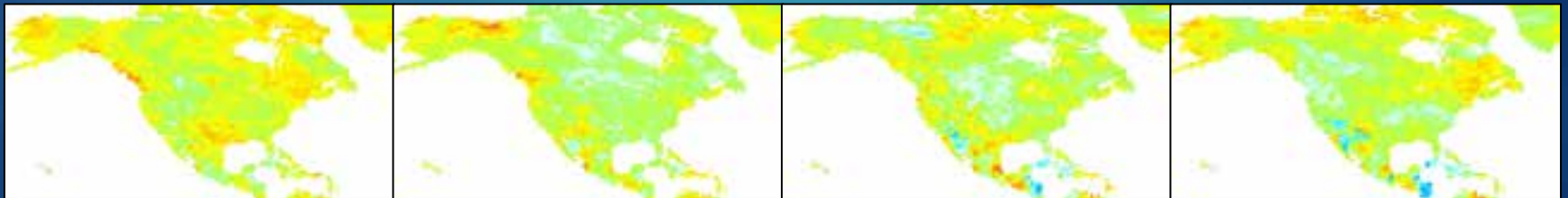
JJA

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Version 1



Version 2



Heidke Skill Scores Lead 1 Precipitation

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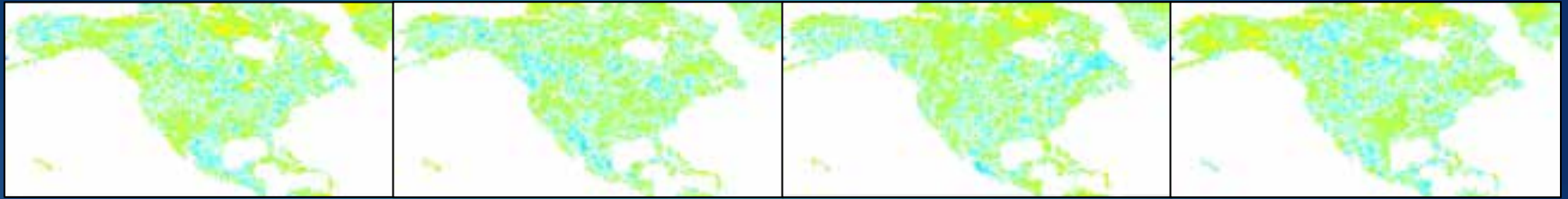
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MAM

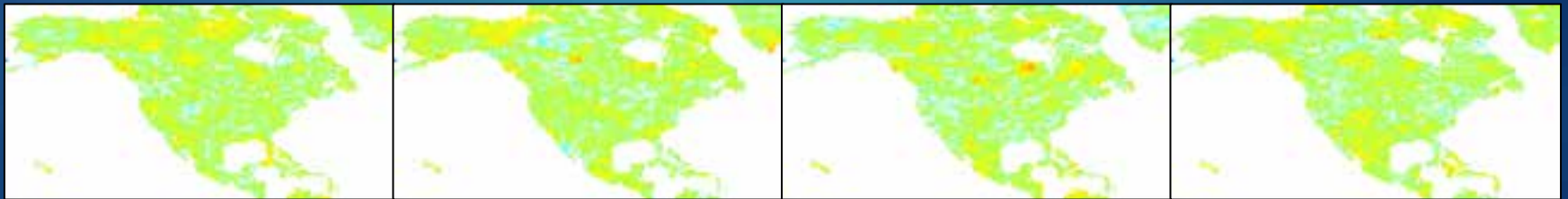
JJA

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Version 1

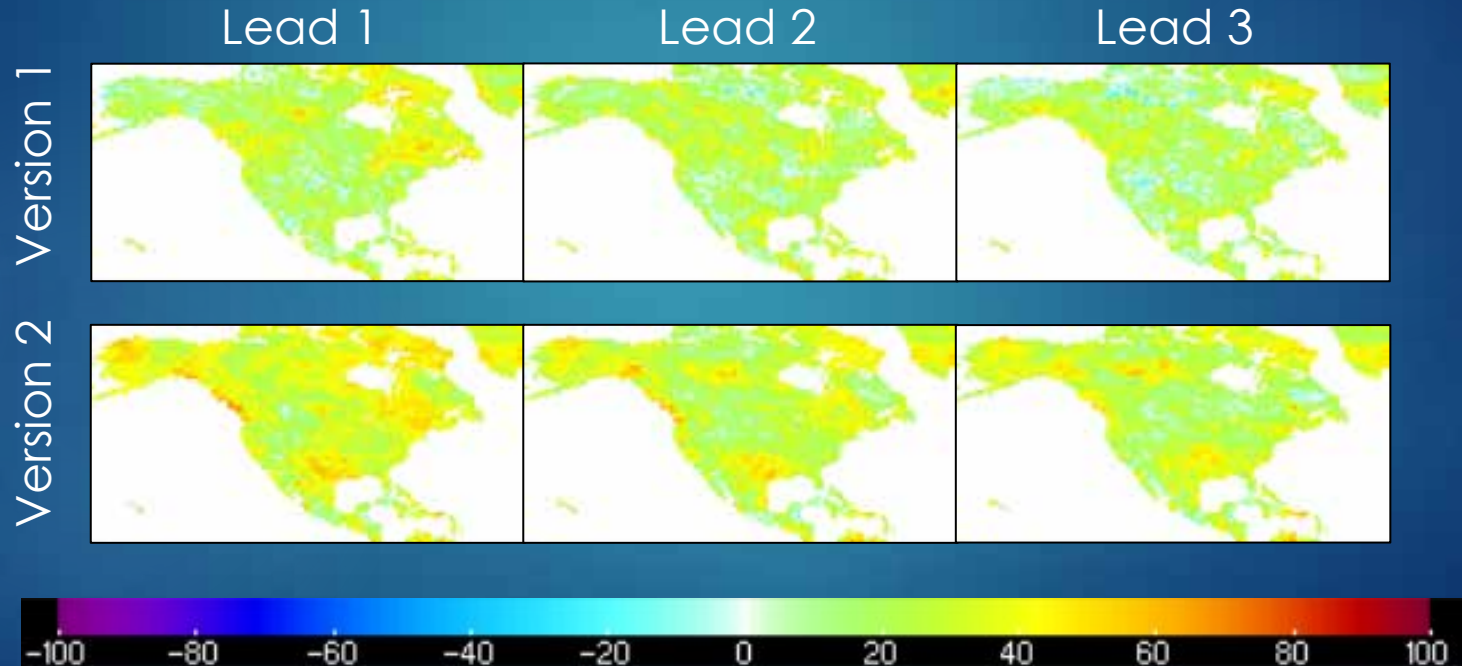


Version 2



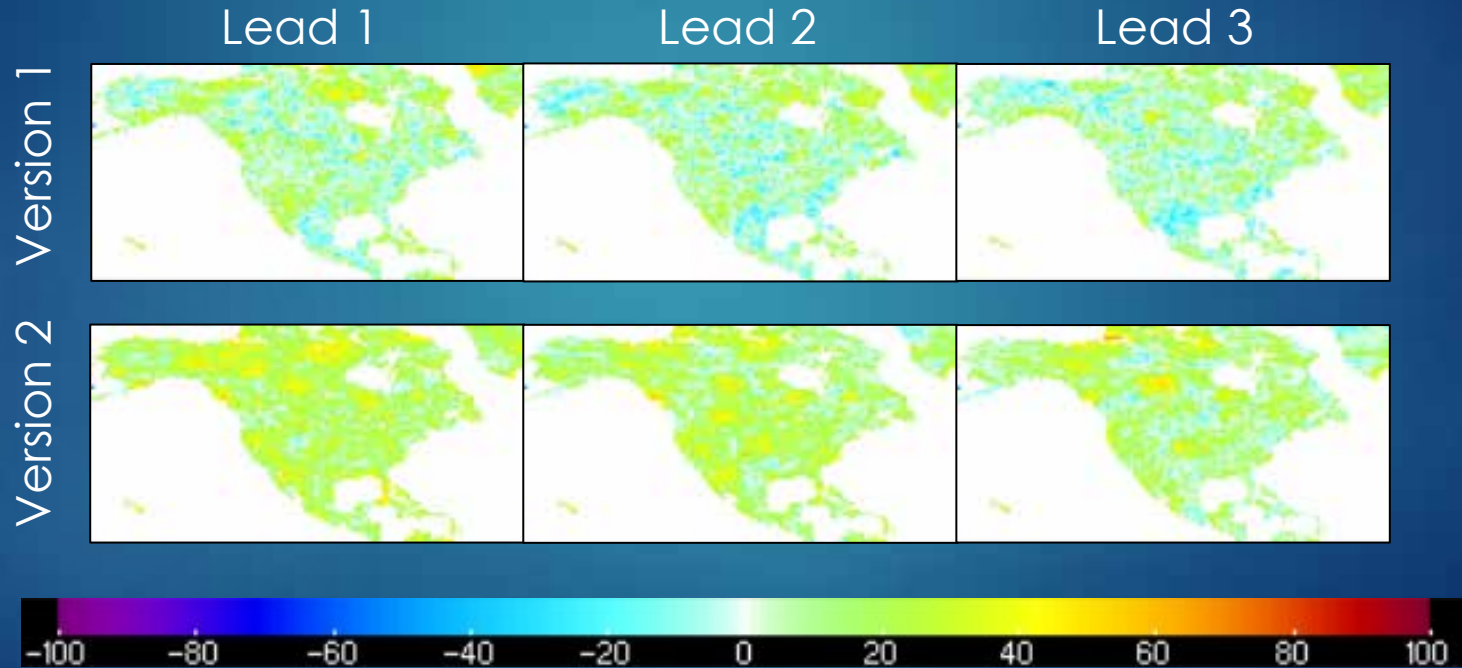
Heidke Skill Scores

DJF Temperature Leads 1-3



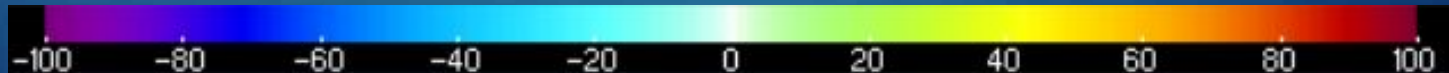
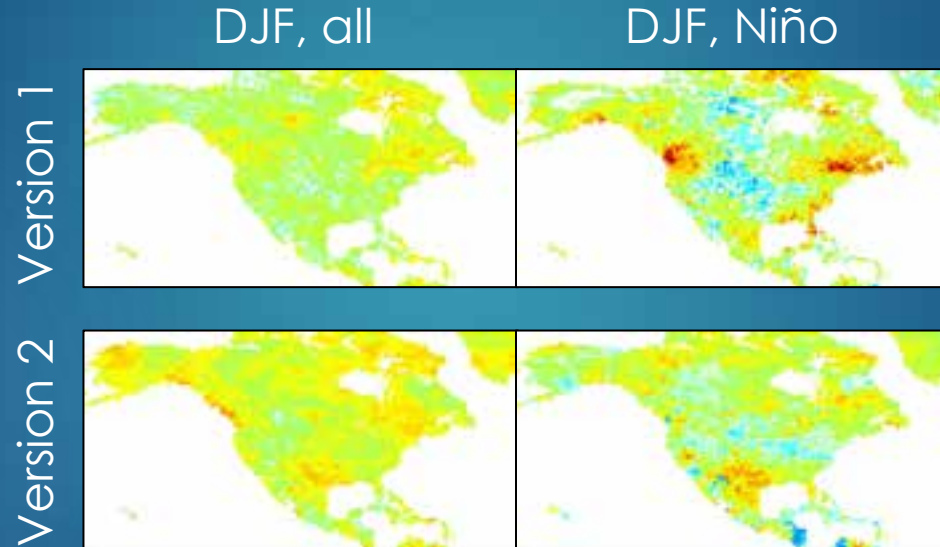
Heidke Skill Scores

DJF Precipitation Leads 1-3



Heidke Skill Scores

Lead 1 Temperatures in El Niño



Conclusions

- ▶ Version 2 of the seasonal consolidation forecasting tool shows improved performance over version 1 in almost all categories
- ▶ Expected trends are seen
 - ▶ Longer leads associated with worse performance
 - ▶ Temperature forecasts better than precipitation forecasts
 - ▶ El Niño improves performance of precipitation outlooks
 - ▶ DJF tends to be more predictable than JJA (version 1?)

Future Work

- ▶ Improve ENSO investigation by using actual ENSO values instead of forecast ENSO
- ▶ Investigate performance during extreme temperature/precipitation seasons
- ▶ Future (v3?) work on ML/AI for further improving consolidation methodology

Thank You!

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