A Diagnostic Comparison of CFSv1 and CFSv2
Predictions of Nino3.4 SST

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Error of CFSv1 and CFSv2 by start time: All seasons/leads

CFSv1

CFSv2
CFSv1: Anomaly correlation before and after correction in 1991 for climate discontinuity

By target season, not start month
CFSv2: Anomaly correlation before and after correction in 1999 for climate discontinuity

By target season, not start month
Difference between CFSv2 vs. CFSv1 **squared anomaly correlation** before and after climate discontinuity corrections

By target season, not start month
CFSv1 rmse(SD) before and after 1991 climate discontinuity corrections

Before

Nino3.4

After
rmse(SD) MOS-corrected CFSv1
CFSv2 rmse(SD) before and after 1999 climate discontinuity corrections

Before
mse(SD) CFSv2

Nino3.4

After
mse(SD) MOS-corrected CFSv2

lead

target
Target Period “Slippage” and MSE Skill in CFSv1

(a) CFSv1

(b) MOS CFSv1

(c) CFSv1 - mean((f-o)^2)/mean(o^2)

(d) MOS 1 - mean((f-o)^2)/mean(o^2)

Nino3.4

MSE Skill
Target Period “Slippage” and MSE Skill in CFSv2

(a) CFSv2
(b) MOS CFSv2

(c) CFSv2 1 - mean((f-o)^2)/mean(o^2)
(d) MOS 1 - mean((f-o)^2)/mean(o^2)
CFSv1: Trend bias in CFSv1 and CFSv2: 1982-2010
(difference [°C] per 28 years compared with obs)

Nino3.4

CFSv1: Trend–bias CFSv1

CFSv2: Trend-bias CFSv2

(target)

(lead)

2012-2010
These 0-lead predictions for the first month at this time of year largely reflect initial conditions.

CFSv1
Increasingly shows mild negative bias;
CFSv2
Increasingly shows moderate positive bias.
CFSv1 SD ratio (fcst/obs) before and after 1991 climate discontinuity corrections

Before
SD Ratio CFSv1

Nino3.4

After
SD Ratio MOS-corrected CFSv1
CFSv2 SD ratio (fcst/obs) before and after 1999 climate discontinuity corrections

Before
SD Ratio CFSv2

After
SD Ratio MOS-corrected CFSv2

Nino3.4
Conclusions

CFSv2 has a serious discontinuity near 1999 in initial condition climatology, partly hiding its general superiority to CFSv1 in predicting Nino3.4, especially for fall starts. Once this discontinuity is accounted for, CFSv2 predicts Nino3.4 SST better than CFSv1:
- Higher anomaly correlations
- Lower RMSE
- More realistic SD ratio ($SD_{\text{fcst}}/SD_{\text{obs}}$)

CFSv2 has an steeper upward trend than seen in the obs, apart from the 1999 discontinuity (CO₂?)