Poster 1143

Seasonal Predictability of Extratropical Cyclone Statistics in the Canadian Seasonal to Interannual Prediction System (CanSIPS)

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1. PACIFIC CLIMATE IMPACTS CONSORTIUM

MEOPAR
MARINE ENVIRONMENTAL OBSERVATION PREDICTION & RESPONSE NETWORK

1. INTRODUCTION

Extratropical cyclones (ETCs) are the predominant transport mechanism of heat and moisture from equator to pole, however the discussion is much more relevant to the human scale when the focus shifts to changes in the frequency, timing, and intensity of extreme events. Thus, seasonal changes in ETC activity are important to understand due to the associated impacts on the environment and society.

Seasonal forecasts are assessed for the multi-model system CanSIPS, which combines predictions from the two global models CanCM3 and CanCM4. Both models have 10 ensemble members which are initialized at the beginning of every calendar month. Some of these runs are dynam-ically downscaled with the regional climate model CanRCM4. We evaluate the performance of CanSIPS by computing ETC tracks for hindcast data, and by comparing the resulting cyclone statistics to results from ERA-Interim. Special attention is paid to model biases in the location, frequency, intensity, and interannual variability of high-impact storms.

2. DATA

REANALYSIS

• ECMWF ERA-Interim (Dee et al., 2011)

SEASONAL PREDICTION SYSTEM

Canadian Seasonal to Interannual Prediction System (CanSIPS), consisting of:

- CCCma Coupled Climate Model, versions 3 and 4
  - CanCM3 – 10 ensemble members
  - CanCM4 – 10 ensemble members

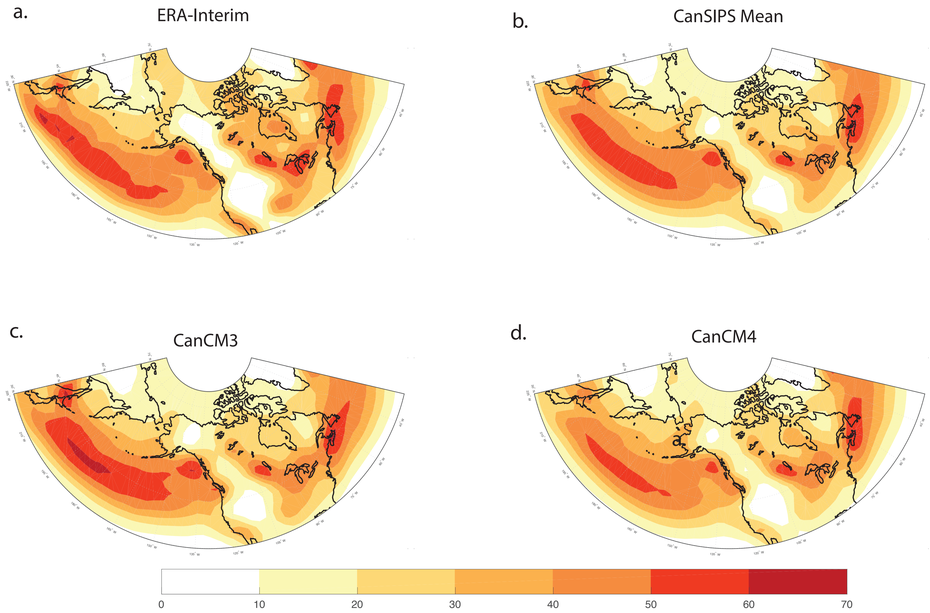
• Cyclone identification and tracking is performed using the Hodges (1994, 1995, 1999) feature identification and tracking algorithm.

• Cyclone identification requires 6-hourly 850 hPa u- and v-component wind to calculate relative vorticity for the feature tracking.

• Cyclone statistics, such as track density and cyclone intensity, are calculated monthly and binned into rolling seasons. The analysis here presents DJF cyclone track statistics for ERA-Interim and the CanSIPS suite of models.

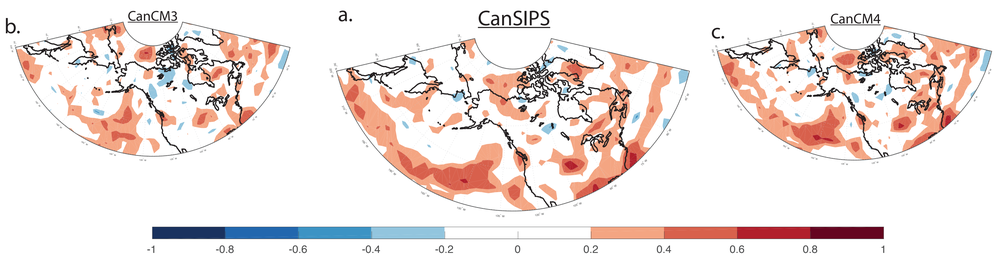
3. RESULTS

A. WINTER (DJF) CLIMATOLOGY 1979/80 - 2009/10: ALL CYCLONES TRACK DENSITY



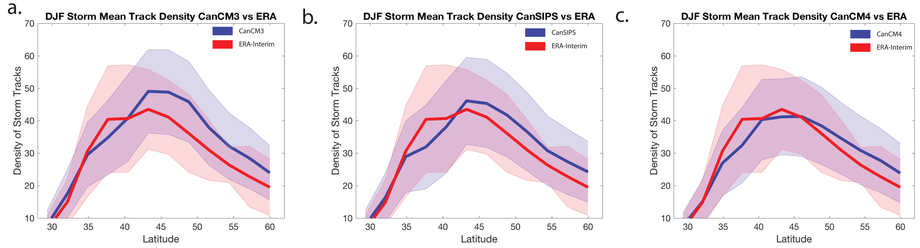
Track density climatology for all cyclones during the period of 1979/1980 - 2009/10 for the a) ERA-Interim, b) CanSIPS ensemble mean, c) CanCM3 model mean, and d) CanCM4 model mean. Values are density of storm tracks per 10^6 km^2.

B. PREDICTION SKILL: SPEARMAN RANK CORRELATION

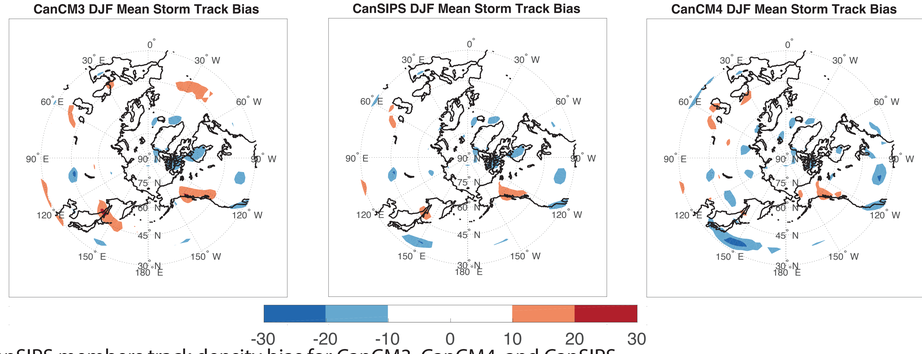


Spearman rank correlation between ERA-Interim track density and a) CanSIPS ensemble mean, b) CanCM3 model mean, and c) CanCM4 model mean for the period of 1979/80 - 2009/10. Correlations greater than +0.29 or -0.29 are considered statistically significant.

C. TRACK DENSITY MEAN AND SPREAD: NORTH PACIFIC



Winter cyclone track density mean (solid line) and spread (shading) for ERA-Interim and a) CanCM3 members, b) all CanSIPS ensemble members, and c) CanCM4 members. All ERA-Interim statistics are represented in red. All CanSIPS model members are represented in blue. The North Pacific is represented by the region from 30 - 60 degrees N and 135 - 260 degrees E.



CanSIPS members track density bias for CanCM3, CanCM4, and CanSIPS.

- All CanSIPS models show an over-estimate of storm track activity in coastal Alaska and British Columbia
- CanCM3 shows an over-prediction of cyclones tracking from northern Japan
- CanCM4 underestimates the strength of the storm track near southern Japan, in the vicinity of the Kuroshio current

4. SUMMARY

- CanSIPS reproduces the overall spatial pattern of cyclone track density found in ERA-Interim. Individual models of CanCM3 and CanCM4 over and under-represent the observed storm track, respectively.
- CanSIPS mean storm track and spread of track density is well represented, though an overall overprediction of storm track density is evident across the North Pacific, particularly from 45 - 60 deg N. This overprediction of storm track density is present in all components of the CanSIPS system.
- Moderate to strong correlation between CanSIPS mean storm track density and ERA-Interim track density are found across the primary storm track in the North Pacific and in the primary formation regions for Atlantic cyclones affecting North America (Gulf of Mexico and Cape Hatteras)
- Most CanSIPS bias in the North Pacific is centralized in the exit regions of the Pacific storm track, localized to Gulf of Alaska and coastal BC.

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