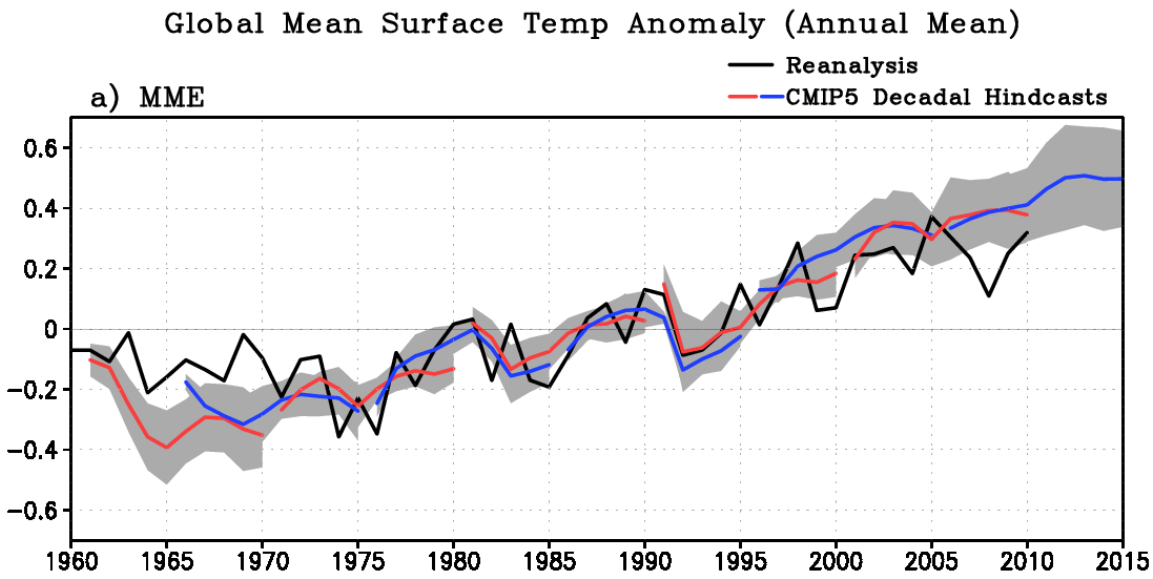
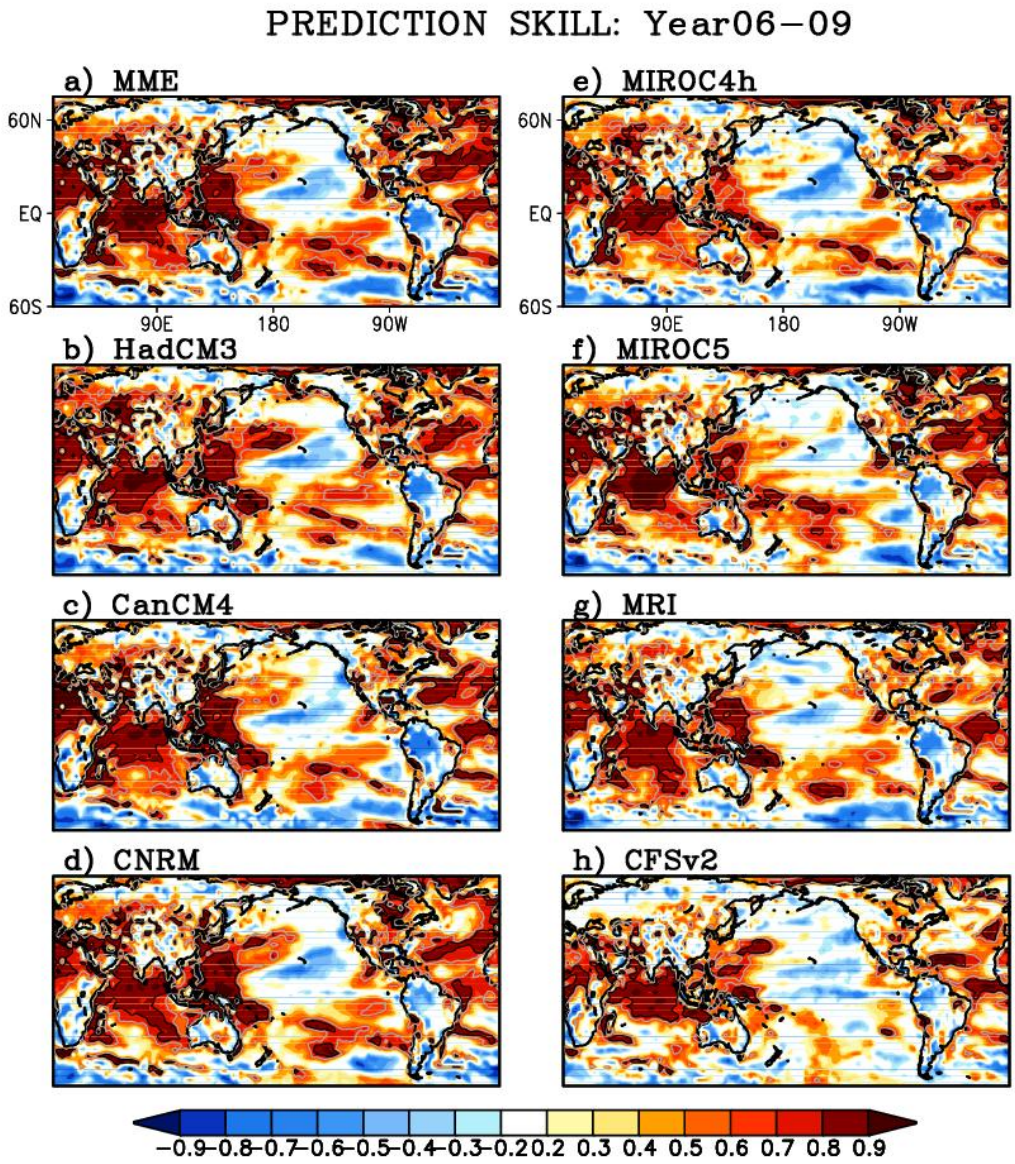
Auxiliary Material:

Auxiliary Material Table S1. A brief summary of each experiment.

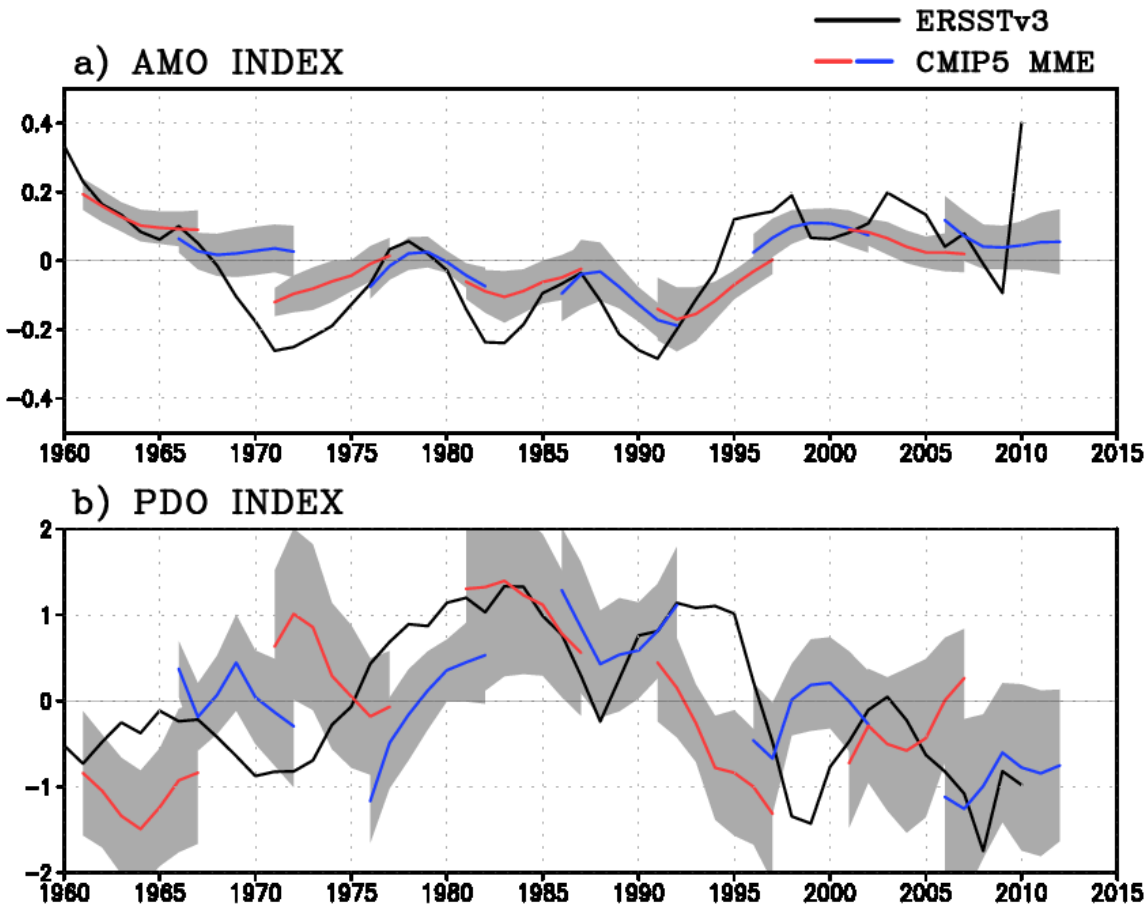
Modeling Center	Model	ENS	ATM resolution
MOHC	HadCM3	10	300km L19
CCCMA	CanCM4	10	200km L35
CNRM-CERFACS	CNRM-CM5	10	100km L31
MIROC	MIROC4h	3	60km L56
MIROC	MIROC5	6	155km L44
MRI	MRI-CGCM3	9	120km L48
NCEP	CFSv2	4	100km L64



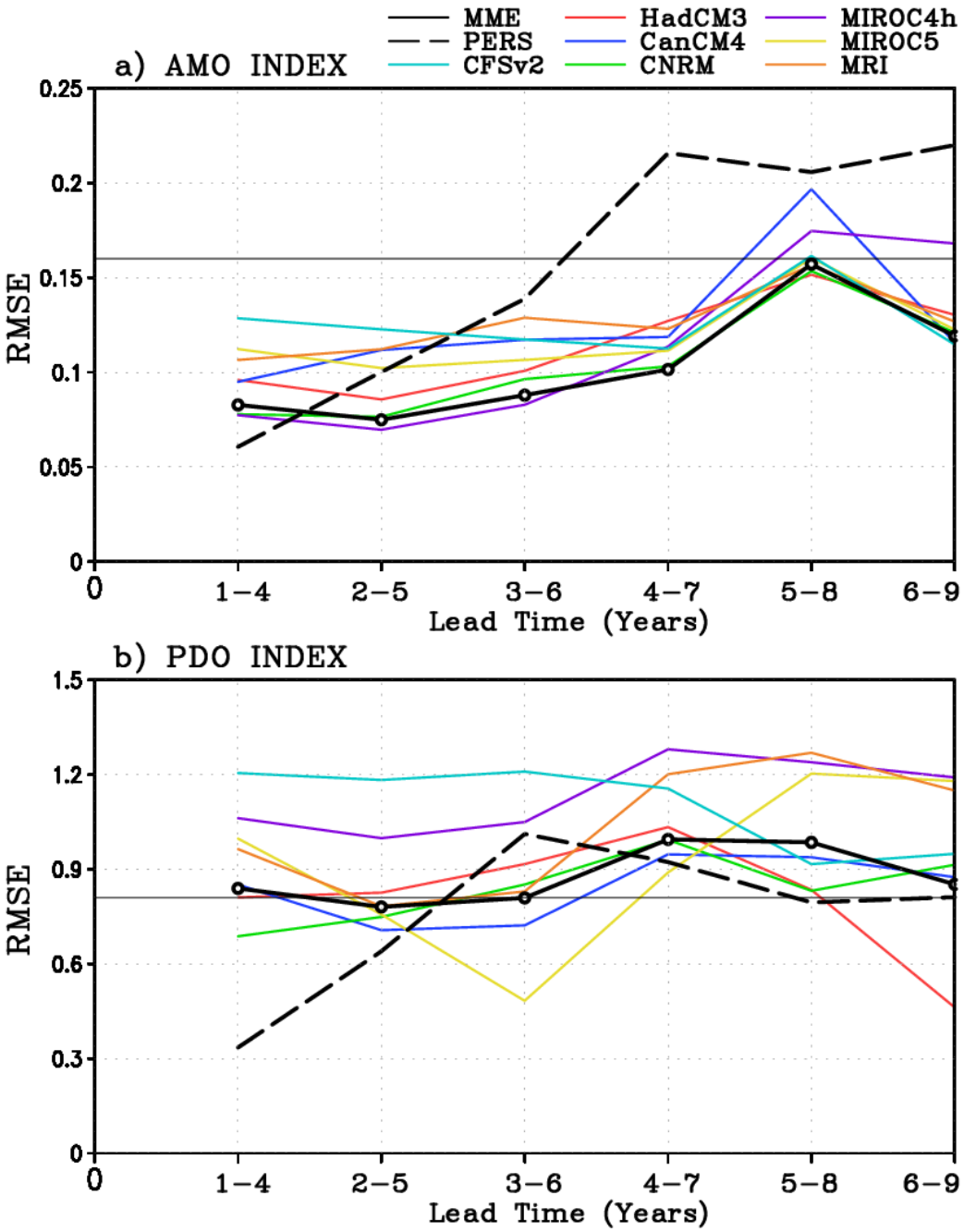
Auxiliary Material Figure S1. Timeseries of globally averaged annual-mean surface temperature anomaly [K] for reanalysis (black) and ensemble-mean of the CMIP5 decadal hindcasts/forecasts for (a) multi-model ensemble mean (MME). Gray shades represent the ranges of one standard deviation for the ensemble-mean in each hindcasts.



Auxiliary Material Figure S2. The spatial distribution of temporal correlation coefficients for the annual mean surface temperature anomaly between reanalysis and decadal hindcasts at 6-9 years average. The values show the correlation coefficients from ensemble-mean for each of models for (a) MME (b) HadCM3, (c) CanCM4, (d) CNRM, (e) MIROC4h, (f) MIROC5, (g) MRI and (h) CFSv2. Solid black (gray) line represents statistical significance of the correlation coefficients at 99% (95%) confidence level.



Auxiliary Material Figure S3. Timeseries of decadal climate indices from ERSSTv3 (black) and multi-model ensemble-mean (MME) of the seven CMIP5 decadal hindcasts/forecasts models (red and blue) for annual (a) AMO index and (b) normalized PDO index. A four-year running average is applied to both observed and predicted indices to filter out high frequencies associated with interannual variations. Gray shades represent the ranges of one standard deviation of the ensemble-mean in each hindcasts.



Auxiliary Material Figure S4. Root-mean-square error (RMSE) for the (a) AMO and (b) PDO index predicted by MME, persistence (PERS) and ensemble-mean of each CMIP5 decadal hindcasts as a function of lead time (years). Gray horizontal lines represent the observed standard deviation.