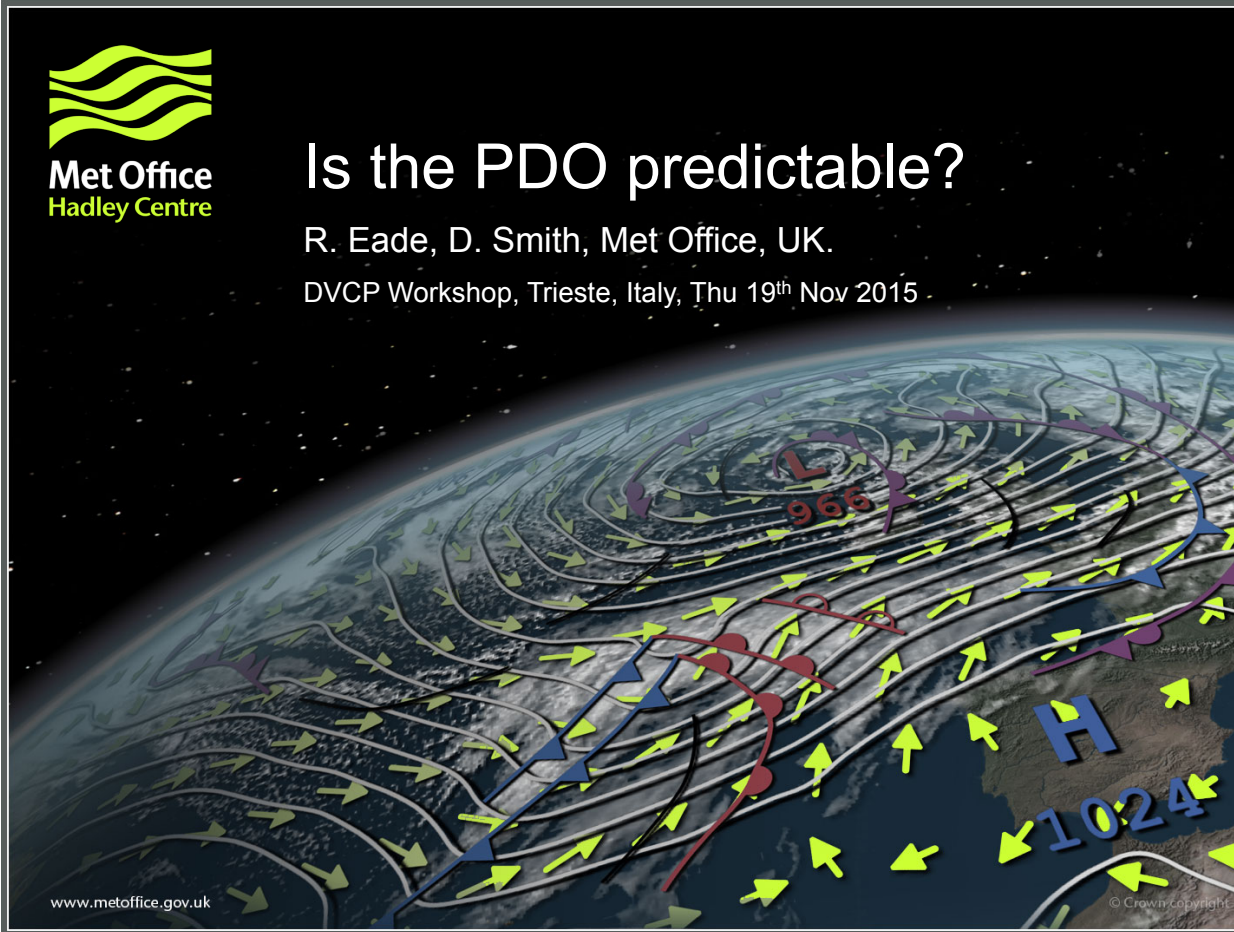




Is the PDO predictable?

R. Eade, D. Smith, Met Office, UK.

DVCP Workshop, Trieste, Italy, Thu 19th Nov 2015



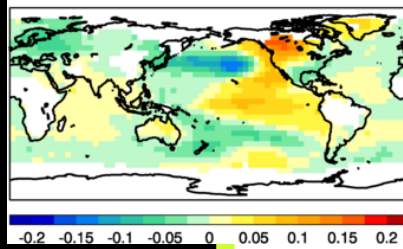
Many indices for Pacific Decadal Variability

PDO EOFs calculated on North Pacific basin, 20-65N

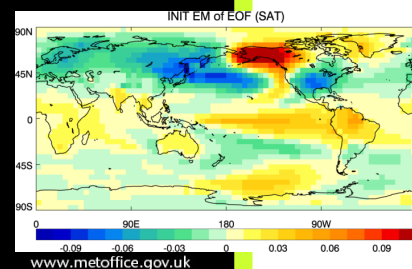
CMIP5 Models capture observed nodes in north Pacific & tropics.

SAT: GMT removed

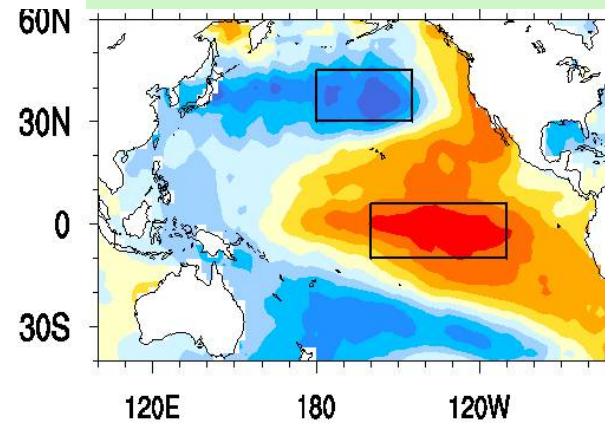
Obs EOF Pattern



Initialised decadal hindcasts



PDV index (Dong et al, 2014) (IPO)



Simpler transferable definition PDV:
Tropical minus Northern Pacific area
averages

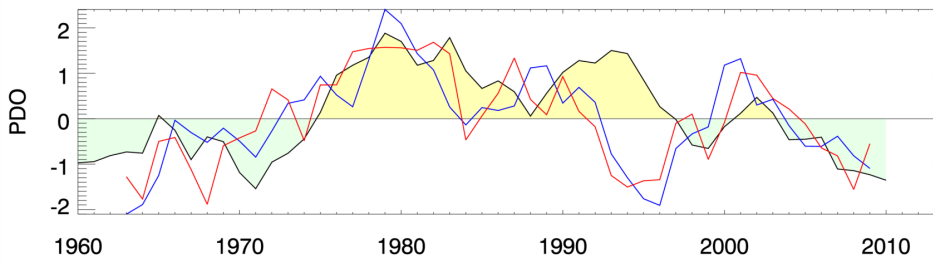
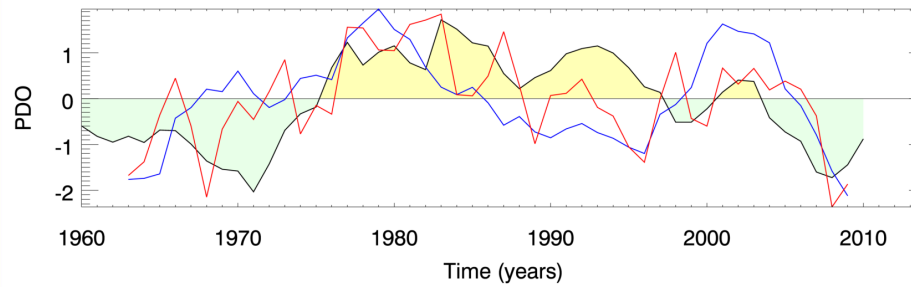


EOF index

PDV index
Trop – N. Pac

www.metoffice.gov.uk

Initialised SAT Decadal hindcasts (5-year means) have some skill for PDV indices



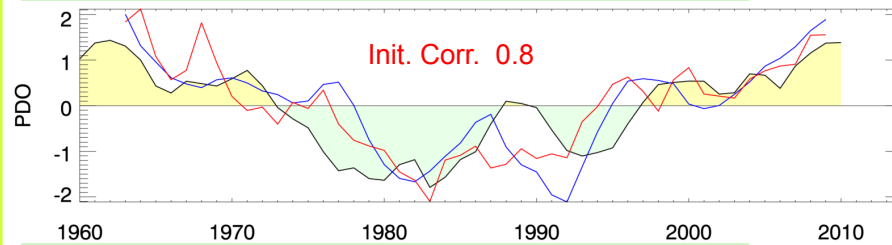
Some skill for PDO ($r = 0.5$)

For EOF and two box definitions (SAT linearly detrended, grid box)

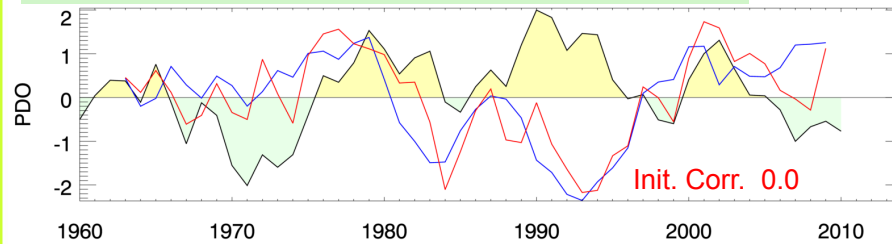
© Crown copyright

Single box averages from PDV

5-year mean NPAC after linearly detrending



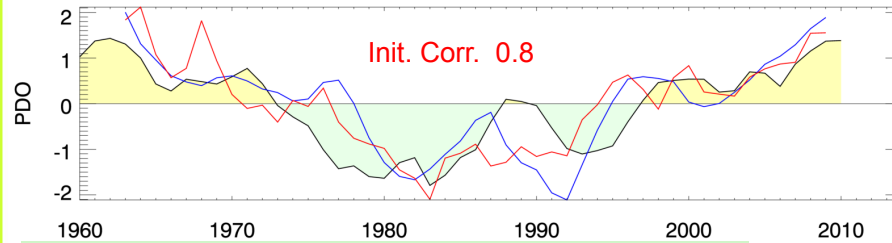
5-year mean TPAC after linearly detrending



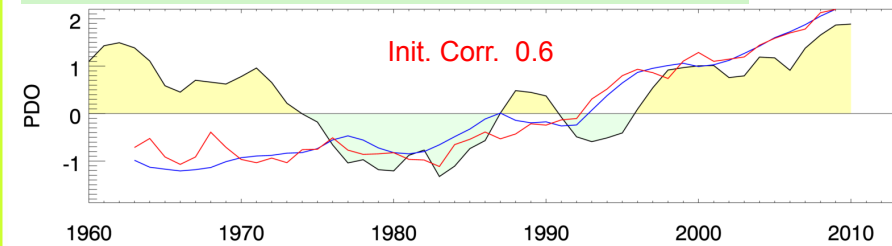
All model skill coming from northern Pacific box

Detrending artificially increases skill

5-year mean NPAC after linearly detrending



5-year mean NPAC anomalies



Removing linear trend on *short* period has added artificial cooling in northern Pacific that not physically there in the model

Uninitialised model has same skill

Skill artificially increased because obs have little trend in this period

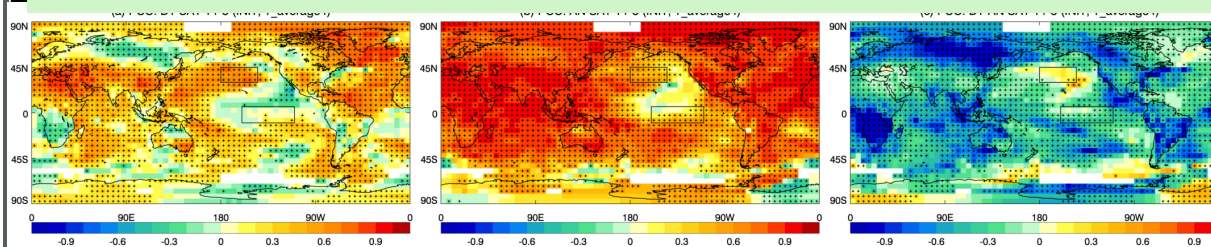
Detrending SAT adding artificial skill

Correlation 5-year mean SAT Initialised decadal hindcasts

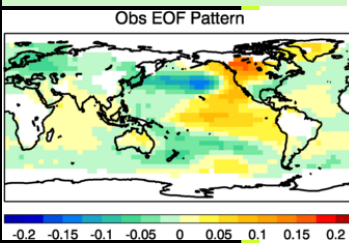
(a) Linearly detrended

(b) Anomalies

(c) a - b



SAT: GMT removed

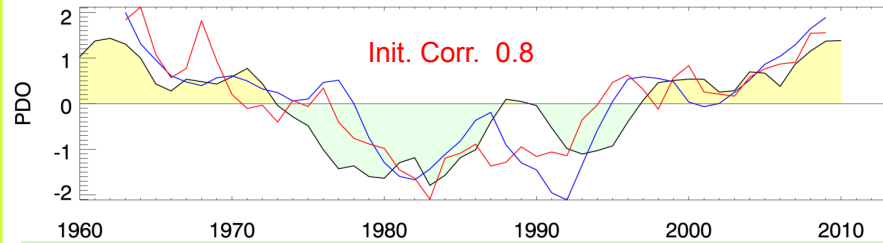


www.metoffice.gov.uk

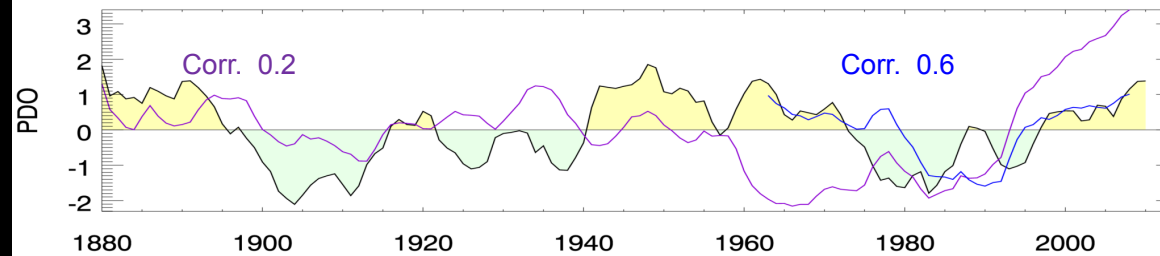
Generally correlation much greater with the trend
 Low correlation for tropical node of Pacific variability when detrend
 But correlation has improved in North Pacific after detrending
 Unexpected and disconcerting as normally use detrending as a technique to assess skill beyond the trend

Detrending SAT adding artificial skill

5-year mean NPAC after linearly detrending



External Forcing Experiments after linearly detrending

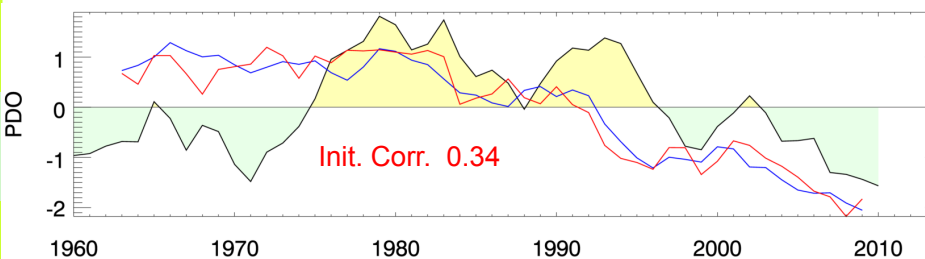
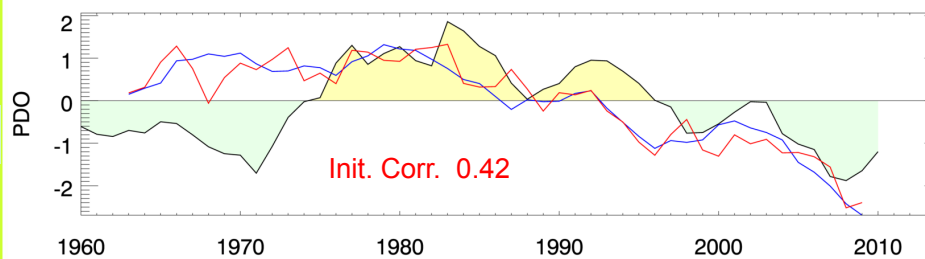


Very different results if detrend over longer period (purple)
Correlation drops from 0.6 (sig at 95%) for hindcast period to 0.2
for historical period

EOF index

PDV index
Trop – N. Pac

Initialised SAT Decadal hindcasts (5-year means) actual skill reduced for PDV indices



Some skill for PDO ($r \sim 0.4$)

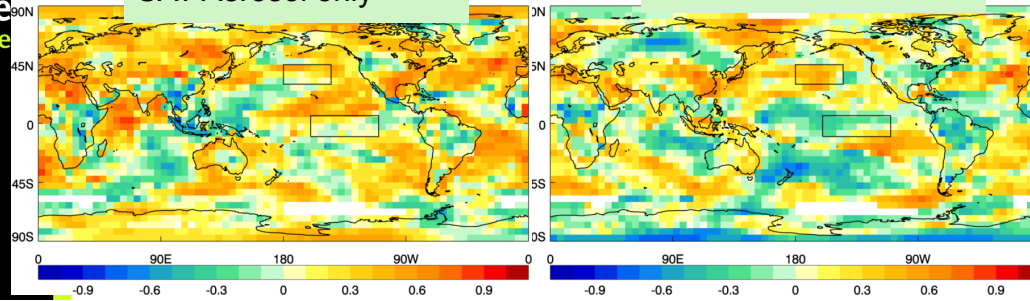
For EOF and two box definitions (SAT with GMT removed)

Aerosol & Natural forcings important (SAT GMT *rm*)

Correlation External Forcing ensembles 5-yr mean 1960s-present

SAT Aerosol only

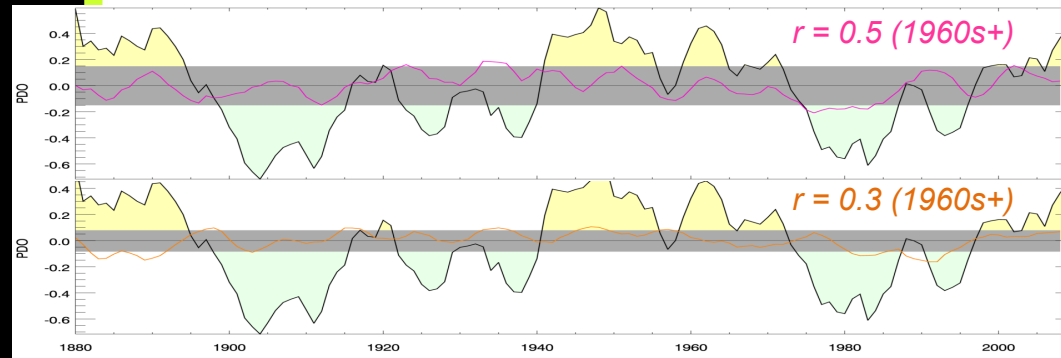
SAT Natural only



NPAC

Aerosol
 $r = 0.10$

Natural
 $r = 0.2$



Ensemble mean variability beyond residual noise expected

5-95% s.d. expected from ensemble averaging ($\text{Av}\{\text{Var}[\text{Mem}]\}/N$)

Summary

- Models capture Pacific variability EOF *patterns* very well
- Moderate skill for PDV index when applied to linearly detrended SAT fields
- Skill mainly in North Pacific rather tropical Pacific
- But skill is artificially inflated by detrending → warning against linear detrending on too short a time period
- Some signal from external forcing since 1960
 - Anthropogenic aerosols
 - Natural factors (likely volcanoes)
- Important to have realistic projections of Aerosol forcings to make forecasts