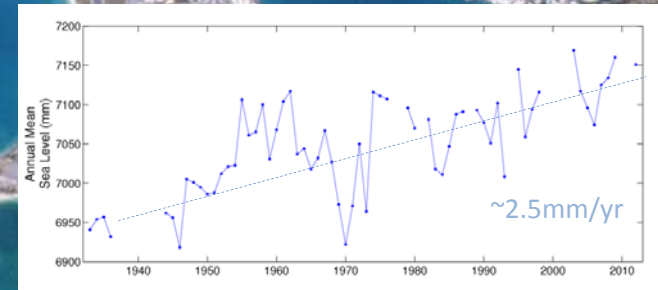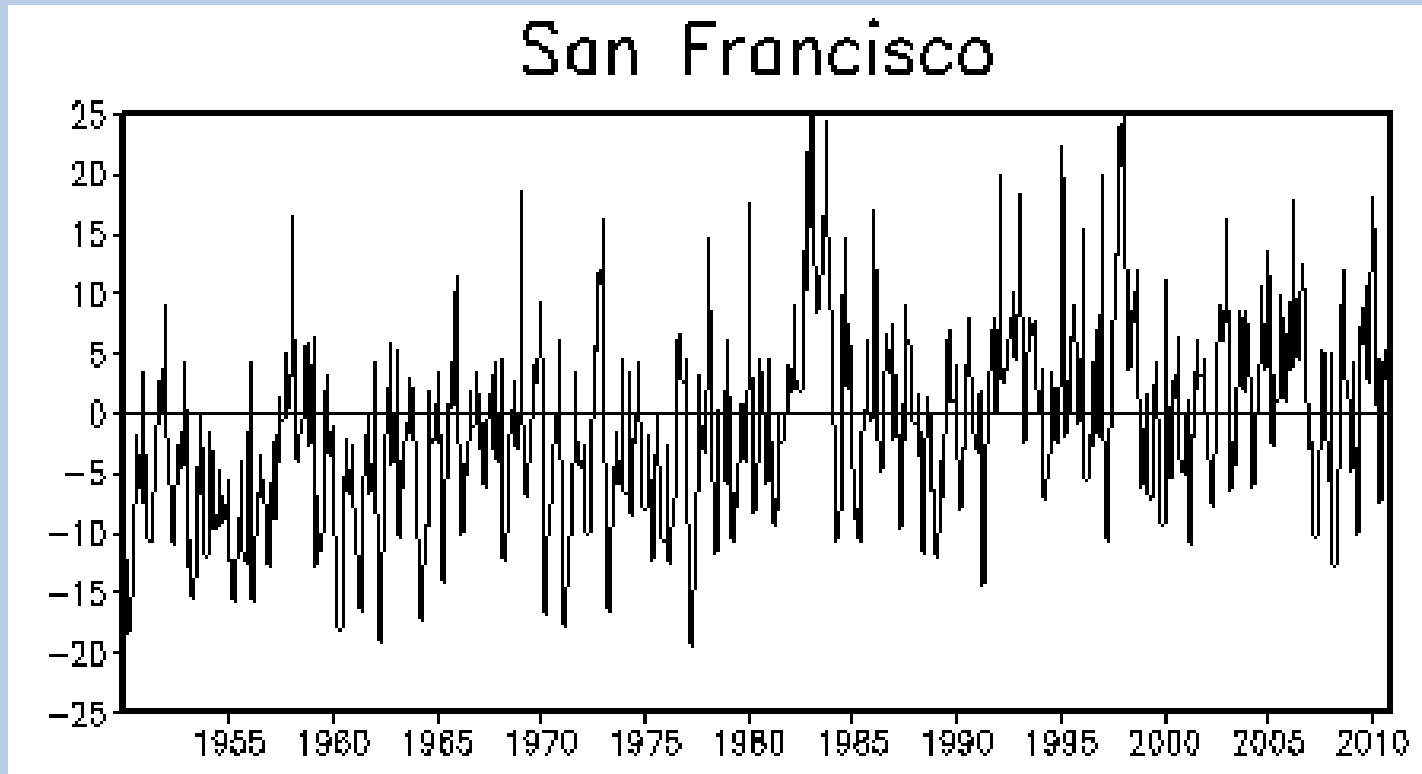# Sea level in ocean reanalyses and tide gauges ------ how similar?

Gennady Chepurin & James Carton (UMD)

Eric Leuliette (NOAA)
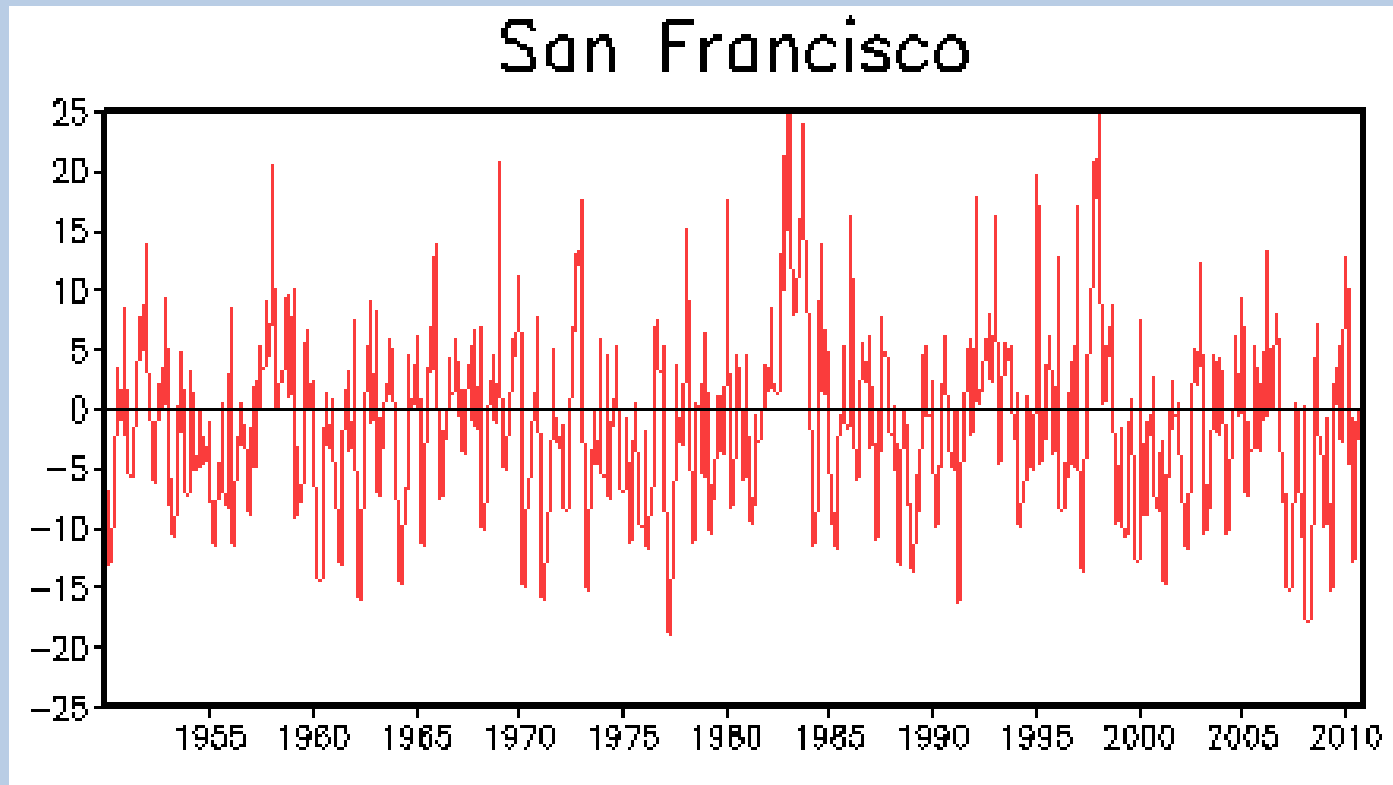
~2.5mm/yr

- 60yr base period
- 110yr extended period
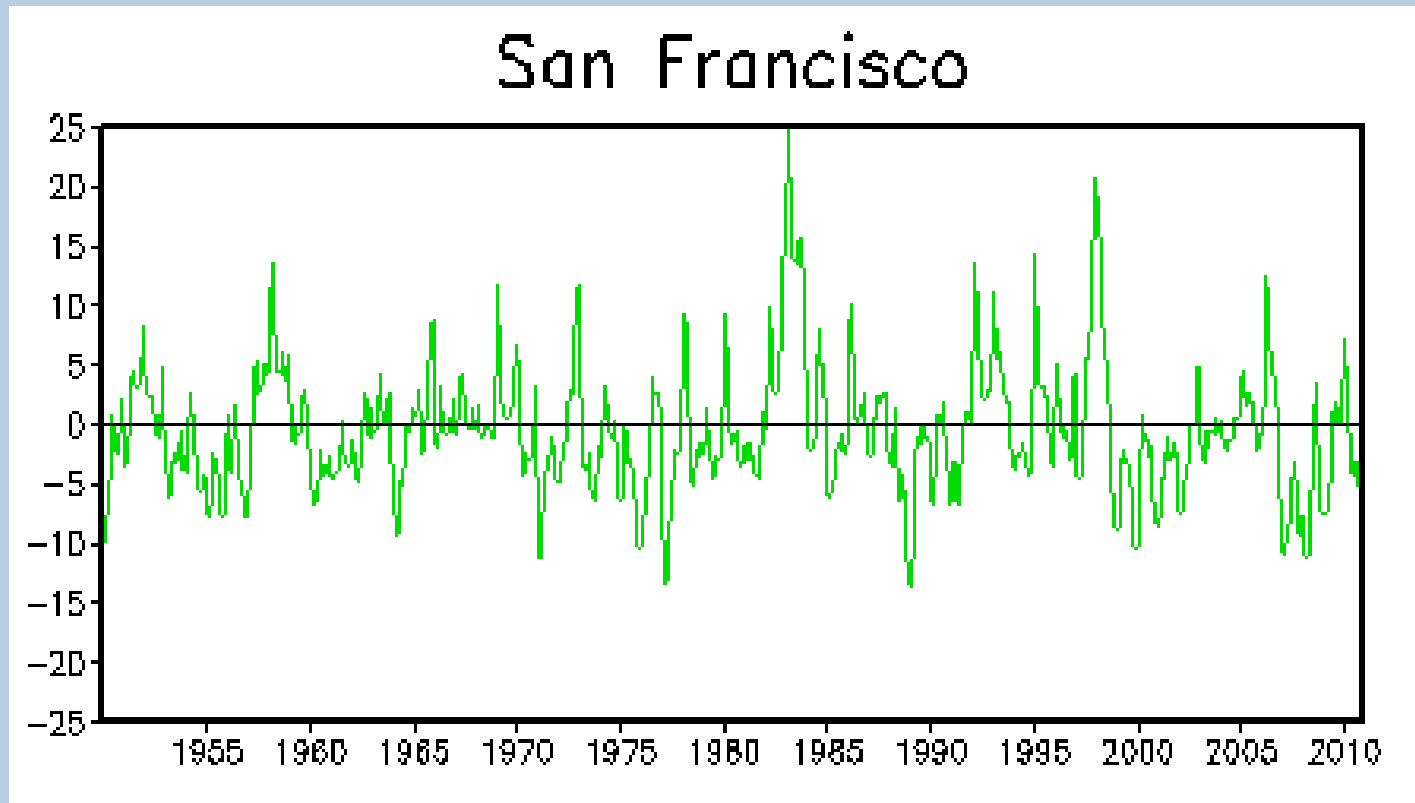- No explicit reference to altimetry (but we're getting there!)

Processing of *Ray and Douglas* set of 87 monthly gauge time series from PSMSL
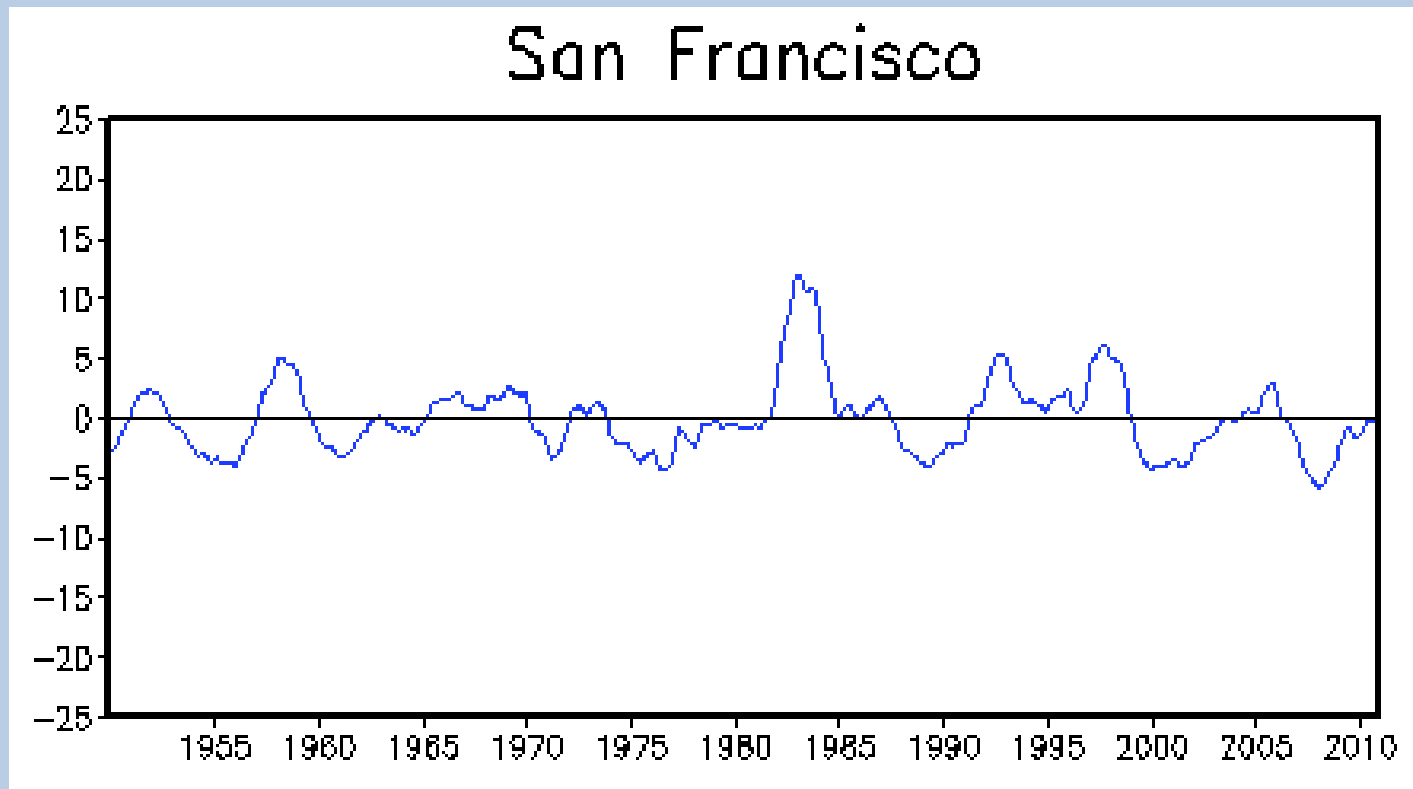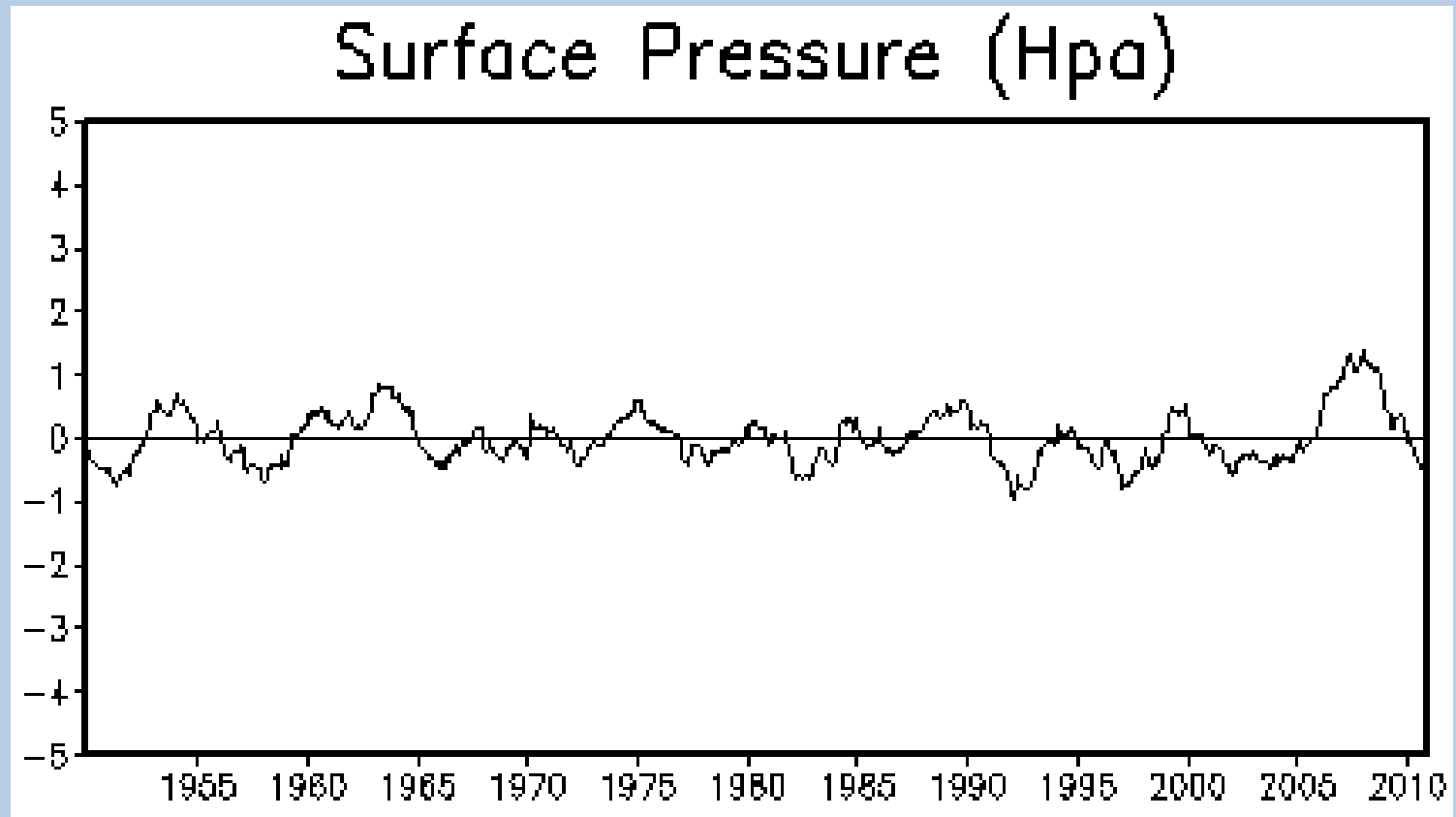
Remove Linear Trend

San Francisco

Remove Clim. Monthly Cycle

Running Smooth

IB Correction

Surface Pressure (Hpa)

Reanalyses/Syntheses we examine

	Time	Resolution	Algorithm	Assim alt. Sea level
SODA 2.2.4	1871-2010	.25x.4x40L	~OI	no
POAMA2	1949-2005	(0.5-1)x1x25L	~EnKF (PEODAS)	no
ECMWF ORA-S4	1958-	(0.3-1)x1x29L	3DVar FGAT	yes
MOVE/MRI	1949-2005	(0.3-1)x1x50L	3DVar	yes
INGV	1962-	2x2x31L	OI	no
CERFACS	1962-2001	2x2x31L	3DVar	
GECCO	1952-2001	1x1x23L	4DVar	yes

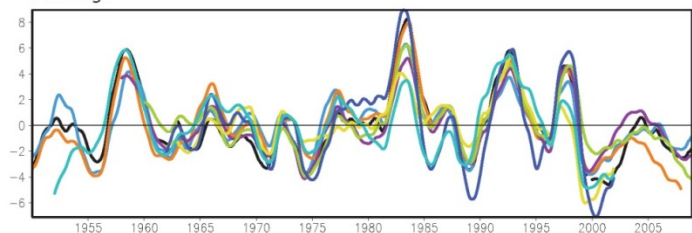# Spatial Structure of 0-lag Correlation
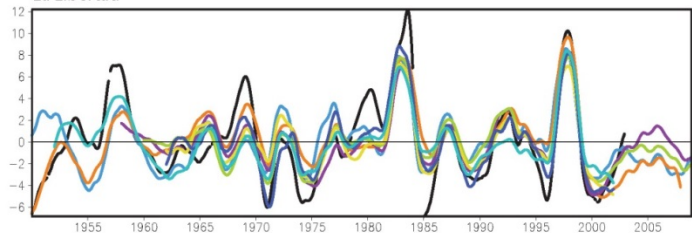## Between product and gauge time series
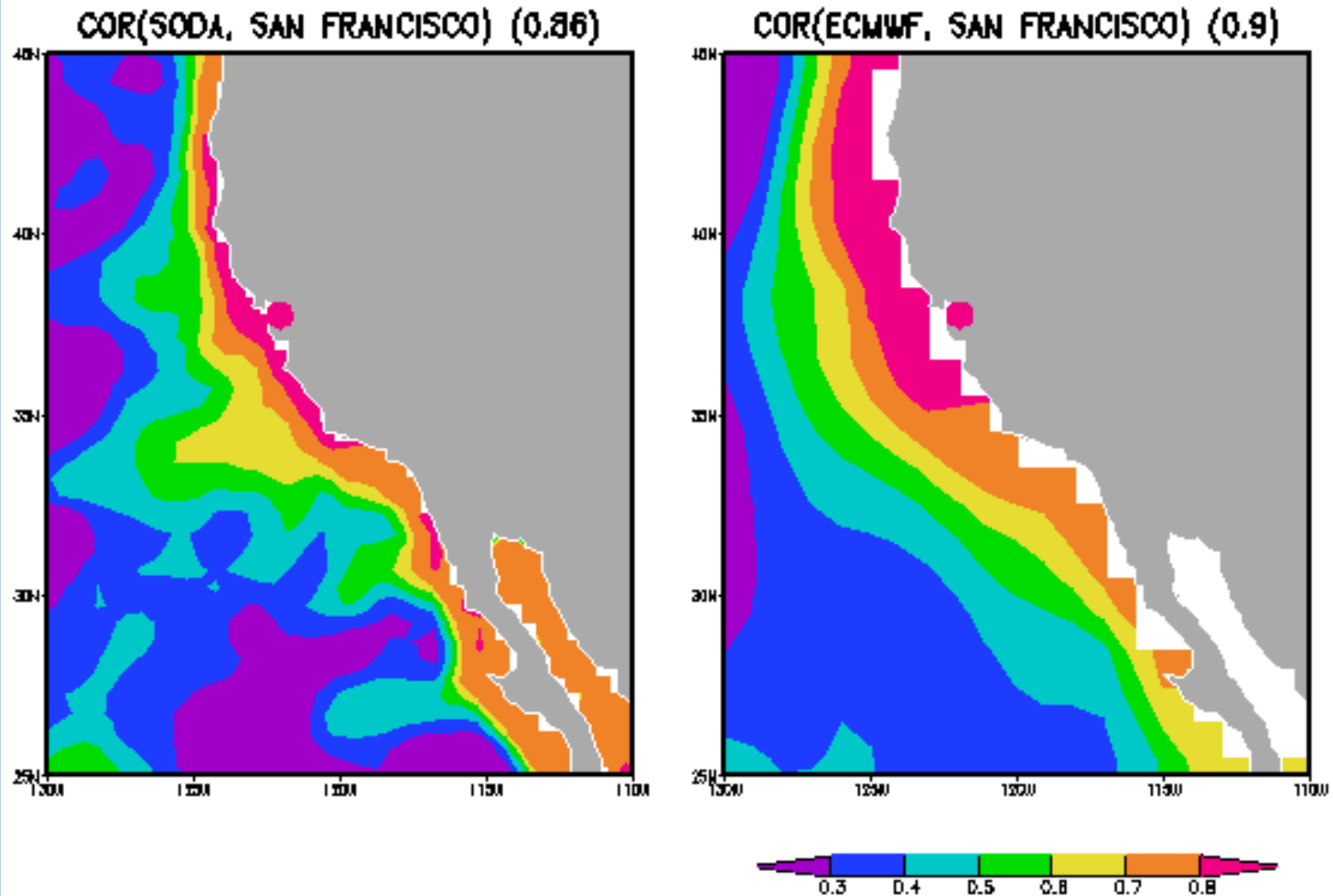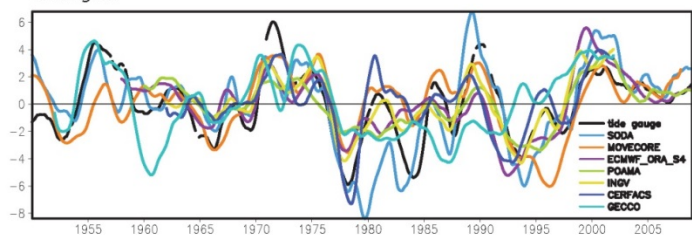
Products vs gauges
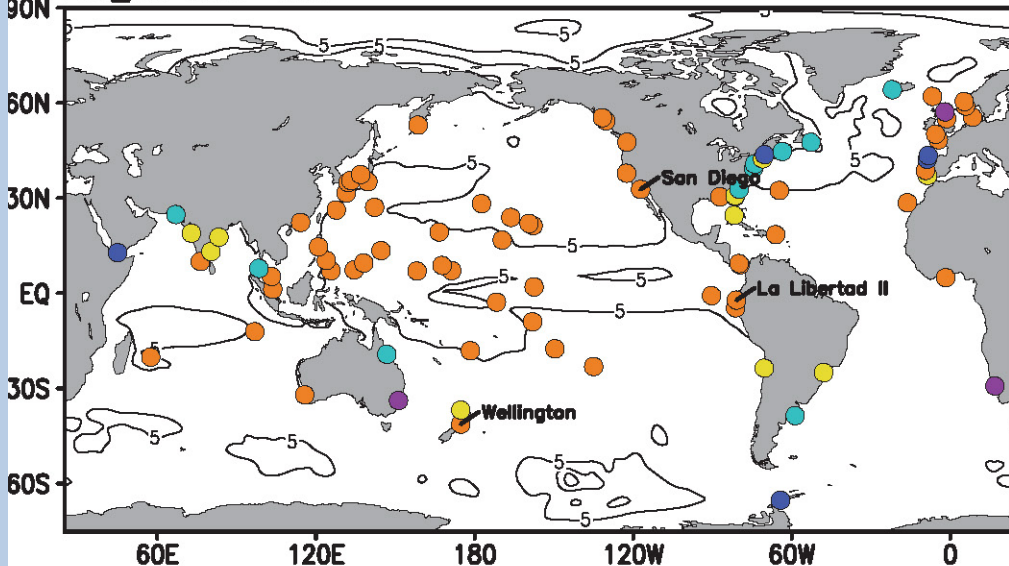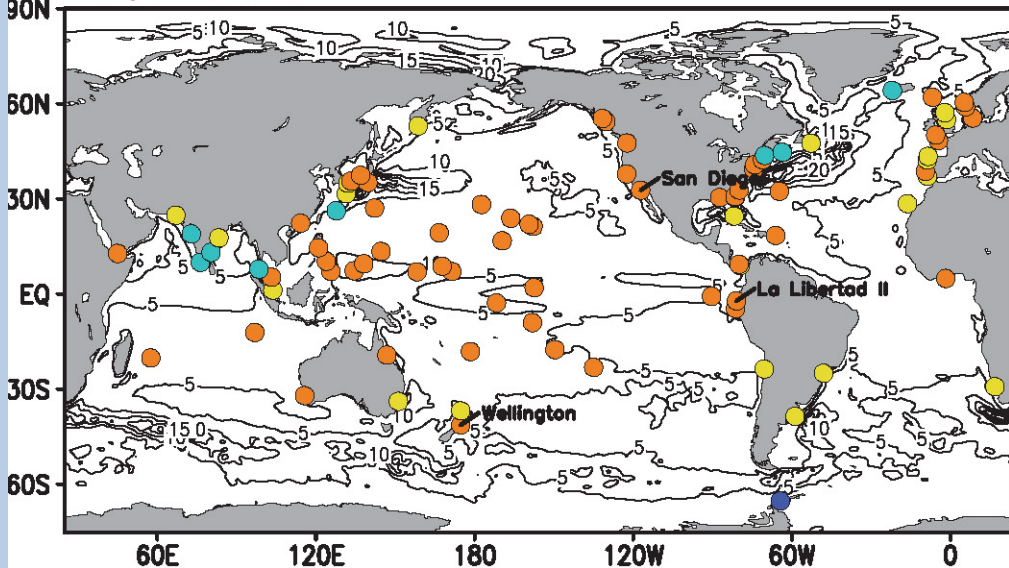
Three examples

San Diego

La Libertad

Wellington

- tide gauge
- SODA
- MOVECORE
- ECMWF_ORA_S4
- POAMA
- INGV
- CERFACS
- GECCO

ORA_S4, 1950—2008

SODA, 1950—2008
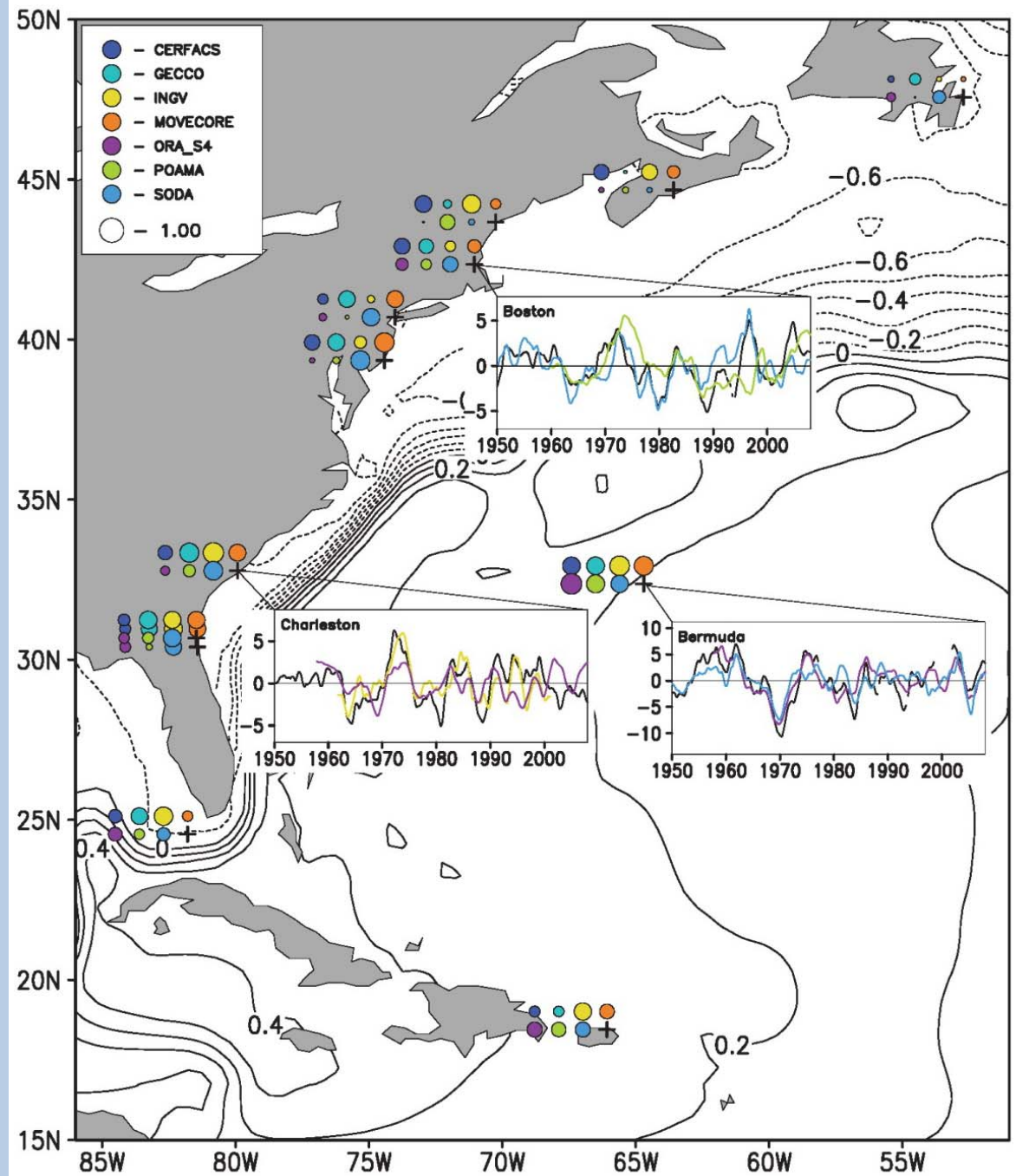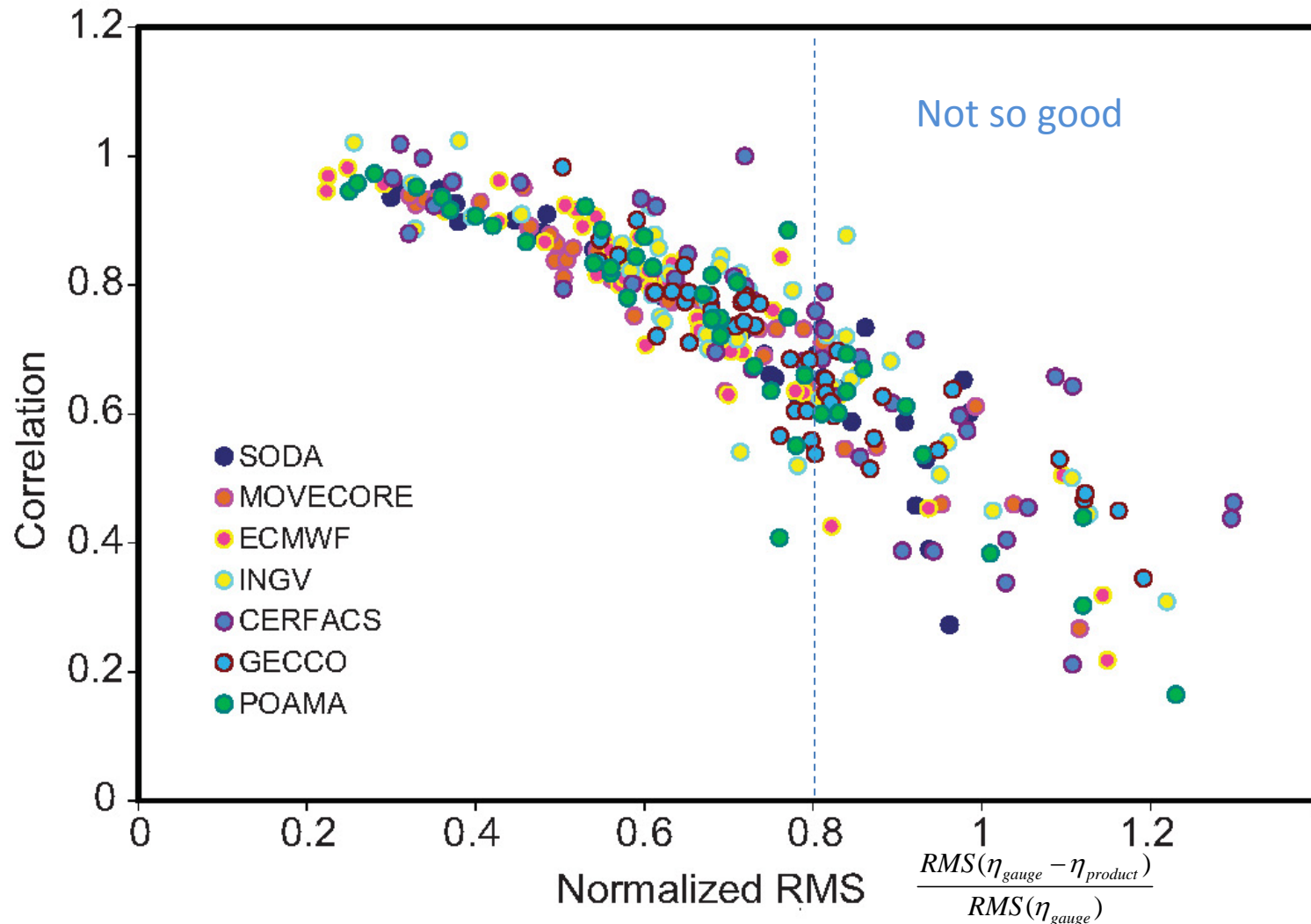
< 0.0
0.0 < < 0.2
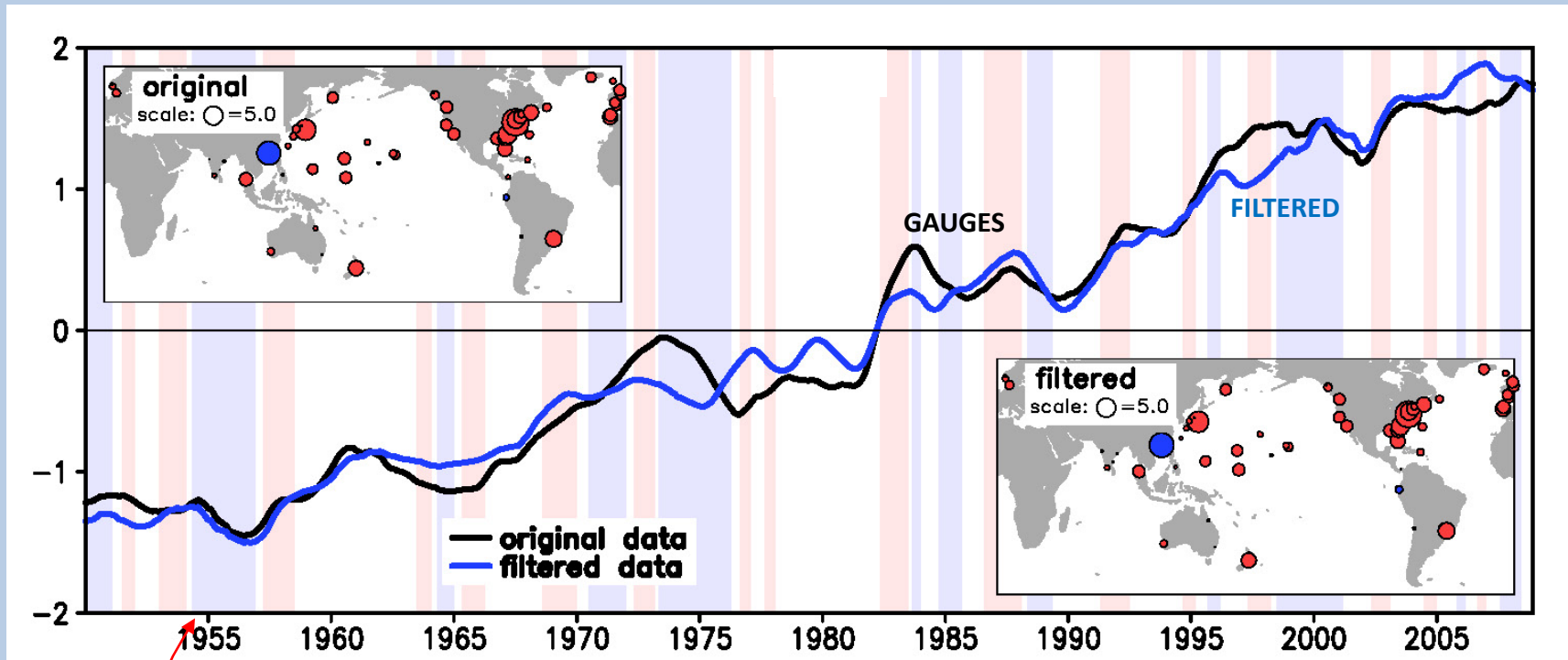0.2 < < 0.4
0.4 < < 0.6
0.6 <

US East Coast

Summary of comparison

Understanding the Differences

- Reintroduce the linear trend
- Compare the 1st EOF of the 87 gauges with the 1st EOF of the gauges filtered by subtracting the products
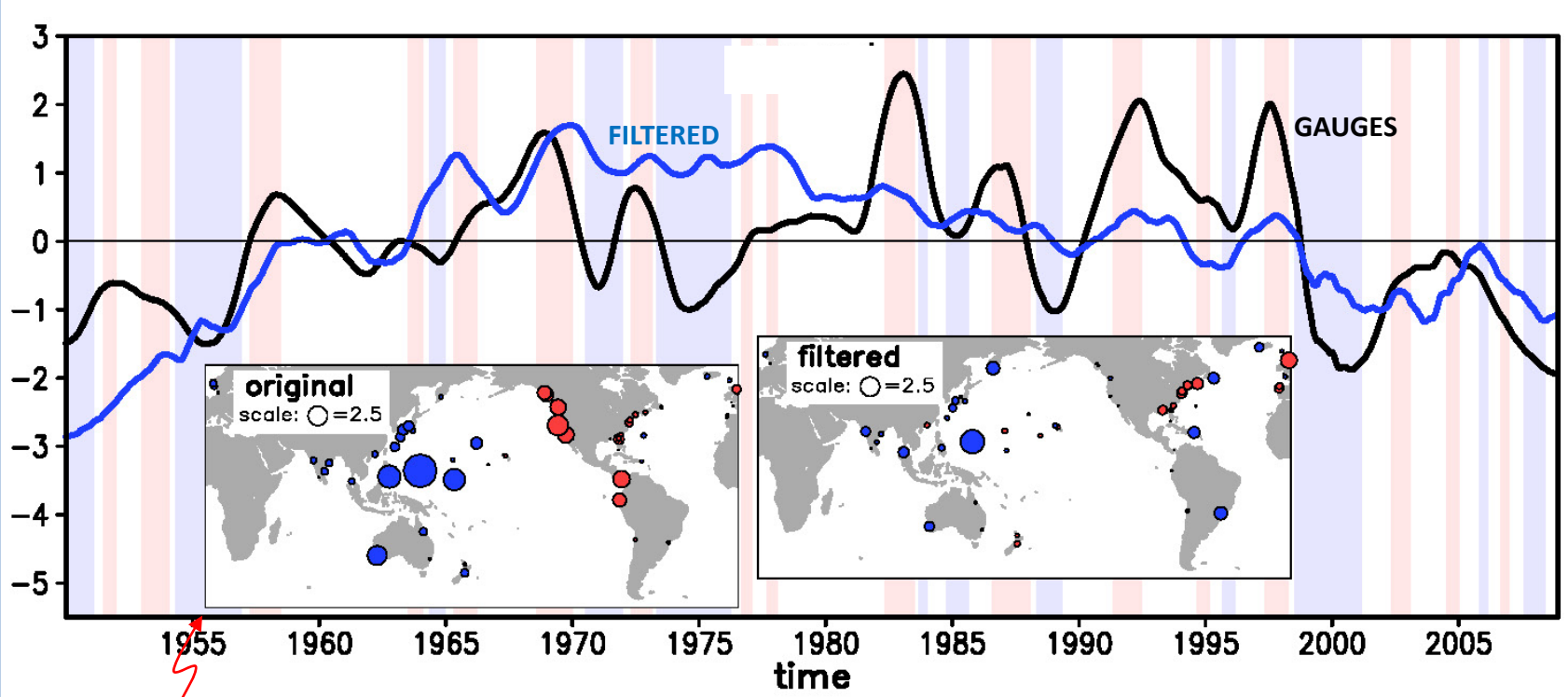

Stripes show ENSO phase

1st EOF describes the trend and that doesn't change. Variability about trend is reduced a bit.

2ⁿᵈ EOF of original and filtered gauges

- 2ⁿᵈ EOF of original is mainly ENSO
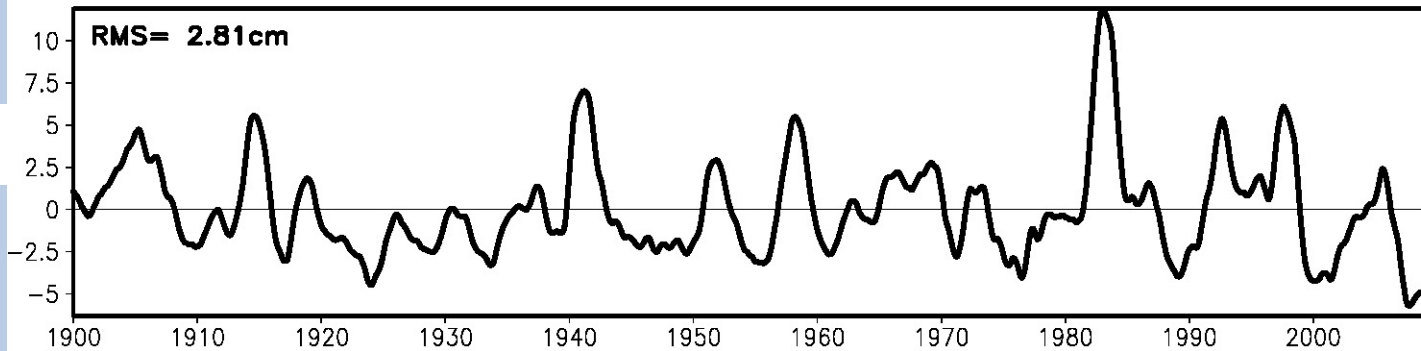- 2ⁿᵈ EOF of filtered time series shows a multidecadal pattern (acceleration of western Pacific, …)
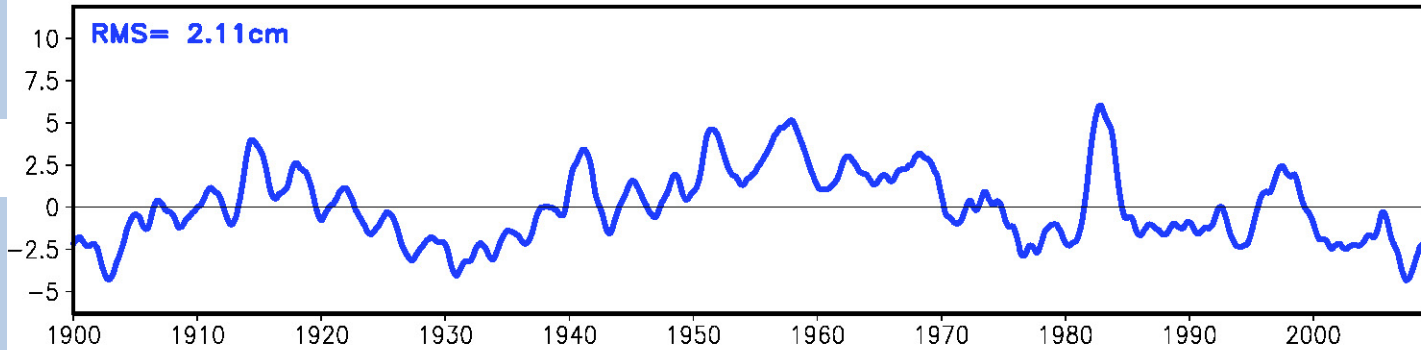

Stripes show ENSO phase

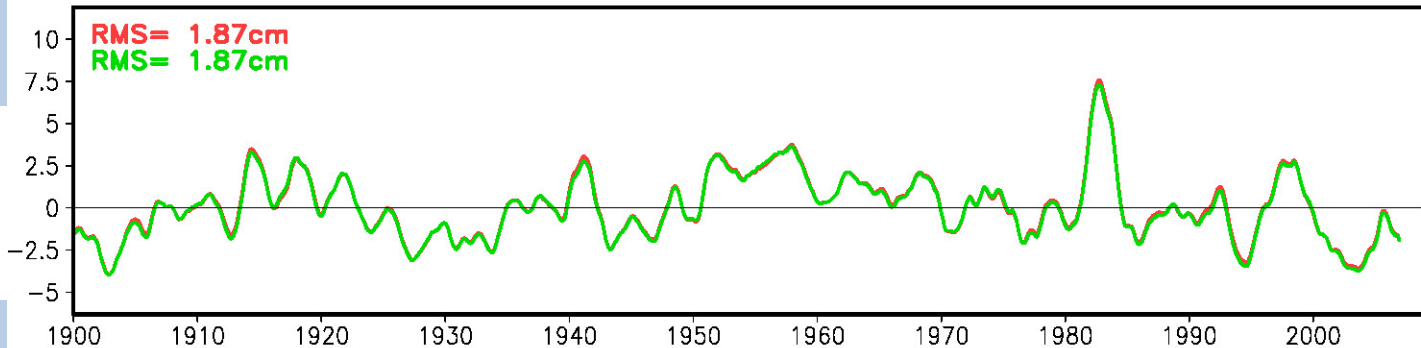# Filtering the 110yr extended period

San Francisco

Summary

- Reanalysis/synthesis sea level estimates explain approximately 25% of the gauge record variance. RMS diff ~2.2 cm.
- Analysis of the residual differences suggests improvements in representation of e.g. PDO can bring this up to 35% or more.

Next

- Modify surface meteorology in accordance with basin-scale gauge variability
- Construct observation error covariances for gauge data set.
- Include detrended gauges in a 3DVar/OI assimilation
- …