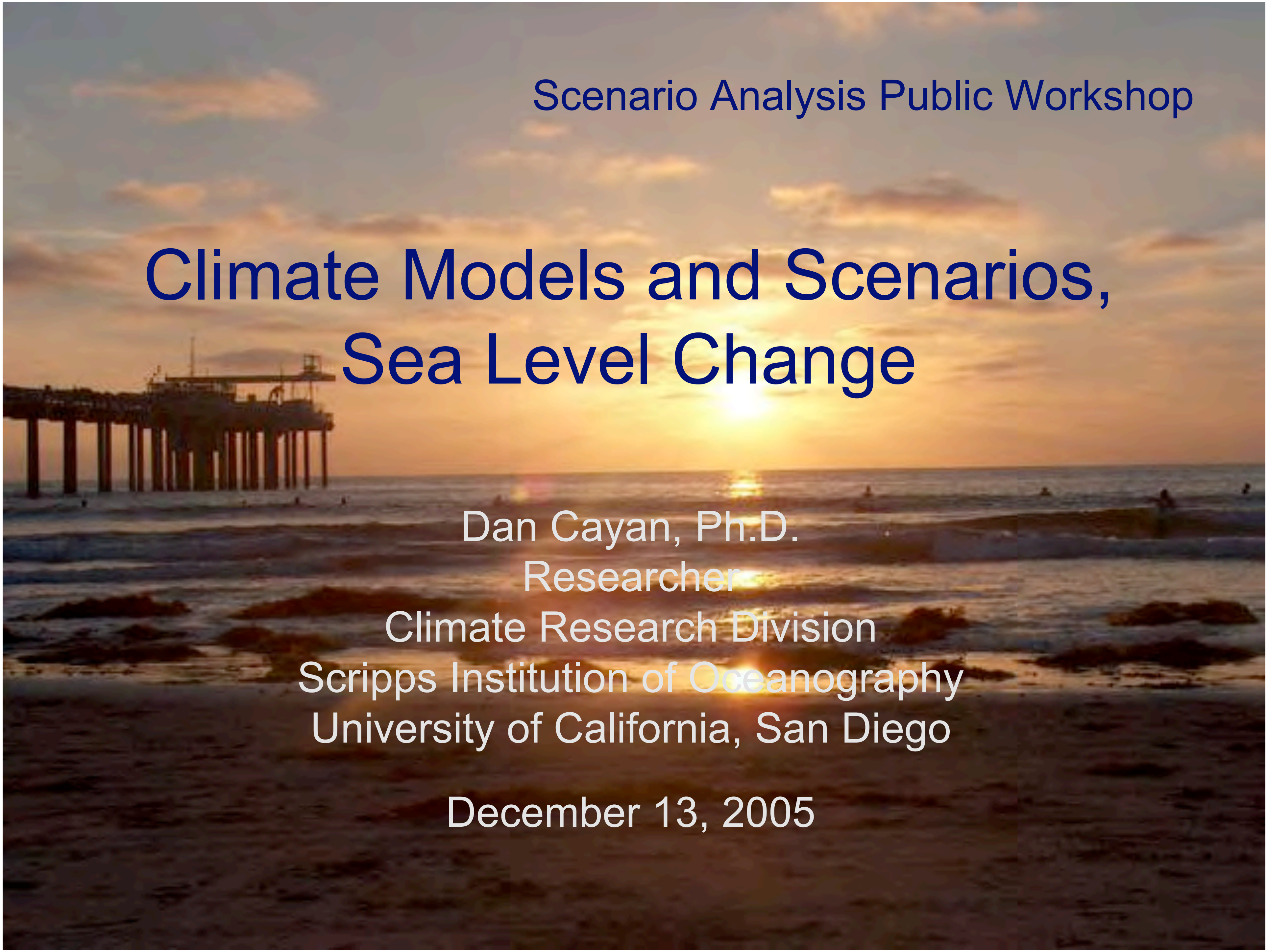

Scenario Analysis Public Workshop

Climate Models and Scenarios, Sea Level Change

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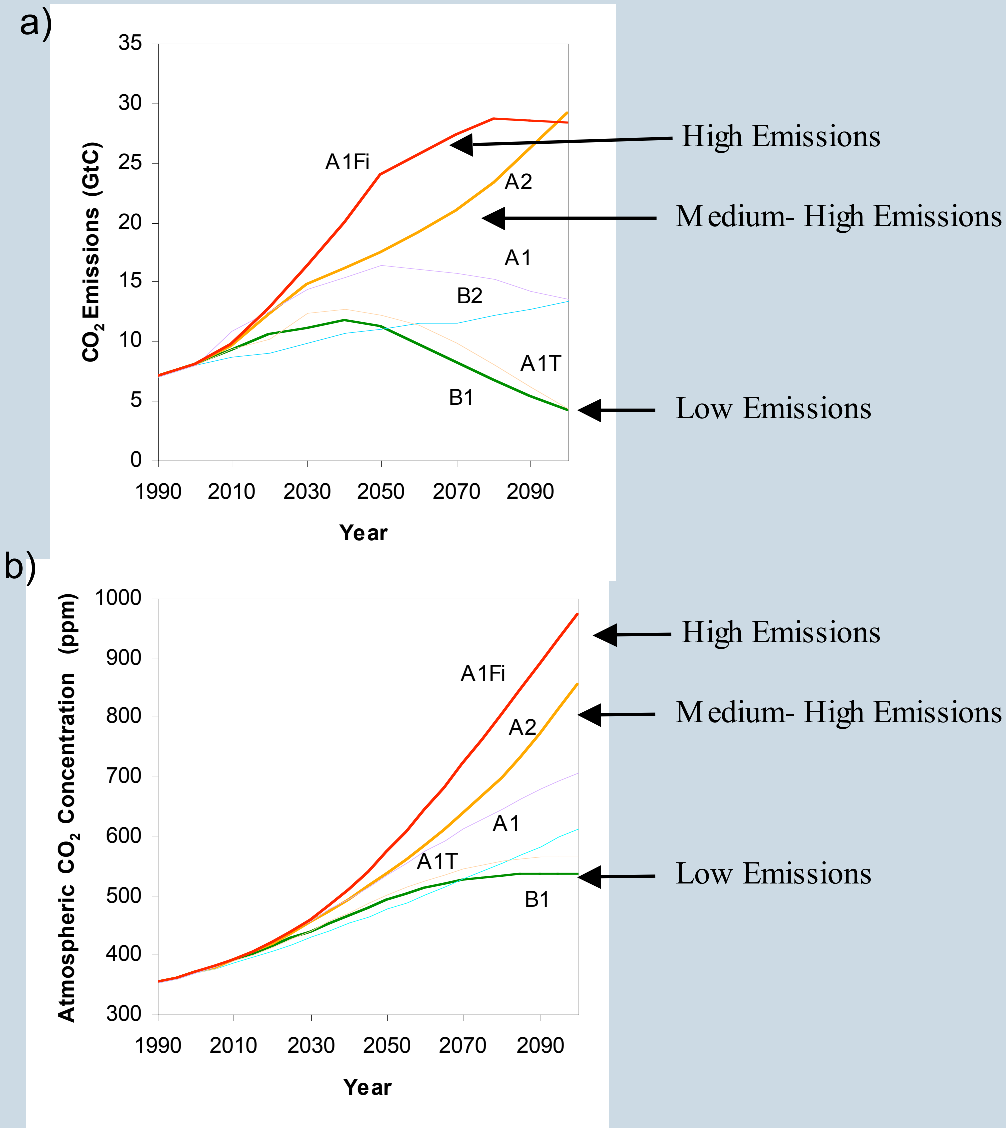
IPCC GHG Emissions Scenarios



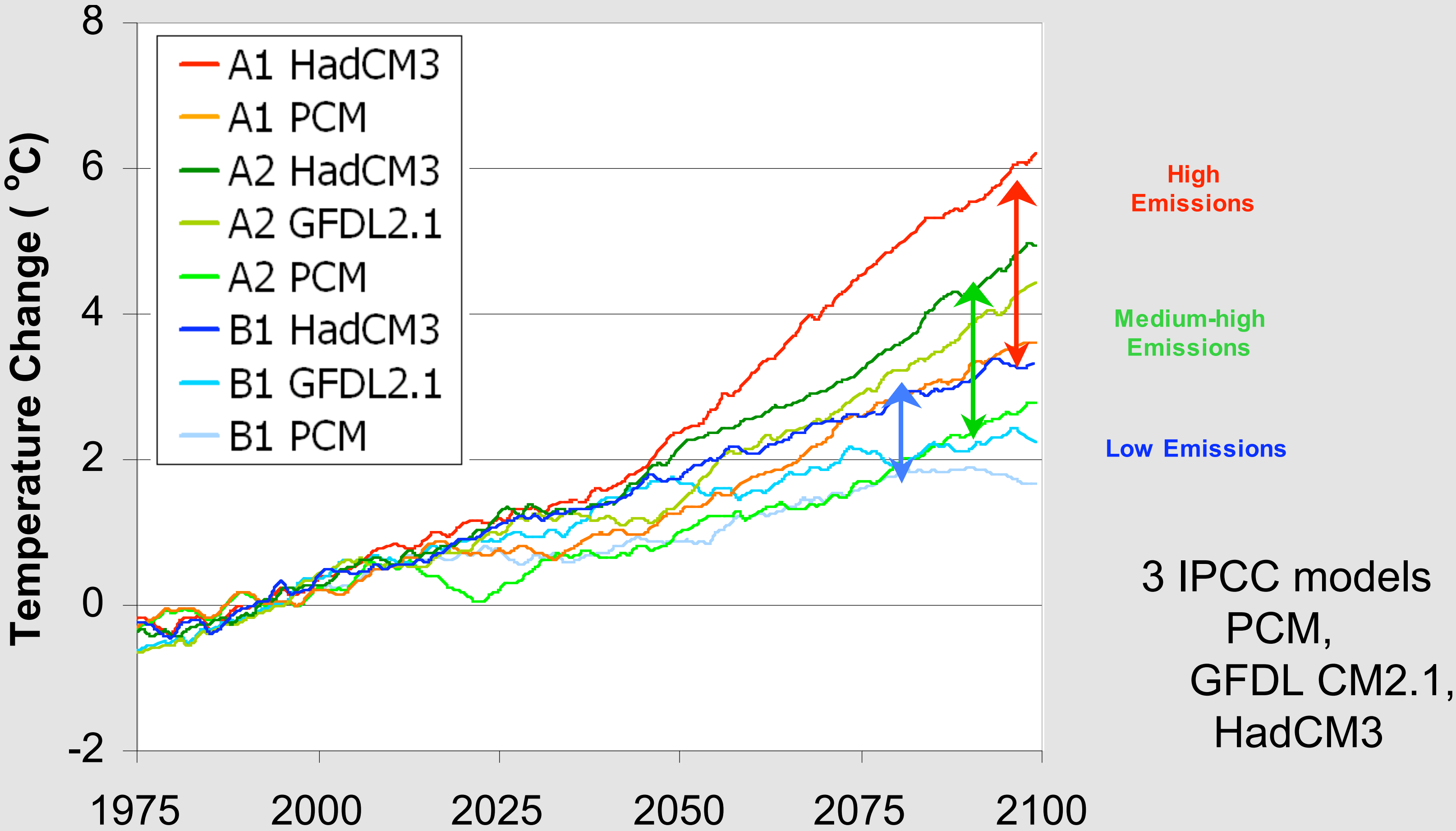
range from low to high

scenarios depend on a global set of economies, populations, technologies, decisions, etc

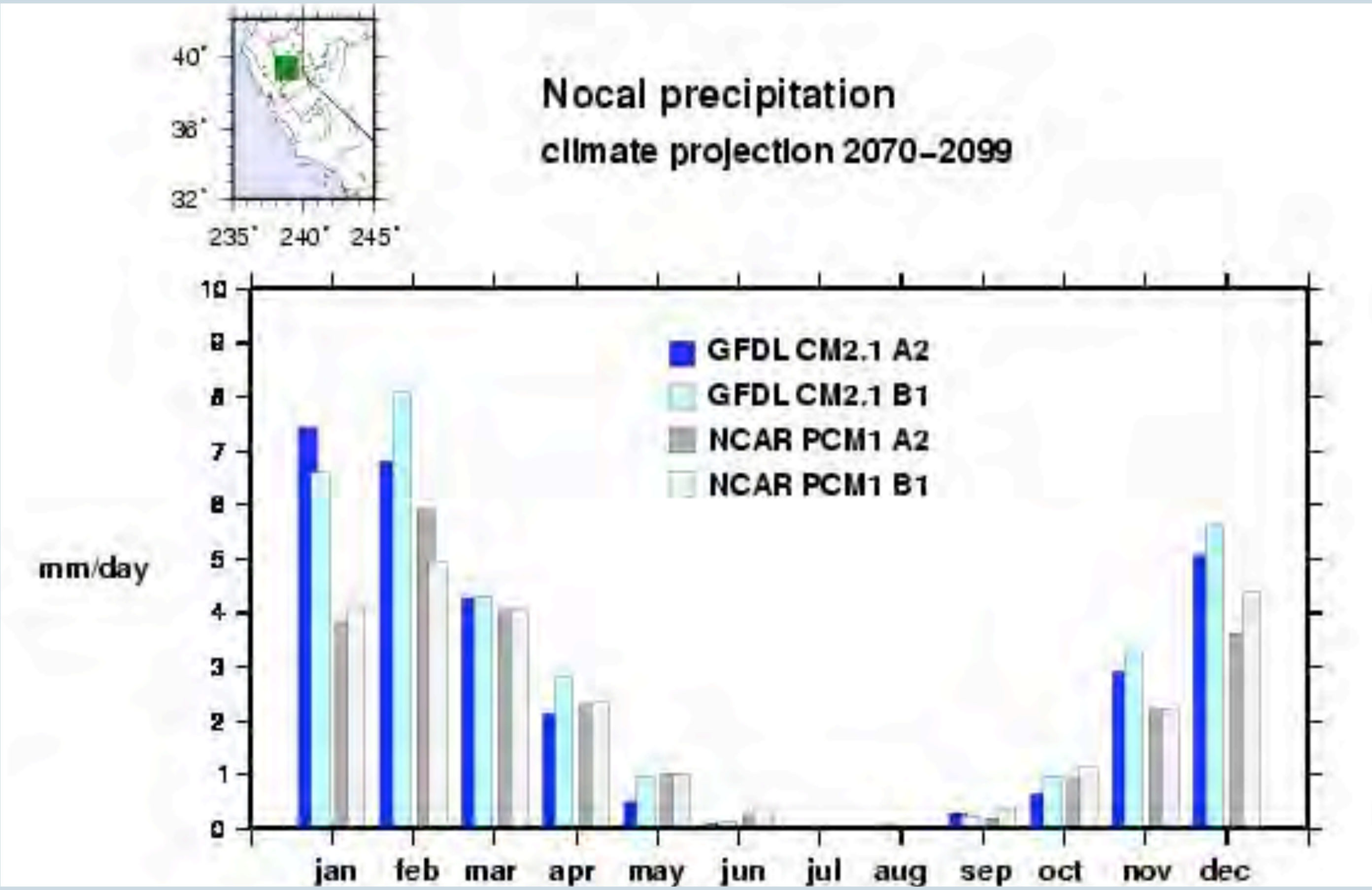
CO2 is most important anthropogenic GHG

CO2 and other GHG's have long Residence times in atmosphere—emissions today accumulate, so will be felt by following generations

Even low scenarios double the concentration of atmospheric CO2. Under high scenarios, CO2 concentration would triple by 2100

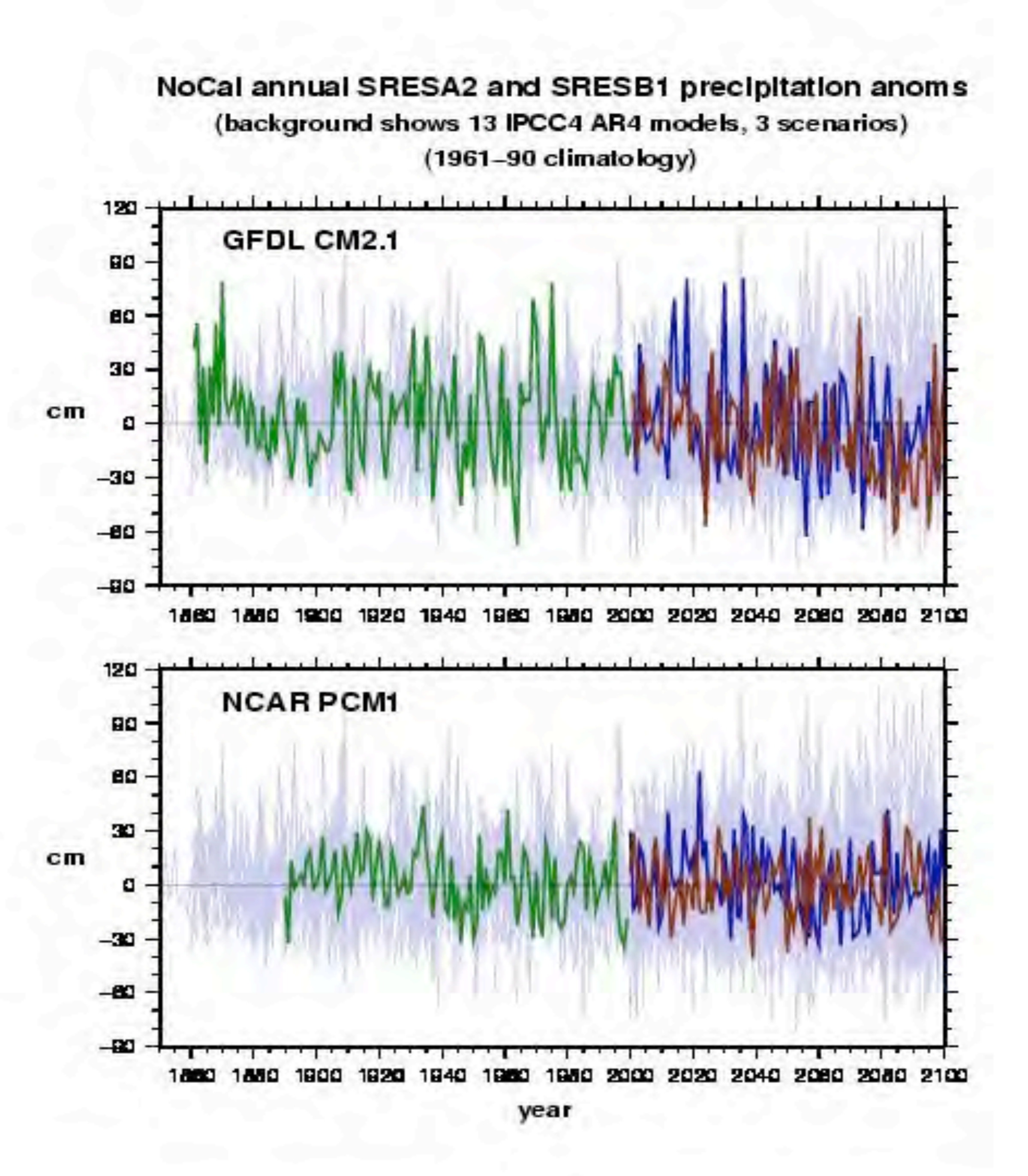


Temperature will increase in proportion to GHG emissions But there is substantial difference between models, reflecting uncertainty in the sensitivity of earth's climate to changes in radiative forcing by GHG's



In the model simulations, precipitation in California retains its seasonal character—water here is delivered by North Pacific winter storms.

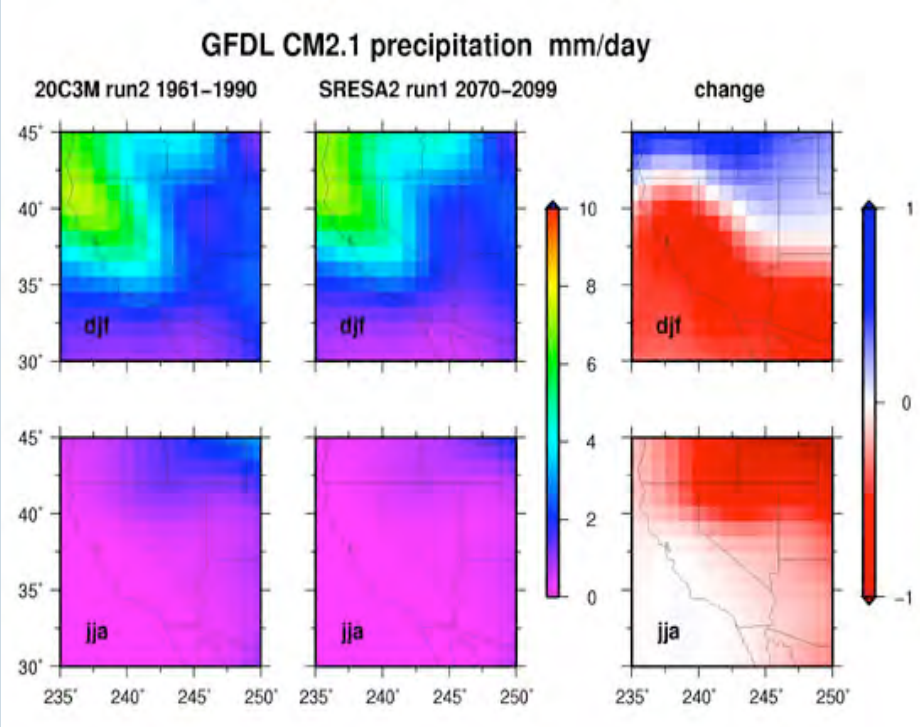
In the present models, summer precipitation does not increase

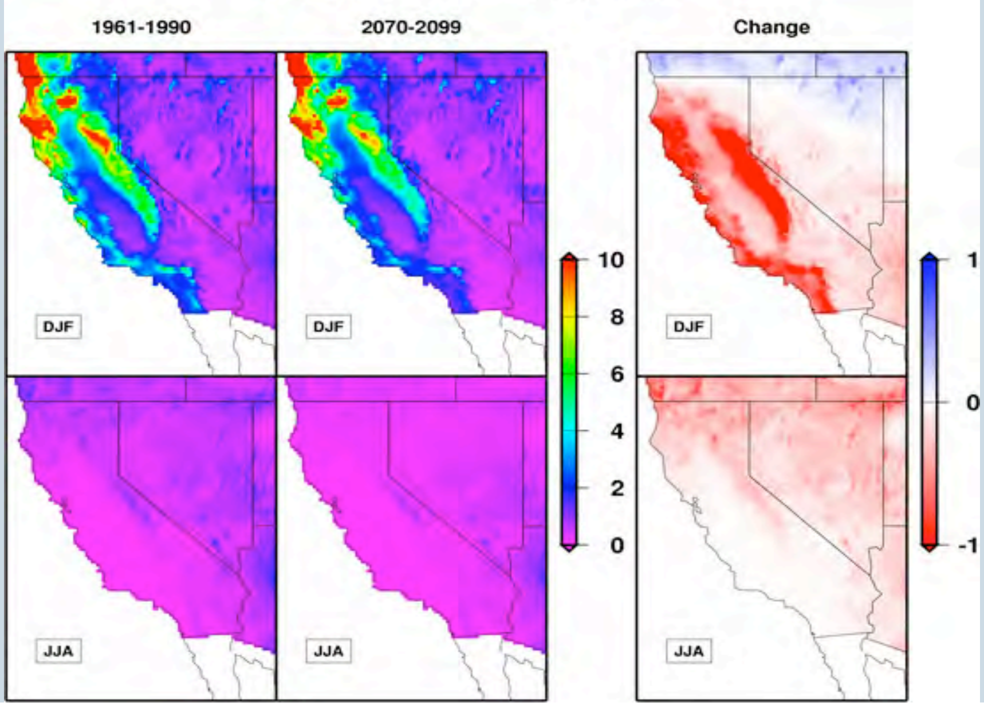


In some models, California precipitation increases, and in some it decreases.

There is a slight consensus for precipitation to diminish somewhat, but it is not very strong.

The majority of models simulate precipitation quite close to historical levels





Global Climate Models compute Climate on a coarse grid

So, a “downscaling” procedure was used to provide temperature and precipitation over a finer mesh that is more commensurate with the California landscape

A hydrologic model is used to simulate streamflow, soil moisture and other hydrologic properties

Scenarios of climate change for California

Scenarios of Plausible Futures, *not* Predictions

Major uncertainties because of climate sensitivity, future GHG emissions,
    inherent difficulty in modeling certain processes such as precipitation

Recent historical record—warming, earlier springs, rising sea levels, highly
    variable precipitation

Global Climate Models
- able to replicate broad scale and regional climate structure, variability
- recent production of historical and climate change simulations

Greenhouse Gas Emissions Scenarios
- GCMs include a menu of known climate forcings
- GHG emissions futures from IPCC, range from relatively low
    to very high

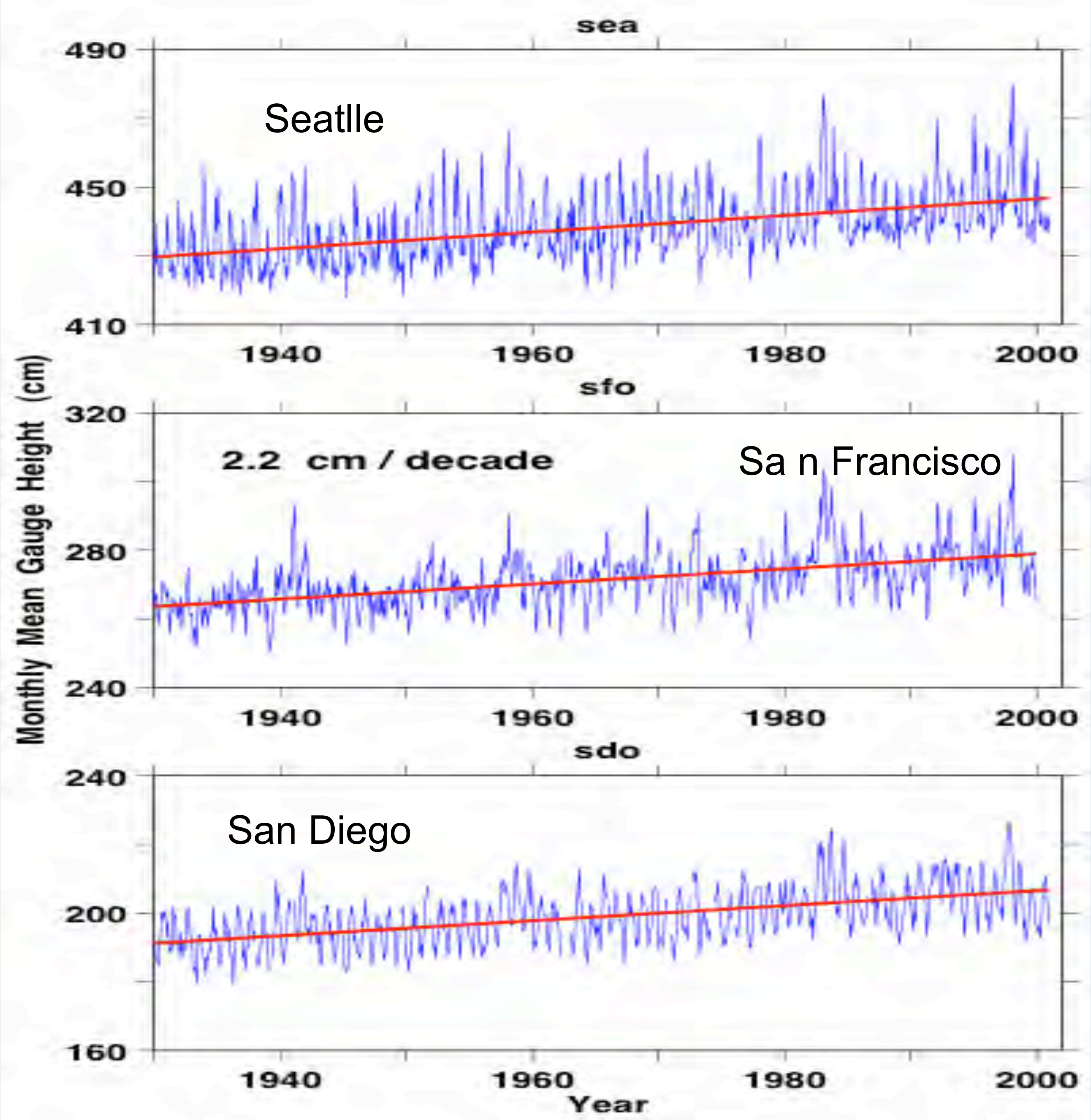
Characteristics of the scenarios
- warming—unanimous consensus, though a wide range is possible
    from +2F to +10F   summer warming may exceed that in winter
- enhanced sea level rise quite likely
- changes in precipitation and other elements very uncertain

Even under lower emissions scenarios substantial regional climate change
    would occur.   Under higher emissions scenario, changes become large.

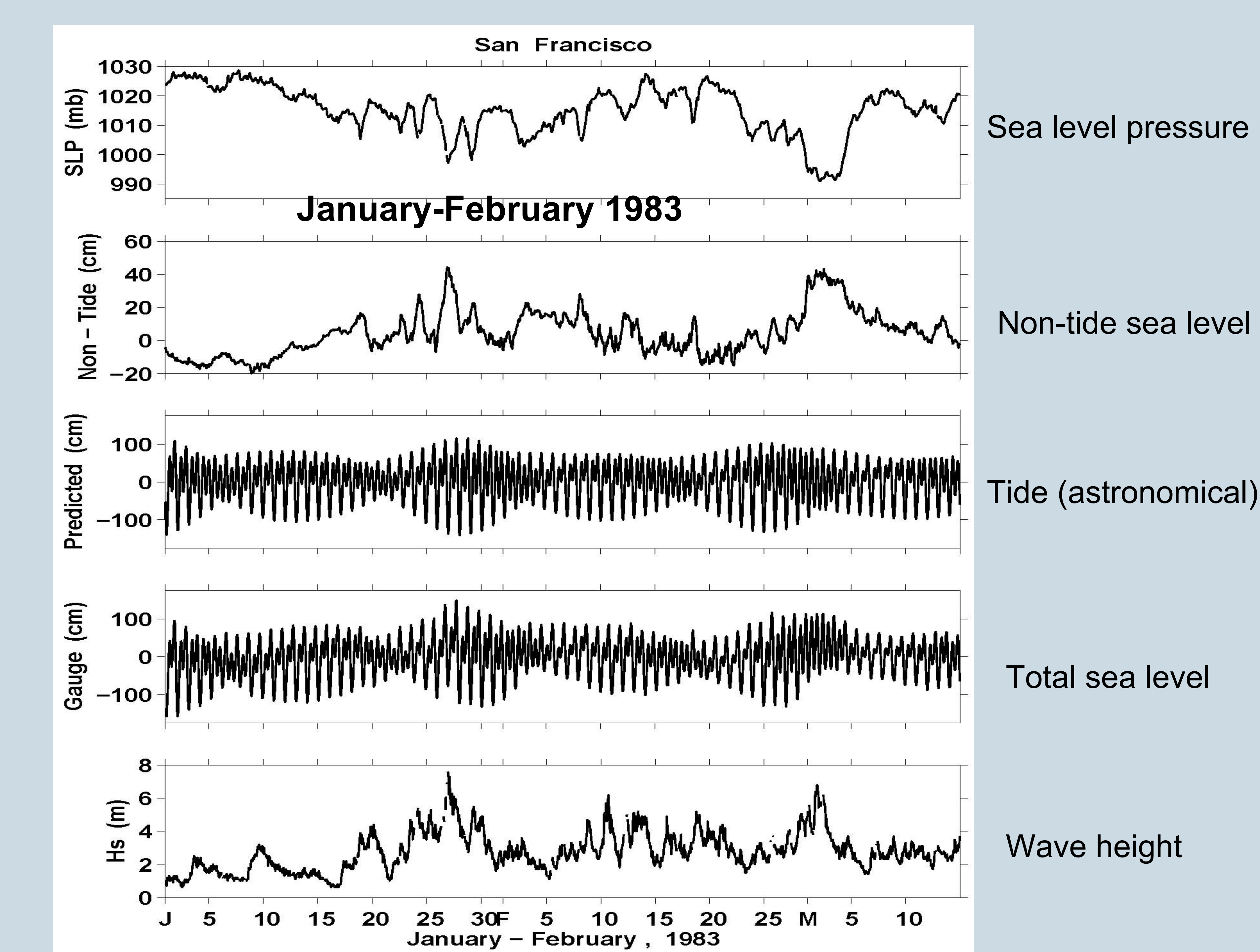
Differences between high and low emission pathways would not be felt in first
    few decades, but become large as GHG's accumulate.

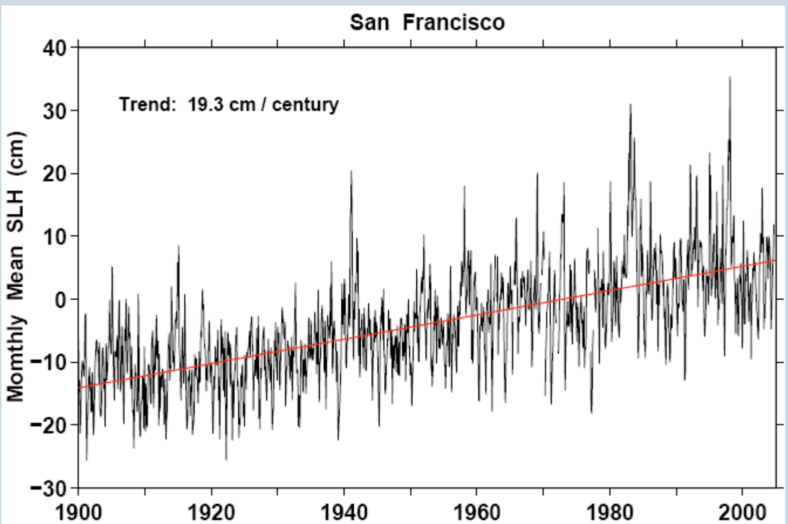
Sea Level Rise

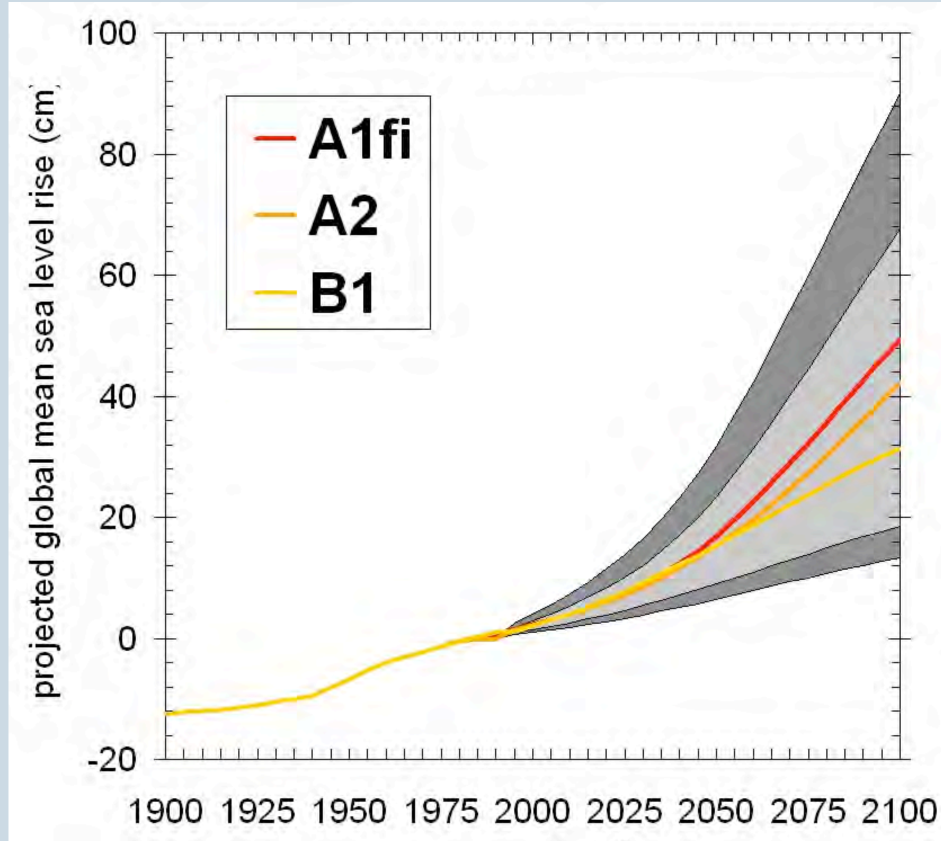
Future Projections For California



West Coast Tide gages exhibit rises in Sea level approximately 6-8” over the 20th century

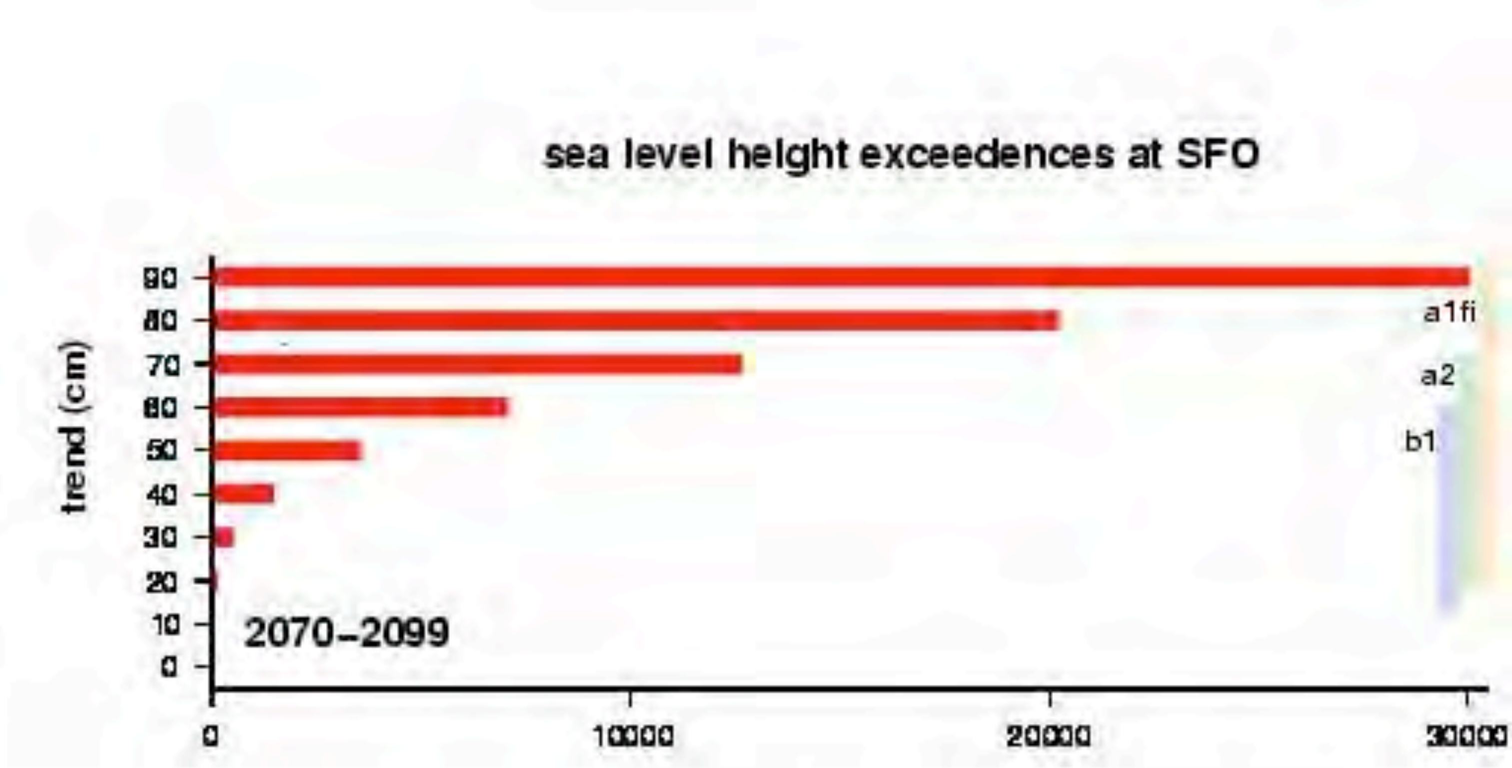

San Francisco
January-February 1983
SLP (mb)
1030
1020
1010
1000
990
Non – Tide (cm)
60
40
20
0
–20
Predicted (cm)
100
0
–100
Gauge (cm)
100
0
–100
Hs (m)
8
6
4
2
0
J 5 10 15 20 25 30 F 5 10 15 20 25 M 5 10
January – February , 1983
Sea level pressure
Non-tide sea level
Tide (astronomical)
Total sea level
Wave height





San Francisco observed sea level, with trend of approximately 7" per century.

Projected sea level rise for three GHG emissions scenarios, A1fi (high emissions), A2 (medium-high emissions) and B1 (low emissions), ranges from a few cm to about 90cm over 100



Projected number of exceedances of San Francisco hourly sea level above historical 99.99 percentile (137cm) for 2070-2099

from GFDL model weather and ENSO for a range of trends, from 0 to 90 cm/100 years.

Potential California Sea Level Rise

California coastal sea level, in geologically stable areas, has risen about 6-9 inches over the last century. This is about the rate estimated for global sea level rise.

Additional global sea level rise is projected due to ocean warming and ice/snow melting

very certain to rise in excess of 3 feet in next few centuries, likely to rise by several inches over the next century

Rates of future rise are not exactly known, but vary proportionately to warming

range of sea level rise is from a few inches to about 30 inches.

Because sea level along the coast is the sum of tides, weather and climate forced Excesses or decreases, and long term changes such as global change, flooding and Erosion will occur in bursts during high tides and extreme weather events.

Long term sea level rise will make these events more frequent. High, energetic waves often exacerbate storm enhanced sea levels.

San Francisco Bay and Delta is vulnerable to sea level rise because of a system of Fragile levees. River flooding accentuates the risks there.

Potential implications of Sea Level Rise

- Increased expenditures on beach nourishment and replenishment
- Reduced availability of beach recreation due to shrinkage of sand area
- Loss of coastal wetlands
- Property damage associated with coastal flooding and cliff erosion
- Expenditures on sea wall construction