SUBSEASONAL VARIABILITY OF CLOUD RADIATIVE PROPERTIES OVER THE SOUTHEAST PACIFIC
Data

2000-2008 time average sea level pressure (SLP)

2000-2008 time average Droplet Concentration ($N_d$)

SLP, Stability, Winds, Temperature Advection

- NCEP Reanalysis
- 2.5° latitude x 2.5° longitude grid

$N_d$, Low Cloud Fraction, LWP

- MODIS (satellite) data
- 1° latitude x 1° longitude grid
EOF Analysis of SLP 2000-2008

EOF 1 explains 61 ± 6%

Temporal structure = Principal Component 1 = “Subtropical High Strength” index = SHS index

North et. al criteria -
\[ \Delta \lambda_i = \lambda_i \sqrt{2/N^*} \]

Power spectrum of PC1

= 99% significant above red noise

\[ \text{Power} \times \text{frequency} \]

\[ \text{Period} \]

\[ \alpha = 0.86583 \]
Subseasonalize variables

- Use butterworth high pass filter to remove periods > 31 days

Percent $\alpha$ power < 31 days
SHS index during VOCALS

Thomas Toniazzo’s regime

June 10, 2008
Oct 1
Oct 15
Oct 31
Nov 16
Nov 30
Composite SLP on SHS index

Composite Difference

SHS index

SLP > 0.5 std devs

magnitude of leading mode

Time (days)
Composite difference plots on SLP dominant mode of variability

Low-Cloud Fraction

Temp. Advection $\mathbf{\nabla} \cdot \mathbf{V} \mathbf{\nabla} \mathbf{SST}$

Vertical Wind 850 mb
Composite difference plots on SLP dominant mode of variability

Stability $\theta_{700\text{mb}} - \theta_{\text{sea level}}$

- Large scale response of small scale variables
- Stability composite difference plot not very similar to CF, large scale appears more similar to $N_{\text{eff}}$ and LWP
- LWP negatively correlated with $N_{\text{eff}}$?
Zoom back into Sc region: lag composites give more of the story
Example, CF composite difference on SHS index and lags
SHS index during VOCALS

Thomas Toniazzo’s regimes

CD = Campaign Day

Oct 1 Oct 15 Oct 31 Nov 16 Nov 30
CD 1 CD 15 CD 31 CD 47 CD 61

1 2 3

1.5 σ

-1.5 σ
Summary
• Cloud variables composited onto the SHS index show interesting regional patterns. There is some consistency with earlier work (stability, temperature advection), but others (e.g. Nd,LWP) are intriguing and need further study.
• In the REx study region, Nd and LWP are inversely correlated through meteorology
  \[\text{difficult to use meteorological variability to constrain the aerosol indirect effects with observations alone}\]
• During VOCALS the SHS index fits well with the synoptic regimes defined by Thomas Toniazzo.
• The SHS index during Oct-Nov tends to see less extremes than other seasons.