

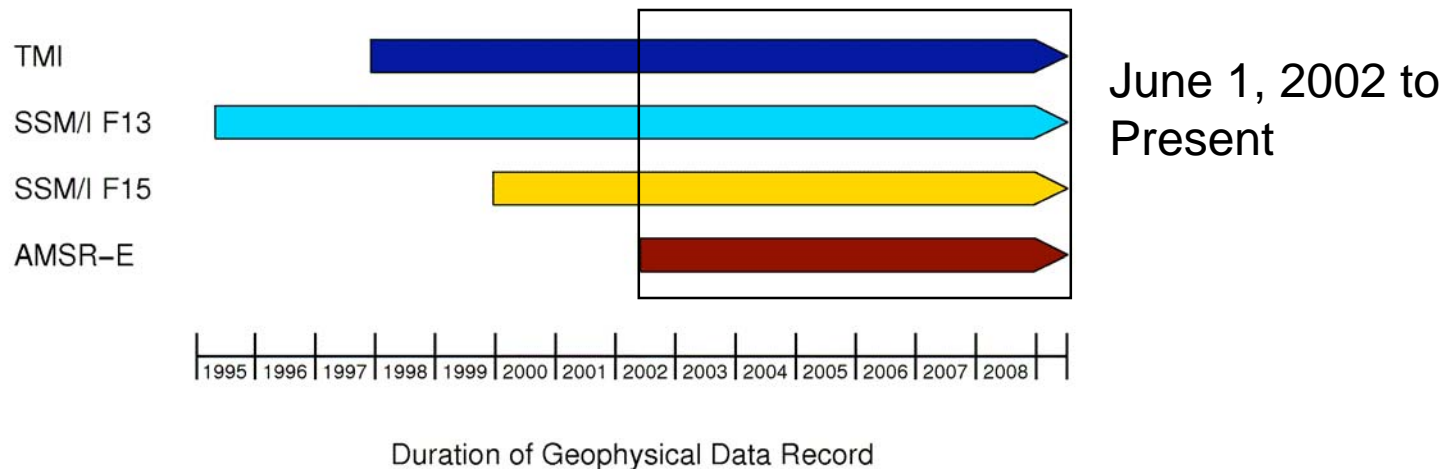
Seasonal Variability of the Diurnal Cycle of Cloud Liquid Water in the Southeast Subtropical Pacific

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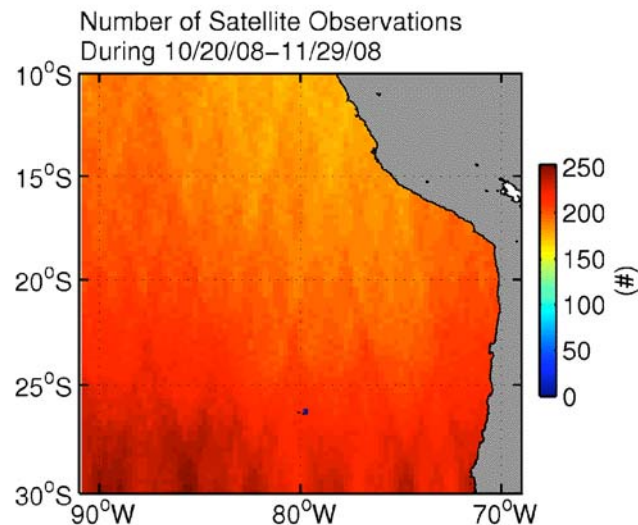
Motivation and Goals

- Diurnal pulsing is a major component of temporal cloud variability in the southeast subtropical Pacific
- Goal: Characterize year-to-year variability of cloud liquid water path (LWP) diurnal cycle
 - How representative are conditions during VOCALS-REx?
- LWP diurnal cycle amplitude and phase are computed from 6+ years of microwave satellite observations measured by 4 satellites:



Spatio-temporal sampling distribution during VOCALS-REx (10/20/2008 to 11/29/2008 = 41 days)

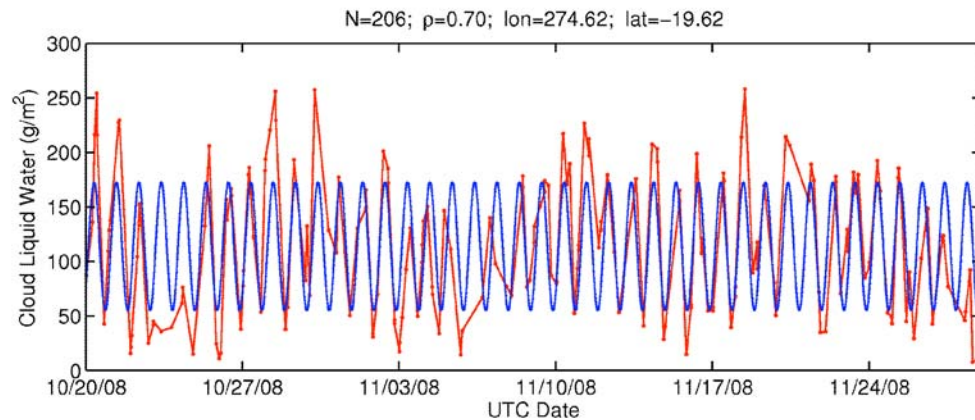
Distribution in space...



There are, on average, 4-7 observations per day at each 0.25° grid cell in this region from this 4 satellite combination

– Measurements distributed adequately in time to resolve diurnal variability

Computing LWP Diurnal Cycle



Example shown at the
WHOI Stratus buoy of
85W, 19.6S

Satellite obs shown in red

$$LWP = \beta_0 + \beta_1 \cos 2\pi f_0 t + \beta_2 \sin 2\pi f_0 t$$

$$Amplitude = (\beta_1^2 + \beta_2^2)^{1/2}$$

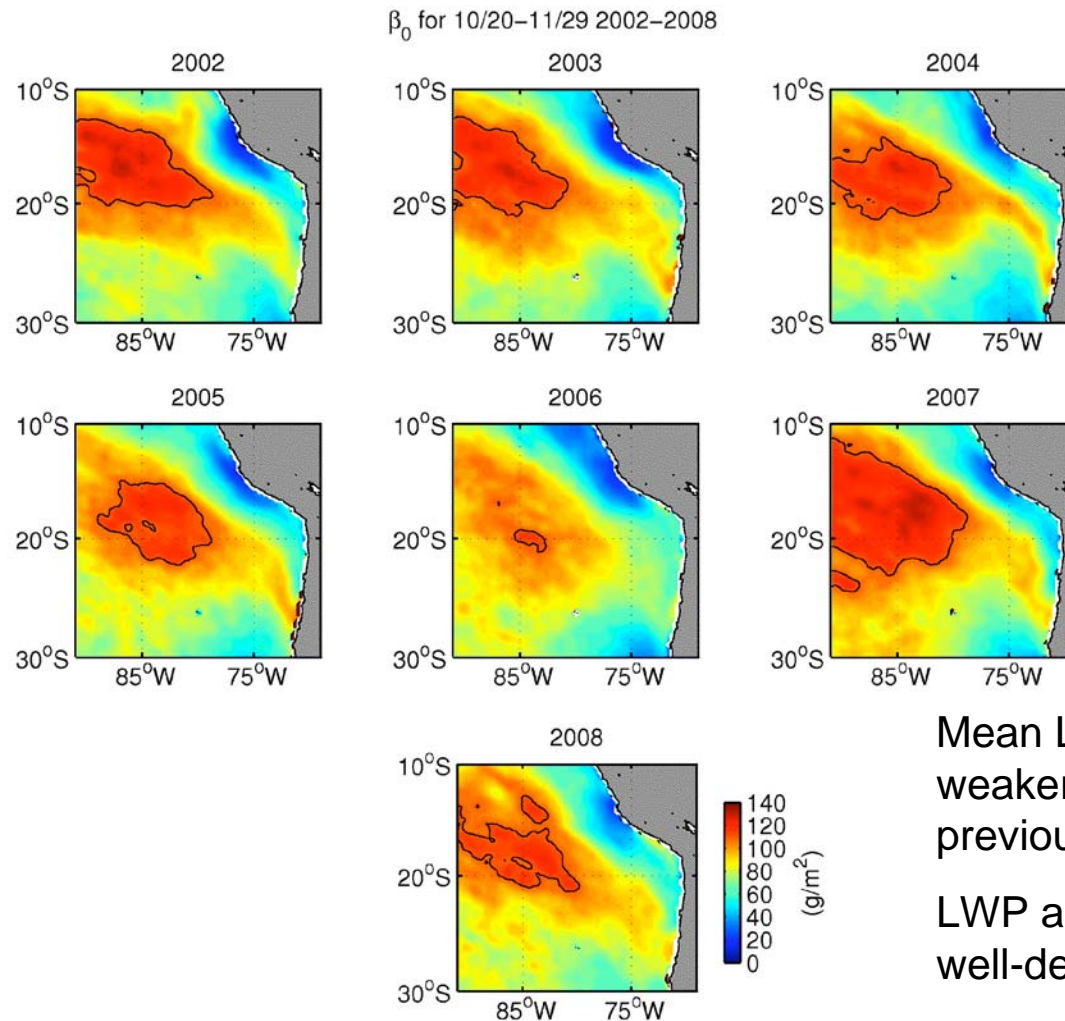
$$Phase = \tan^{-1} \frac{\beta_2}{\beta_1}$$

$$f_0 = 1 \text{ cycle per day}$$

LWP diurnal cycle during VOCALS-Rex

Cloud Liquid Water Diurnal Cycle Regression
VOCALS Period 10/20/2008–11/29/2008

Year-by-year comparison of β_0 computed for Oct. 20 to Nov. 29



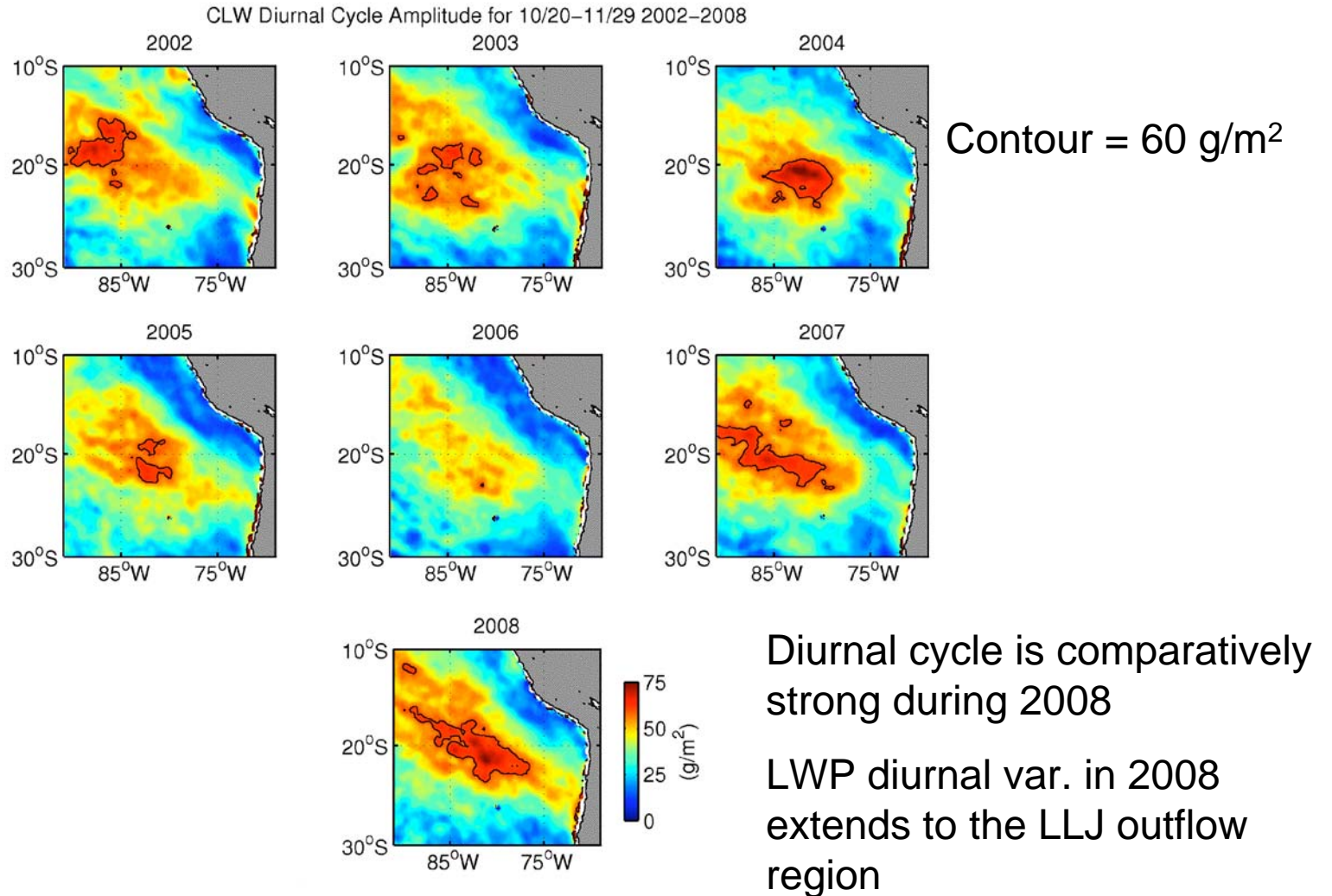
Contour = 110 g/m²

Mean LWP is somewhat weaker in 2008 compared to previous years

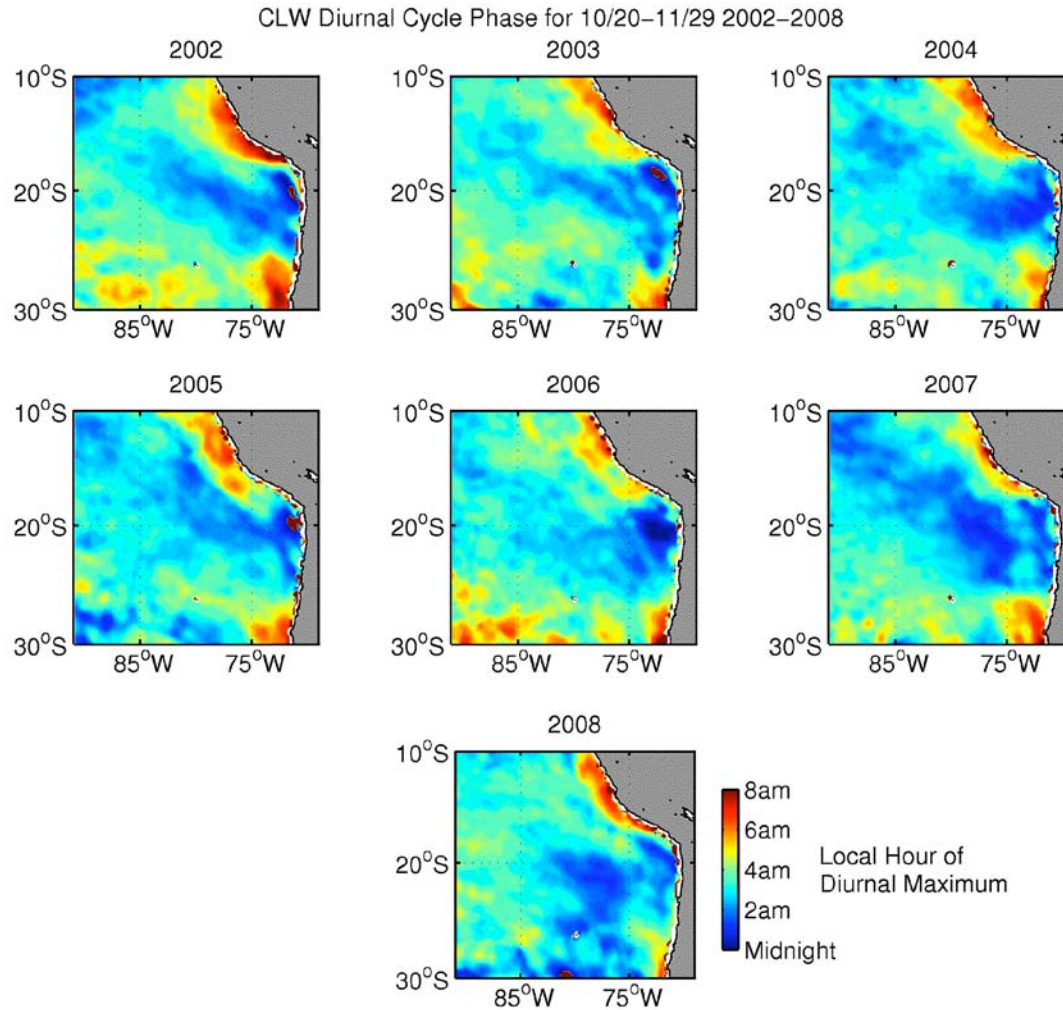
LWP associated with LLJ less well-defined

2006 is much different than other years

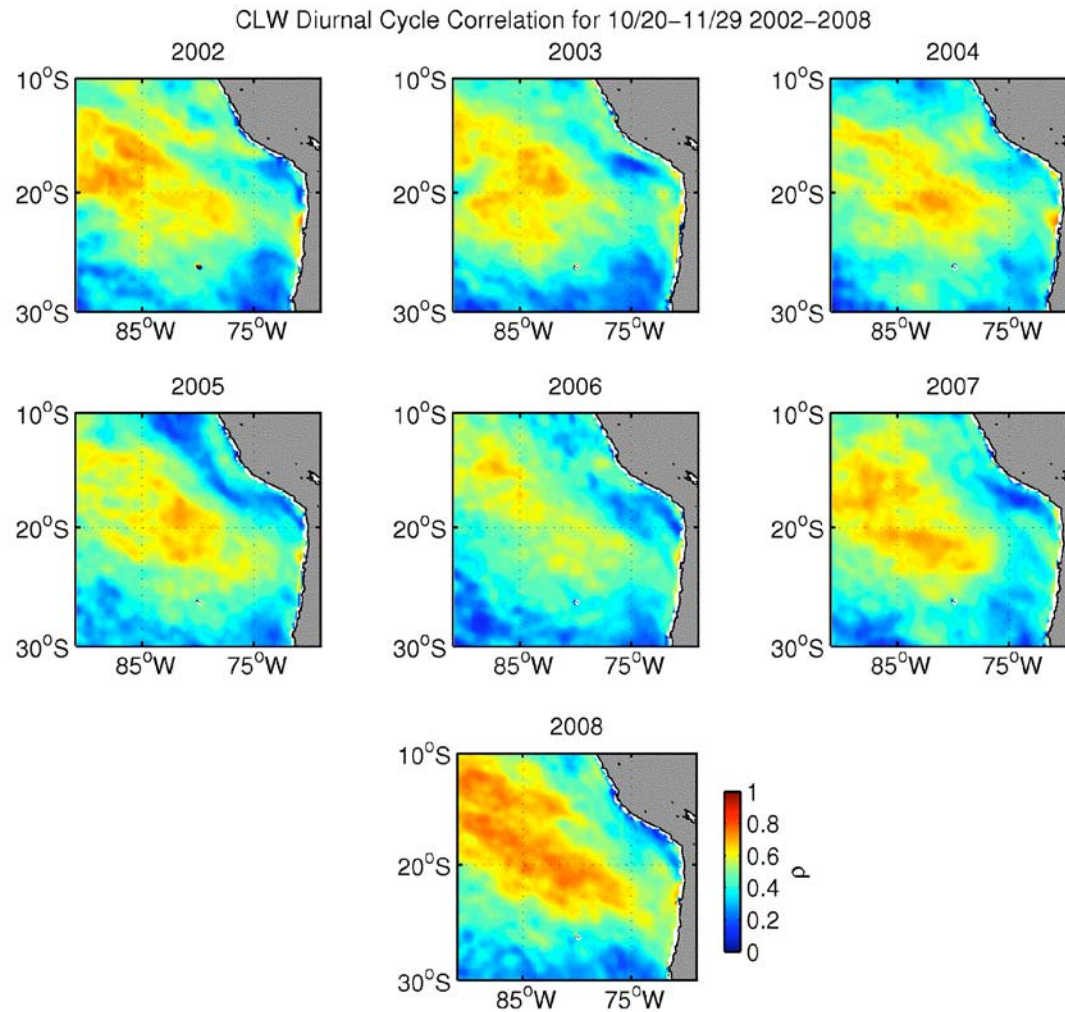
Year-by-year comparison of LWP diurnal amplitude computed for Oct. 20 to Nov. 29



Year-by-year comparison of LWP diurnal cycle phase computed over Oct. 20 to Nov. 29

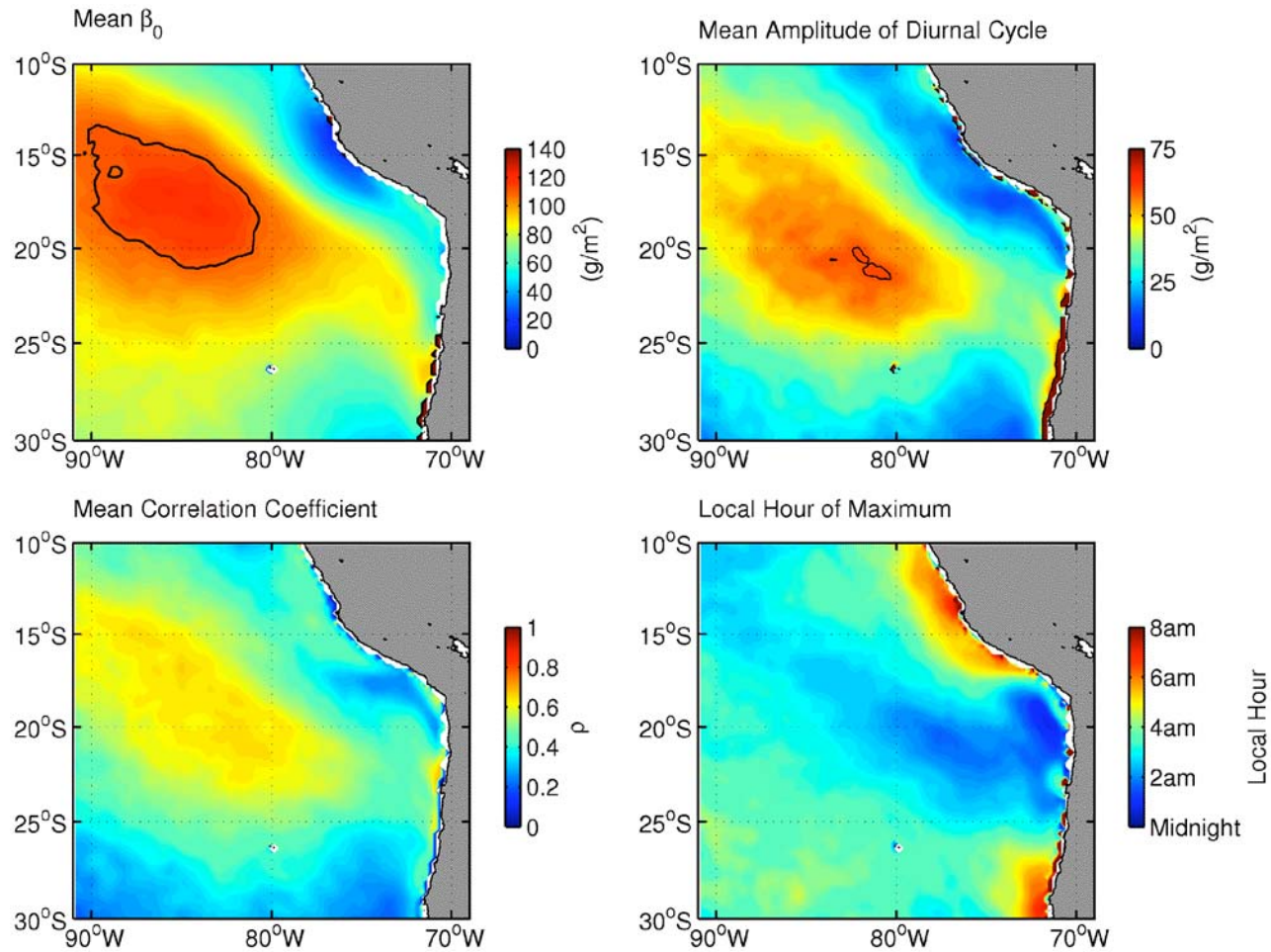


Year-by-year comparison of LWP diurnal cycle correlation coefficient computed over Oct. 20 to Nov. 29



CLW diurnal cycle during 2002-2008 computed for 10/20 to 11/29

Cloud Liquid Water Diurnal Cycle Regression
Averaged over 10/20–11/29 2002–2008

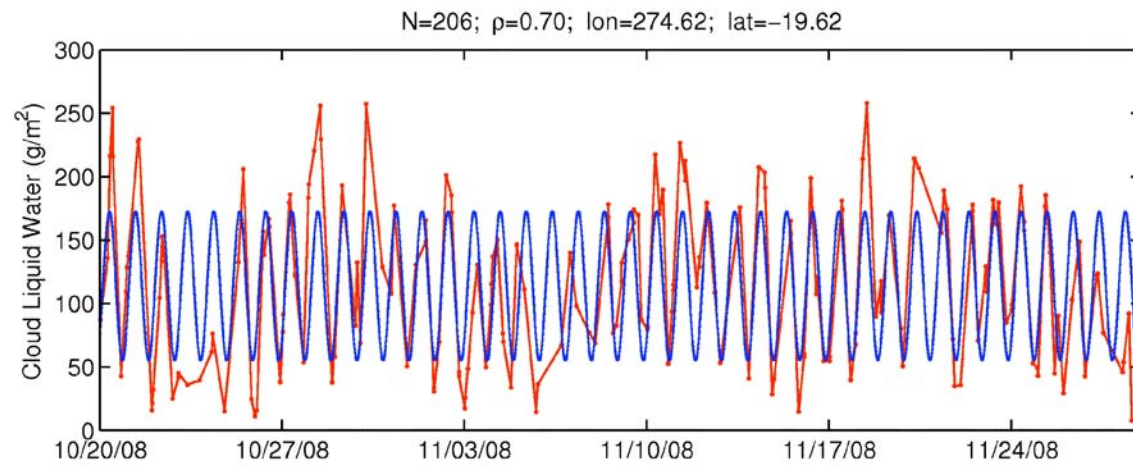
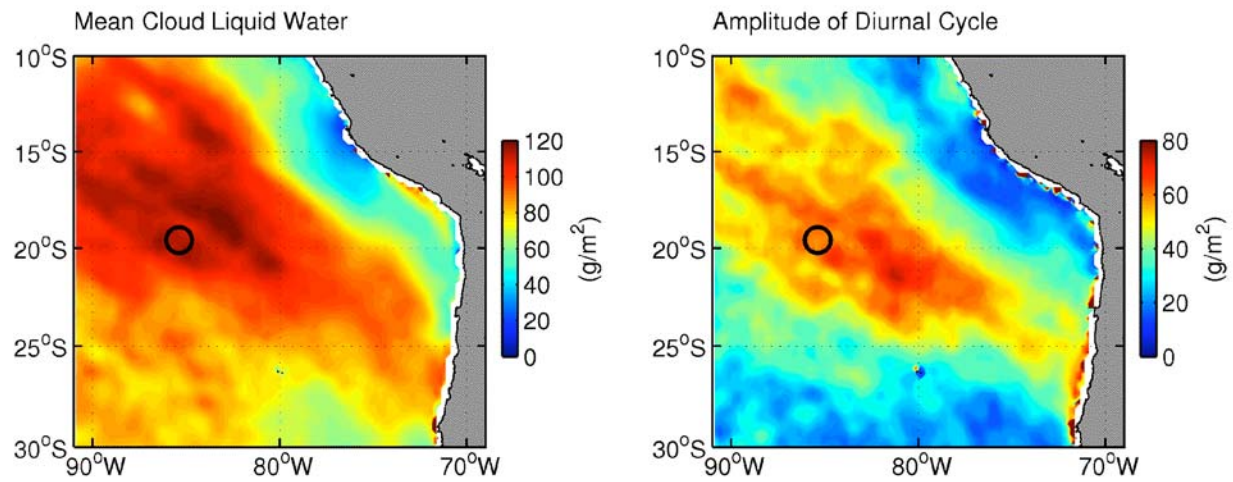


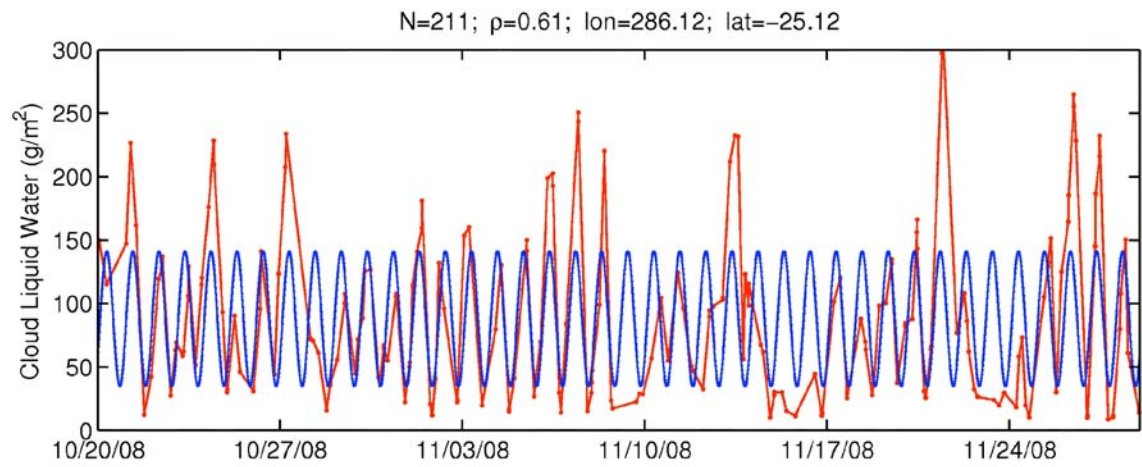
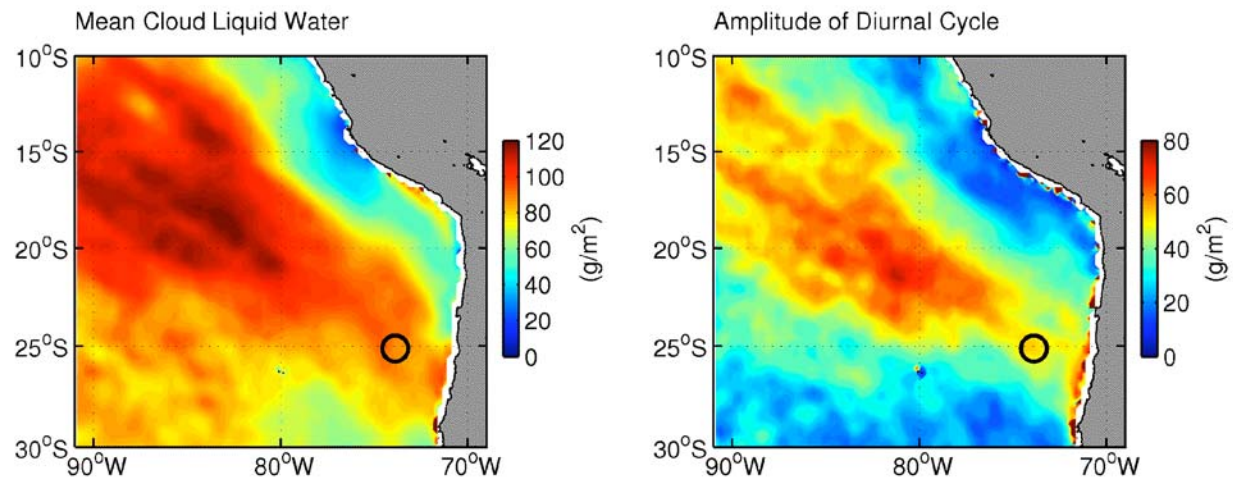
Conclusions so far...

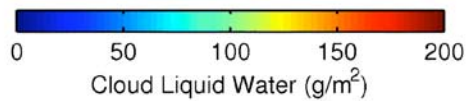
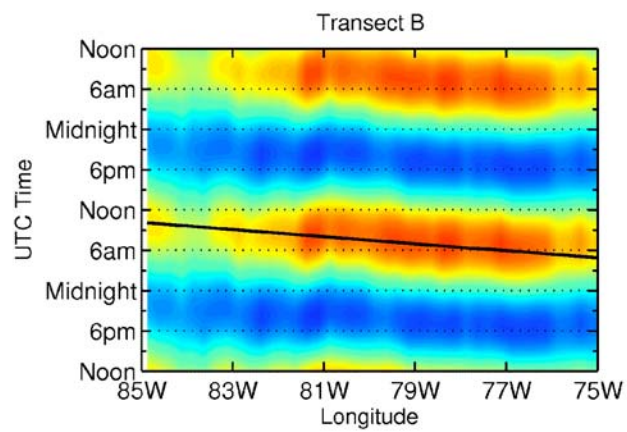
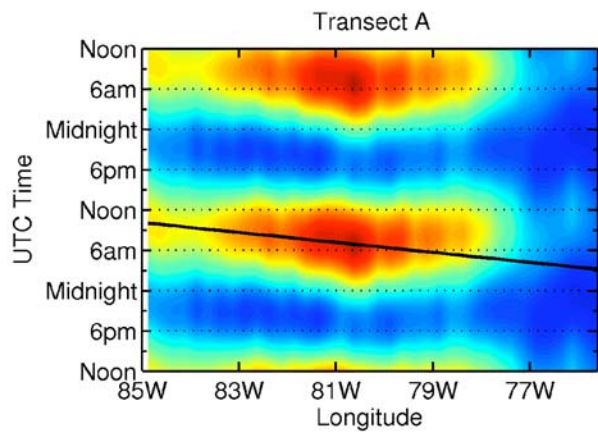
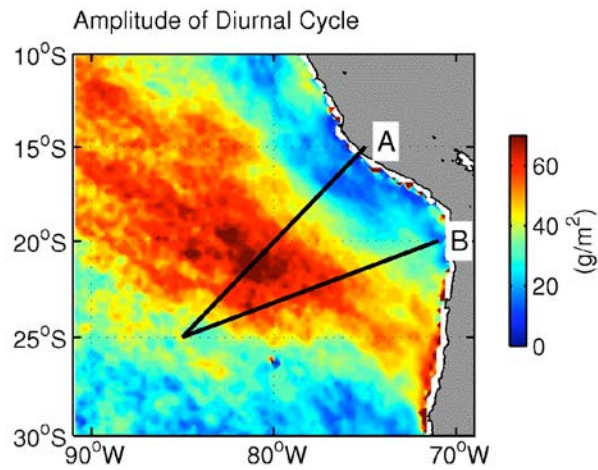
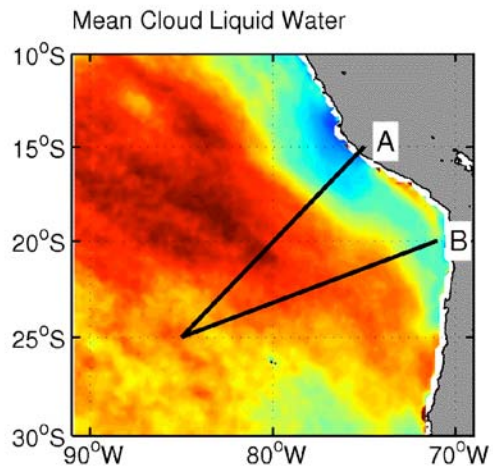
- Large scale patterns of LWP diurnal variability similar between years for study period (Oct. 20 to Nov. 29)
- Differences in mean LWP and diurnal amplitude
 - LWP diurnal cycle amplitude in 2008 is comparatively larger even while mean LWP field is weaker
 - LWP diurnal cycle composes more of LWP temporal variance during 2008
- 2006 is an anomalous year – much weaker LWP diurnal cycle and smaller mean LWP field

Current and future work

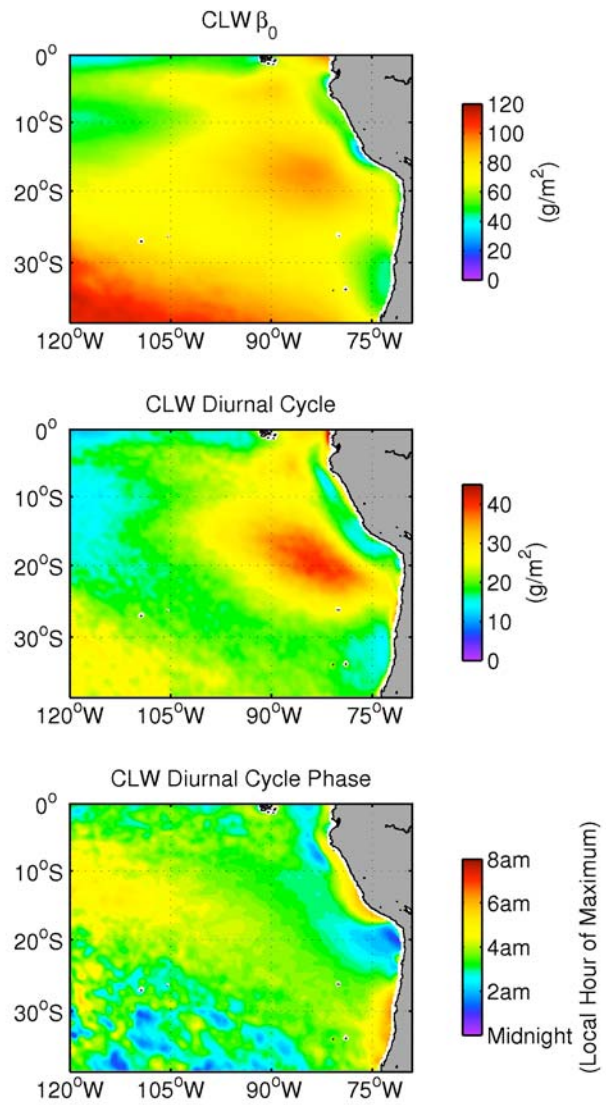
- Evaluation of COAMPS CLW forecasts
- Diagnosing mechanisms for interannual variability of CLW diurnal pulsing
- This analysis has been repeated for the 10-m wind speed
- More quantitative assessment of diurnal cycle amplitudes and phases using complex EOF analysis completed

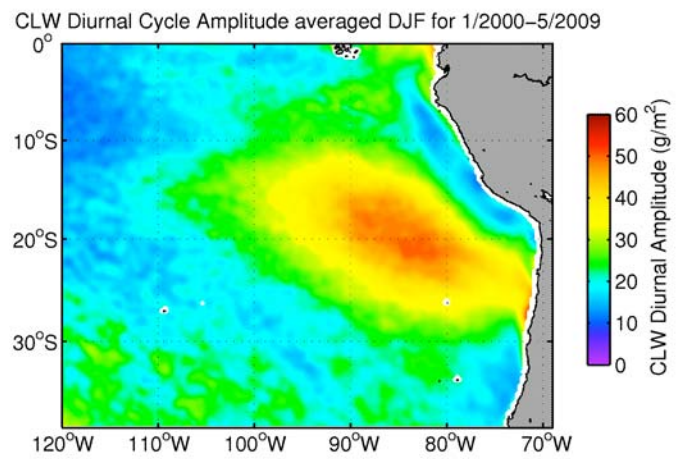
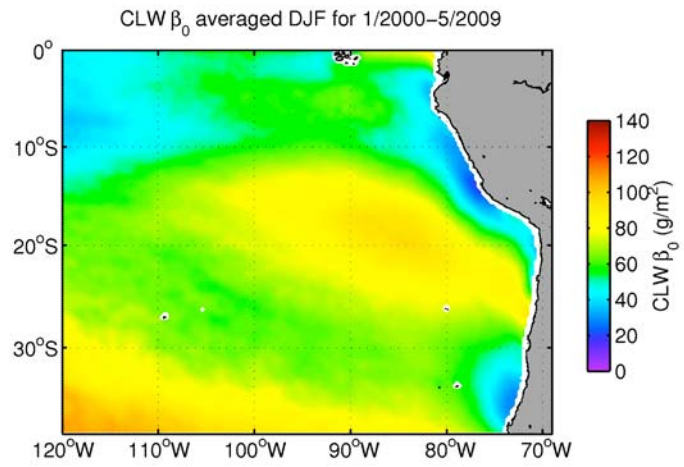






Averaged for 1/2000–5/2009





Cloud Liquid Water Diurnal Cycle Regression
Averaged Nov 2000–2008

