Summary of Science Thoughts for Possible Future NASA Mission 2
• Decadal and longer climate variability
• Diurnal and sub-diurnal variability and constellation cross-calibration
• Synergy with other measurements
Importance of OVW for Climate Studies

- Ocean Vector Winds (OVW) are recognized by the Global Climate Observing System (GCOS) as an essential climate variable, and monitoring decadal trends will yield important information about the mechanisms underlying climate change.

- In order to meet the GCOS requirements and to be able to identify trends, consistent, cross-calibrated time series of Ocean Vector Winds are required that can capture the observed and expected trends in Ocean Vector Winds.
The challenge of climate observations resides in having consistent observations without global drifts over periods of decades. Observations show regional variations $< 1\text{m/s/decade}$.
Wind-SST interactions over warm ocean

SST anomaly (colors) and SSM/I wind stress anomalies (vectors) for August 1997. Picaut et al. (2002, JGR)

Surface vector wind

Convection

Ocean processes

SST

Observed with combined scatterometer & AMSR
Climate Change: Surface wind (1950-2008)

ICOADS (uncorrected)  Intensification of trade winds

WASWind (corrected)  Weakening of Western Pacific trade winds

Importance of diurnal ocean-atmosphere coupling to tropical climate

- Various coupled model studies contrasting daily coupling and diurnal coupling (every 1-3 hours) suggest that diurnal air-sea interaction affects
  - mean state,
  - seasonal cycle,
  - interannual variability,
  - intraseasonal variability.

- Diurnal measurements are sparse, esp. coincident measurements of atmospheric and oceanic variables. Coincident satellite measurement of OVW and SST would improve the understanding and prediction of tropical climate variability and change, e.g., by evaluating, constraining, and improving climate models.
Importance of the sub-daily forcing for mid-latitude oceans

- Mid-latitude inertial oscillation in the ocean have sub-daily/diurnal frequencies.
- These oscillations provide a major mechanism of upper-layer mixing.
- Diurnal forcing is thus important to mid-latitude ocean.
Enhancement of variability due to increased (sub-daily) sampling
• Impact on SST is significantly larger than SST error.
• Impact with scat. wind is substantially larger than that with NCEP wind.
• Consistent with larger increase of scat. wind variability due to twice-daily sampling (previous slide).
The TropSat Mission:
An Observatory for Mesoscale Convective System Processes in the Global Tropics

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19 Nov. 2008
The Mesoscale Convective System (MCS) life cycle

precursor disturbances

formation ← several hours → maturity → decay

successor disturbances

Major processes (expressed as GCM parts & parameterizations):

- dynamics, PBL
- PBL, shallow cumulus
- PBL, cumulus, stratiform cloud
- stratiform cloud & precip

Key variables measured by TropSat:

- SST, $\nabla^2$SST
- $\nabla \cdot V_{\text{sfc}}$, inflows, gravity waves
- $\nabla \times V_{\text{sfc}}$, Ekman pumping
- $\nabla \cdot V_{\text{sfc}}$, column vapor, cloud top, rainrate & rainwater
- preconditioning and triggering
- net latent heating, momentum effects
- production of atm & ocean cold pools

SST, $\nabla^2$SST
- rain, flux effects
- $\nabla \cdot V_{\text{sfc}}$, outflows, gravity waves
- $\nabla \times V_{\text{sfc}}$, cyclogenesis, planetary waves
QuikSCAT U Component
Morning Evening Differences
Ascat V Component
Morning-Evening Differences
QuikSCAT V Component
Morning-Evening Differences
QuikSCAT vs ASCAT
U component
Rain effects in QuikSCAT?
Rain impacts U components more strongly
QuikSCAT vs ASCAT
V component
Zonally Averaged Differences

Zonally Averaged Biases

Bias (m/s)

Latitude (deg)

U bias

V bias
Why is this important?
Stress multiplies the biases