SeaGlider observations of temperature and salinity in diurnal to intraseasonal timescales during DYNAMO.

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Support

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- ONR

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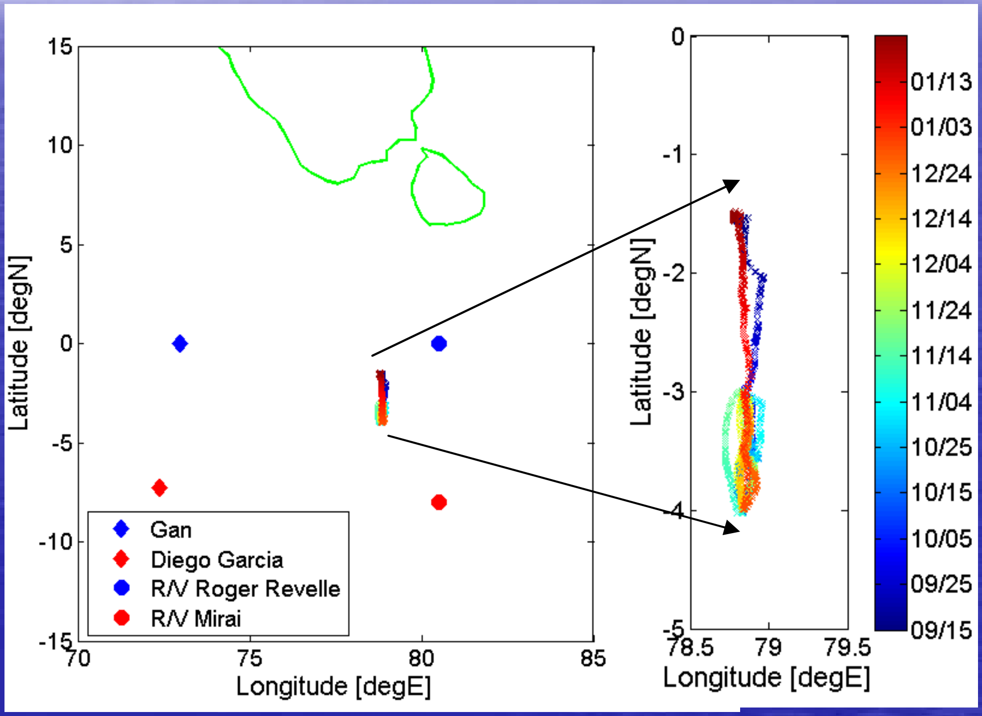
Plan and goals

- Better understanding of air-sea interactions on diurnal to intraseasonal timescales
- SeaGlider observations
  - Unique long term high resolution observations of upper ocean up to 0.5m
- This allows to study intraseasonal (MJO phase related) variations of the diurnal cycle of the upper ocean

UEA Sea Glider

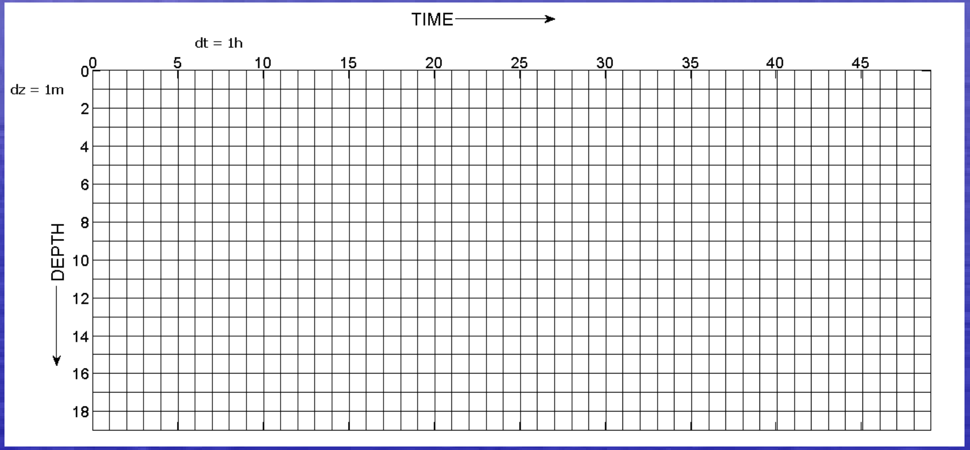
- Deployed on September 14, 2011
- Recovered on January 23, 2012
- 737 dives – 1474 vertical profiles
- On station from Oct 1 to Jan 8
  - 3-4S, 78.8E
  - 10 horizontal sections



Local Time = UTC + 5
Local Noon = 7 UTC

UEA SeaGlider data

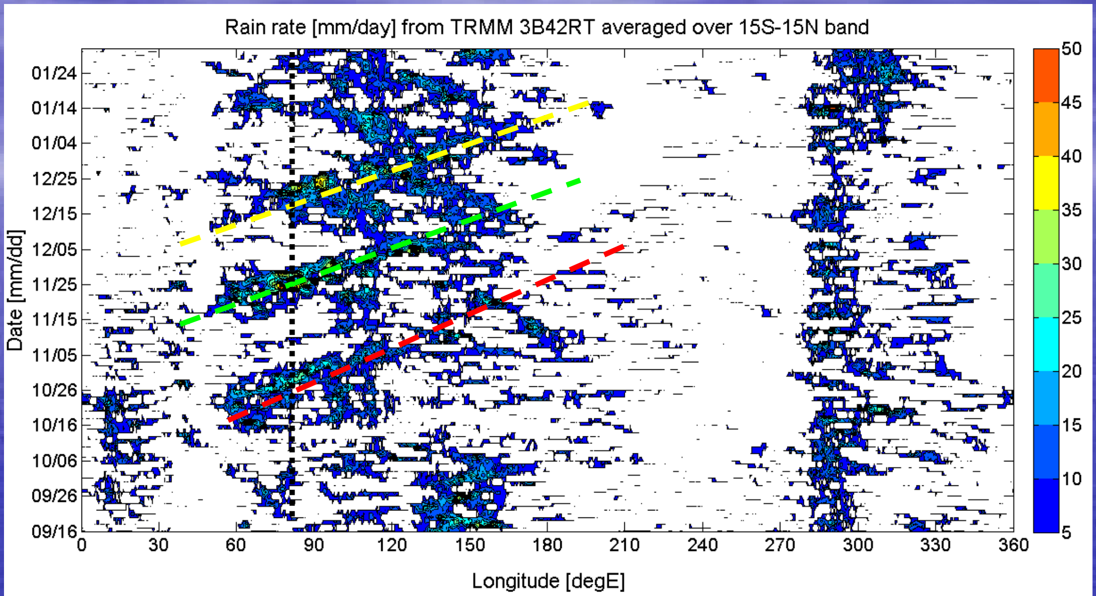
- Original data: 10-14 profiles a day
  - Ascenting profiles with data up to 0.5m
  - Distance travelled ~20km/day
- Quality Control
- Optimal Interpolation
  - High temporal and vertical resolution: 1h and 1m
  - Dataset preperad for diurnal cycle analysis



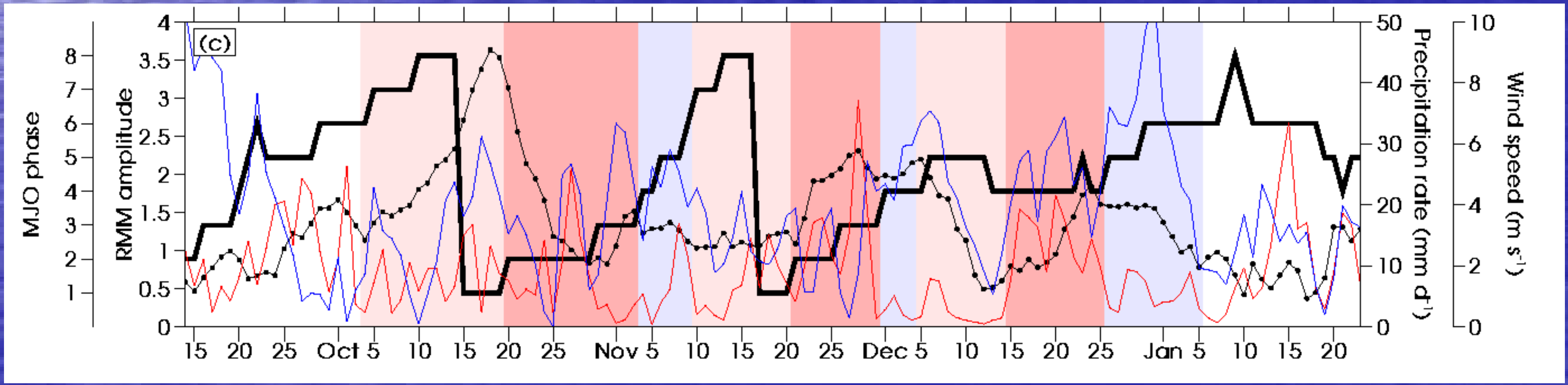
MJO events during DYNAMO

- 3 MJO at the UEA SeaGlider location

- Selection of onset, active and decay phases for diurnal cycle comparison in various phases



Onset Active Decay

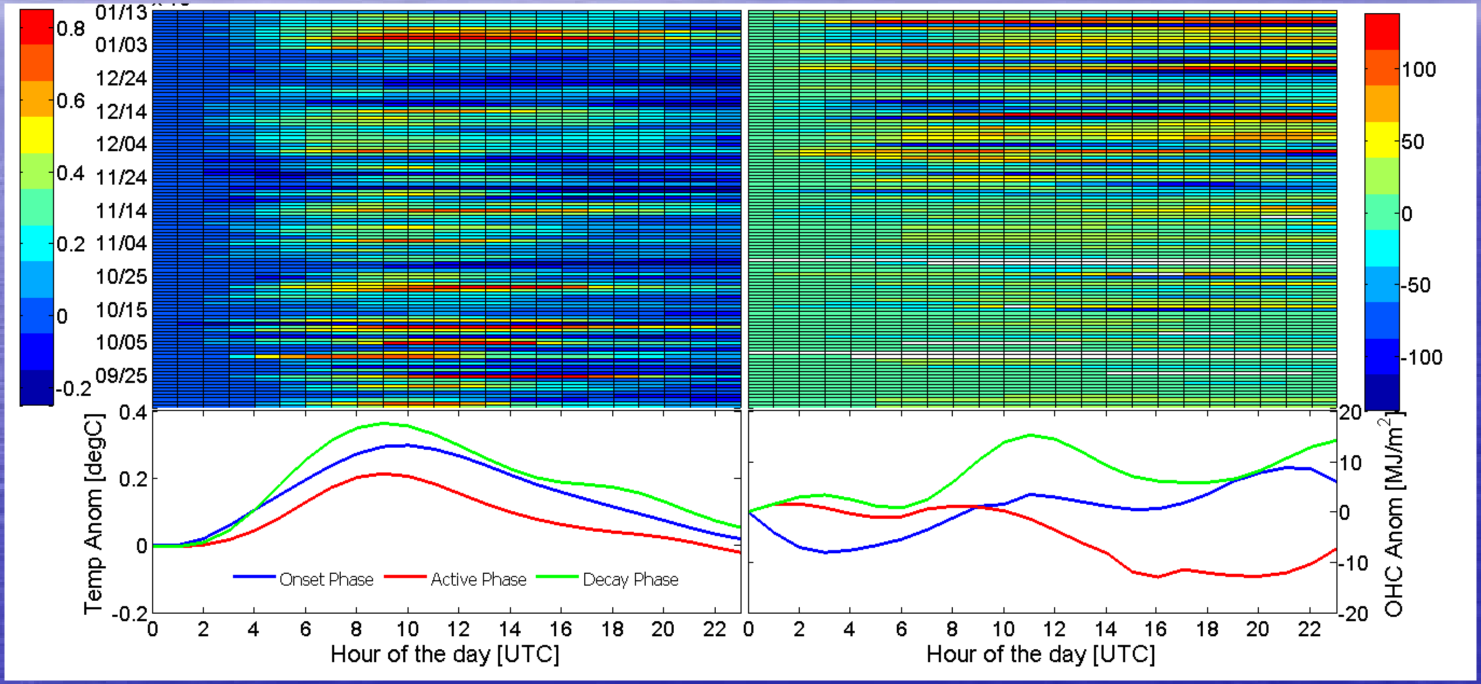


Temperature and OHC variation

- Temperature at the end of the day roughly the same as in the beginning
- Magnitude of temperature anomaly depends on the MJO phase
- OHC change depends on the MJO phase
  - Charge
  - Discharge
  - Recharge

Local Time = UTC + 5
Local Noon = 7 UTC

Diurnal temperature anomaly at 1m | Diurnal OHC anomaly down to 50m



$$Anom_{day}^{hour} = Var_{day}^{hour} - Var_{day}^{00UTC}$$

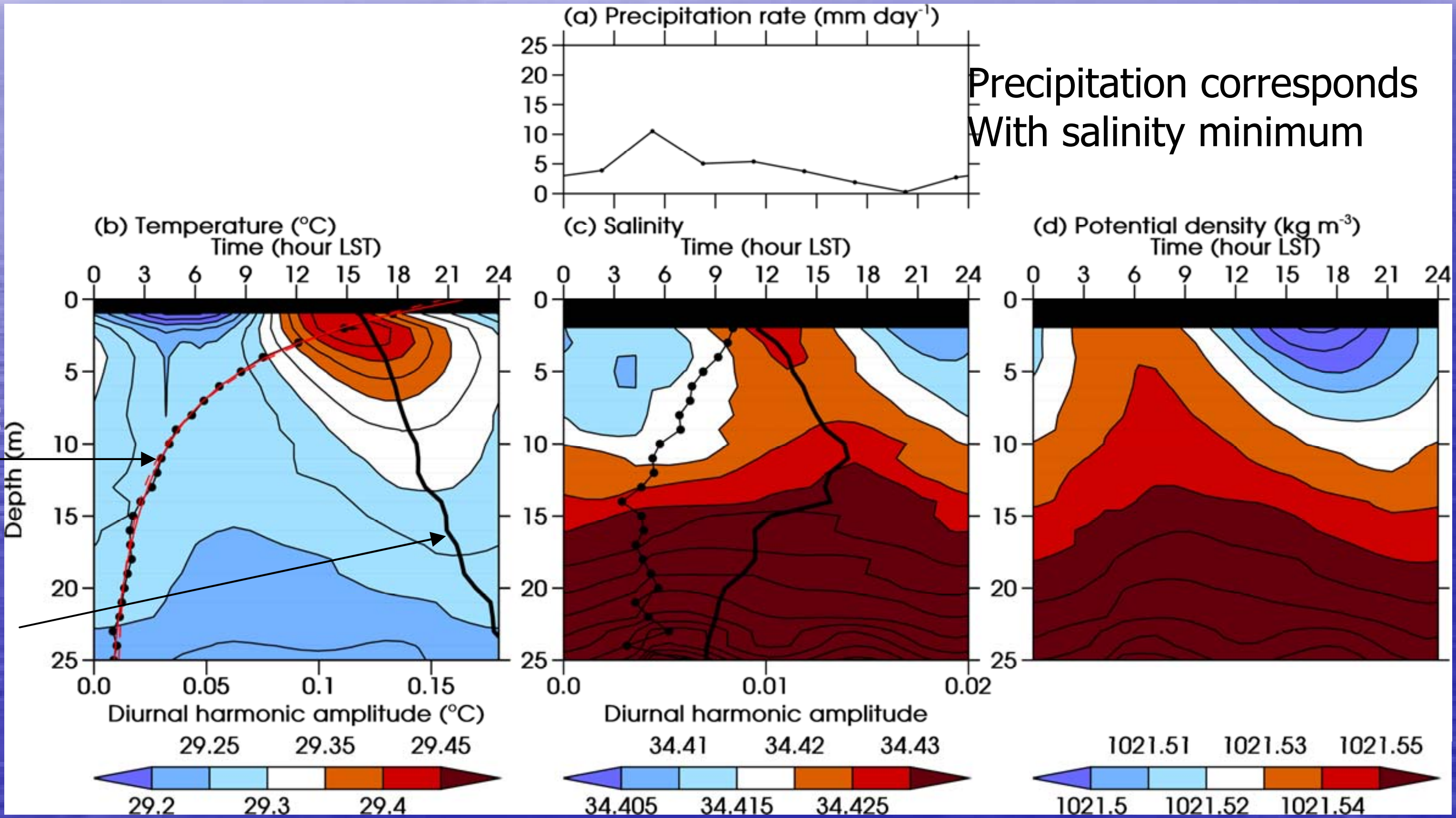
$$OHC = c_p \bar{\rho} \int_0^{50m} T dz$$

MJO onset phase upper ocean composite

- High gradient in the upper ocean
- Downward propagation

Diurnal harmonic Amplitude

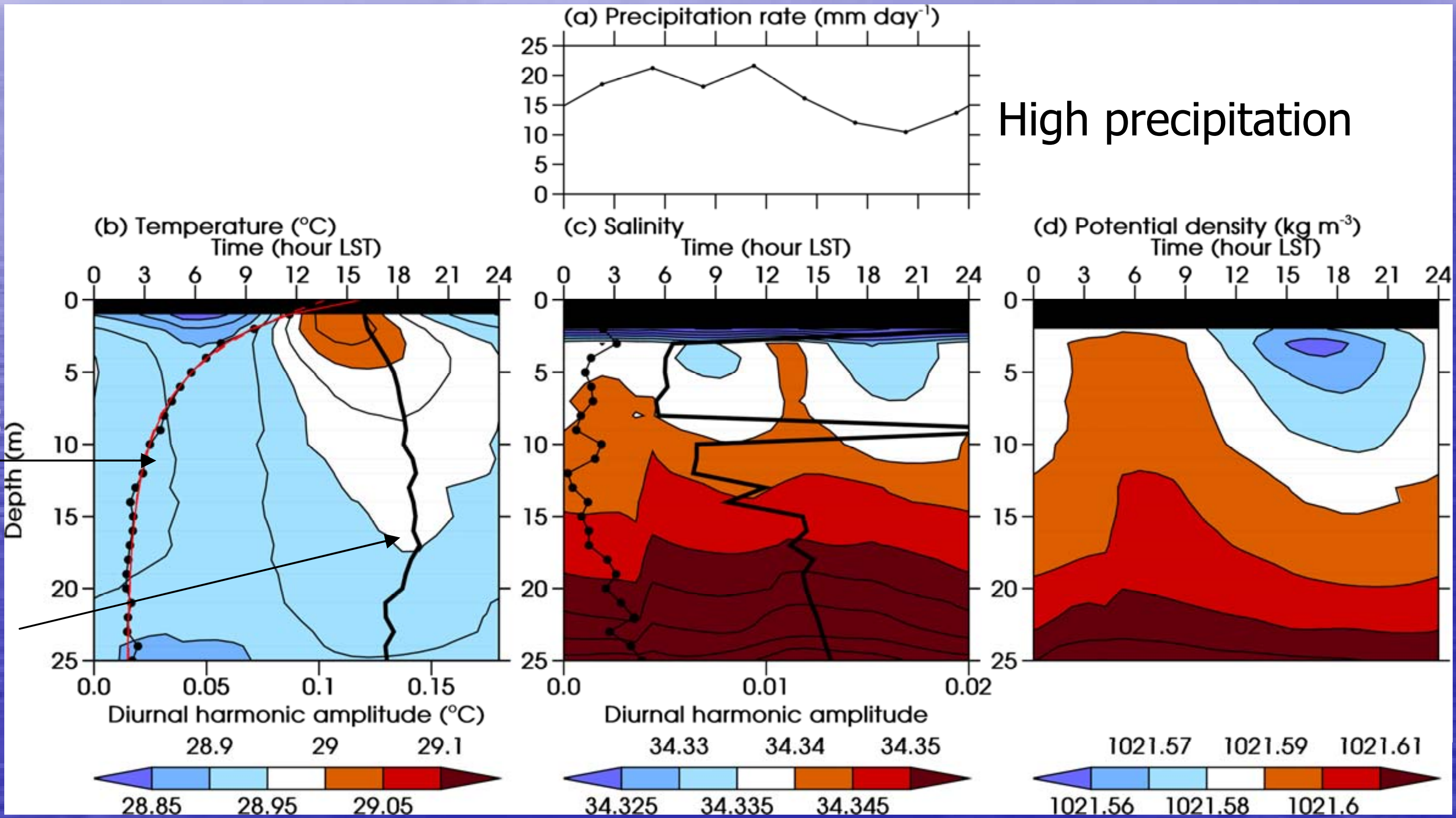
Diurnal harmonic Phase



MJO active phase upper ocean composite

Diurnal harmonic Amplitude

Diurnal harmonic Phase



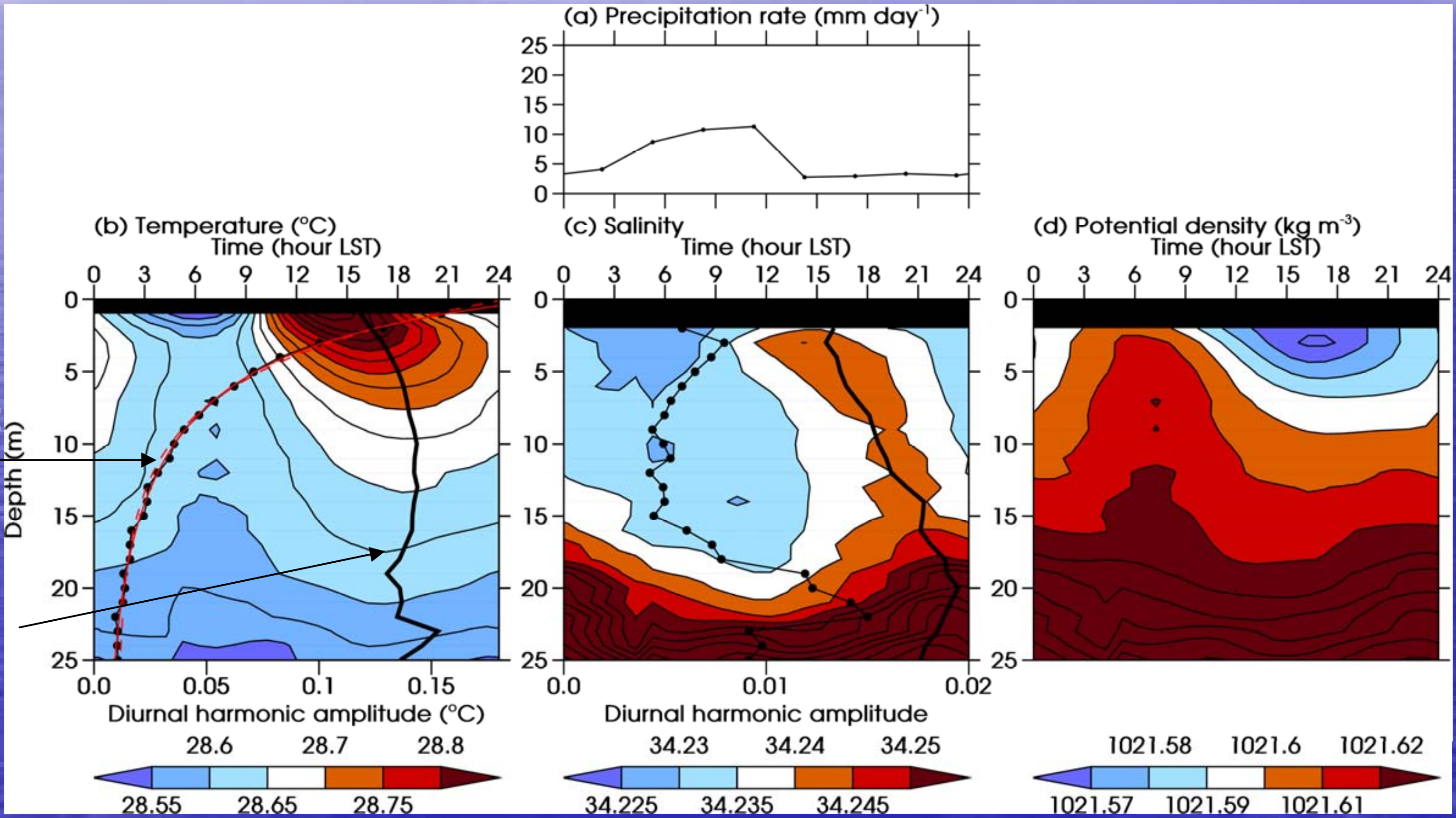
High precipitation

MJO decay phase upper ocean composite

- High gradient in the upper ocean
- Downward propagation

Diurnal harmonic Amplitude

Diurnal harmonic Phase



Conclusions

- Our results are important for understanding of air-sea interactions in intraseasonal timescales (charging, discharging and recharging mechanisms)
- Temperature at end of the day is roughly the same as the temperature at the beginning of the day
- OHC diurnal anomaly strongly depends on MJO phase. Charging observed during onset and decay phases, discharge visible during active phase.
- Diurnal temperature anomaly magnitude for decay phase is higher then for onset phase
- Onset temperature anomaly propagates downwards slowly. During active phase downward propagation is fast (wind induced mixing)
- Larger gradient of temperature anomaly during onset and decay phases then during active phase.
- Shallow convection and tropical waves preceed MJO and may contribute to smaller magnitude of diurnal anomaly
  - During onset phase major convection is on western IO, during decay phase it is located over Maritime Continent and WestPac

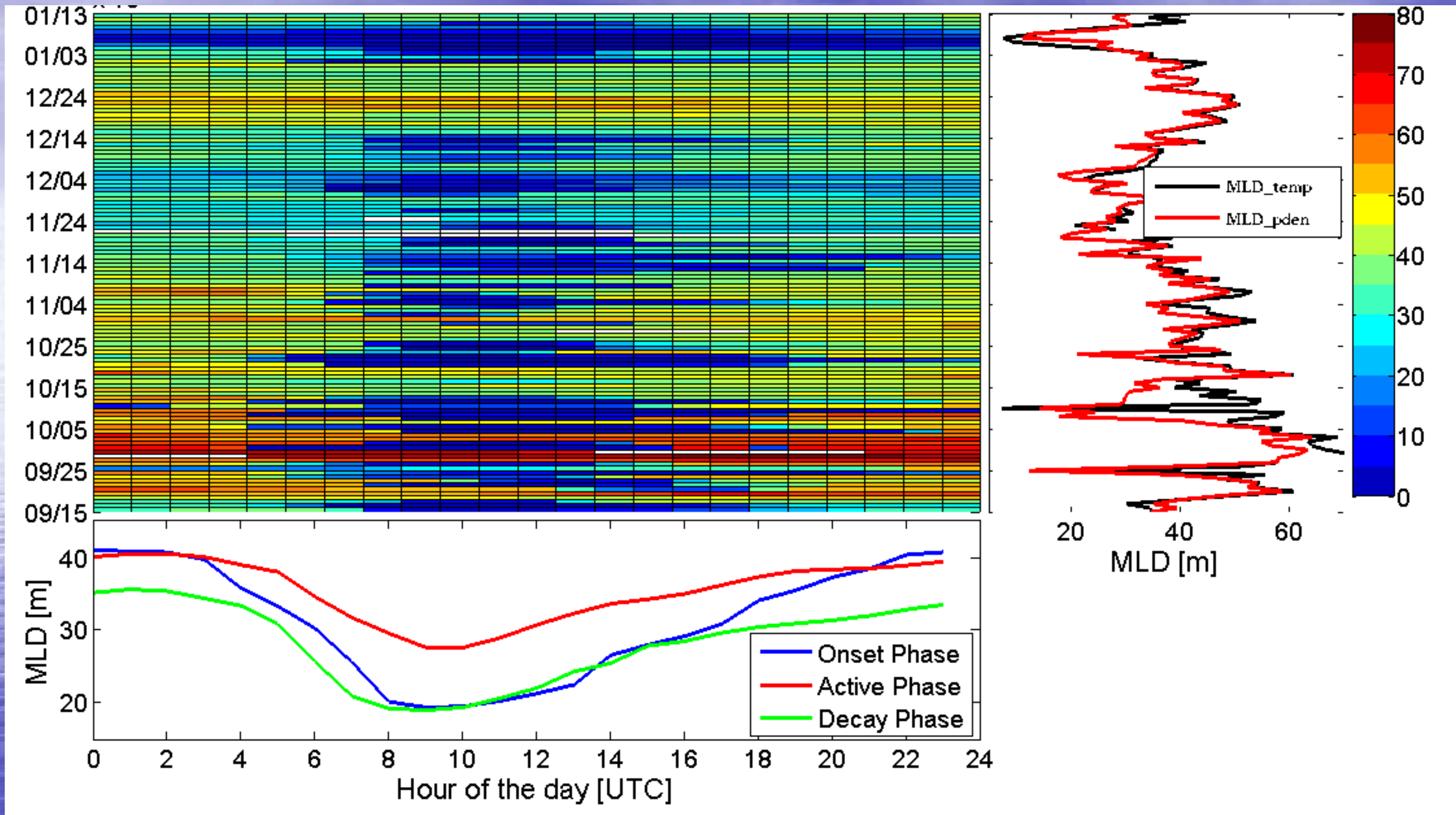
Plans

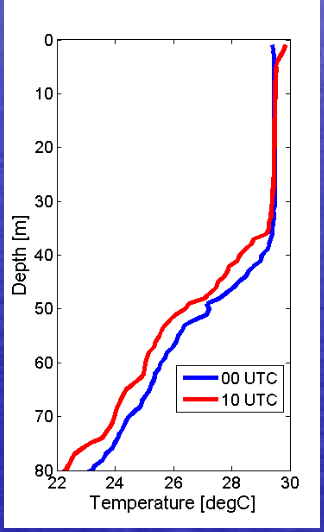
- Understanding of physical reasons for differences between phases (currents, fluxes,clouds)
- Studying possible implications for atmospheric convection

Webber et al *„Seaglider Observations of Equatorial Ocean Rossby Wave Interactions With the Madden-Julian Oscillation During CINDY-DYNAMO”* poster session A13A-0214

Thank you for your attention!

Diurnal MLD variability

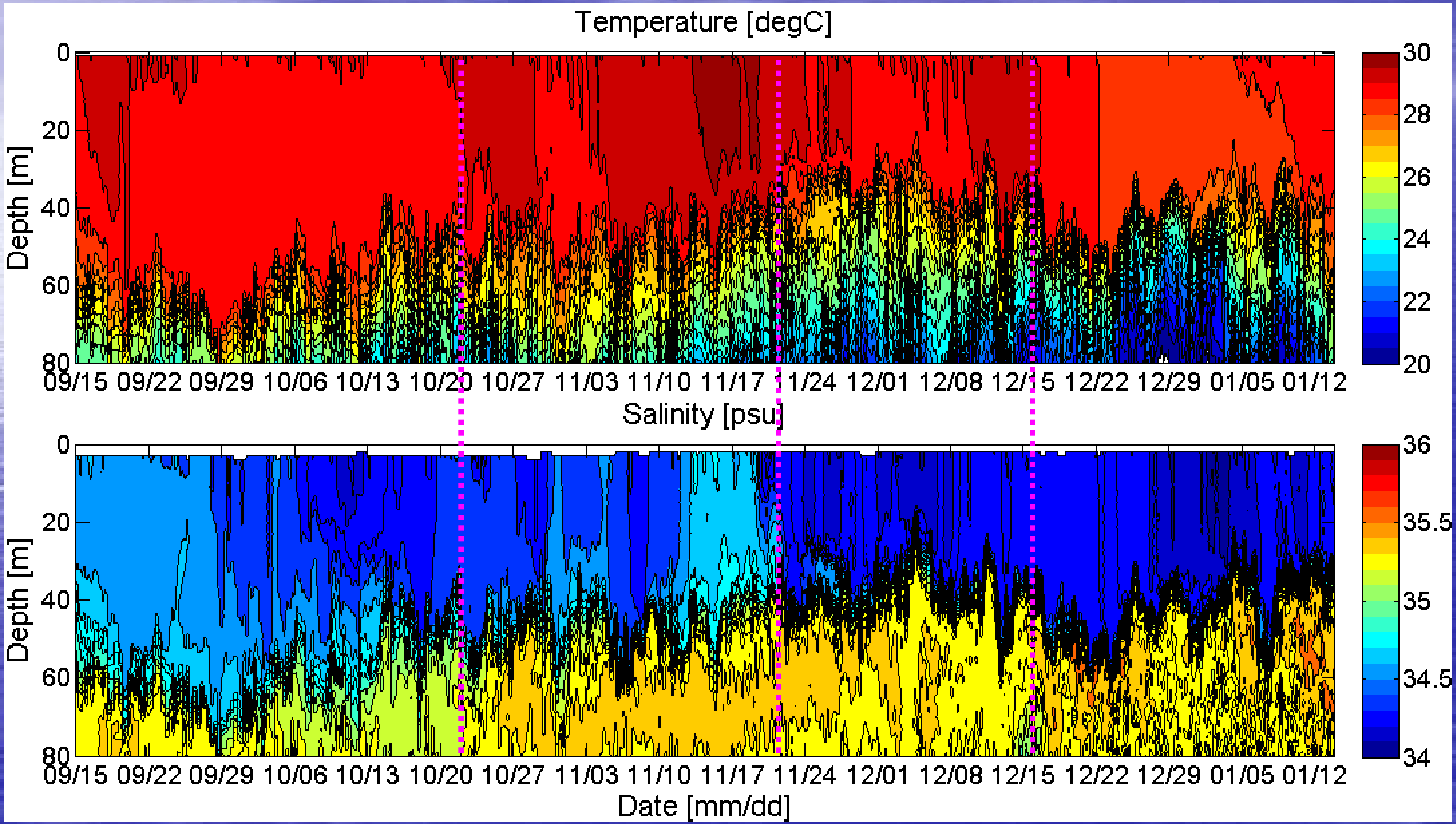




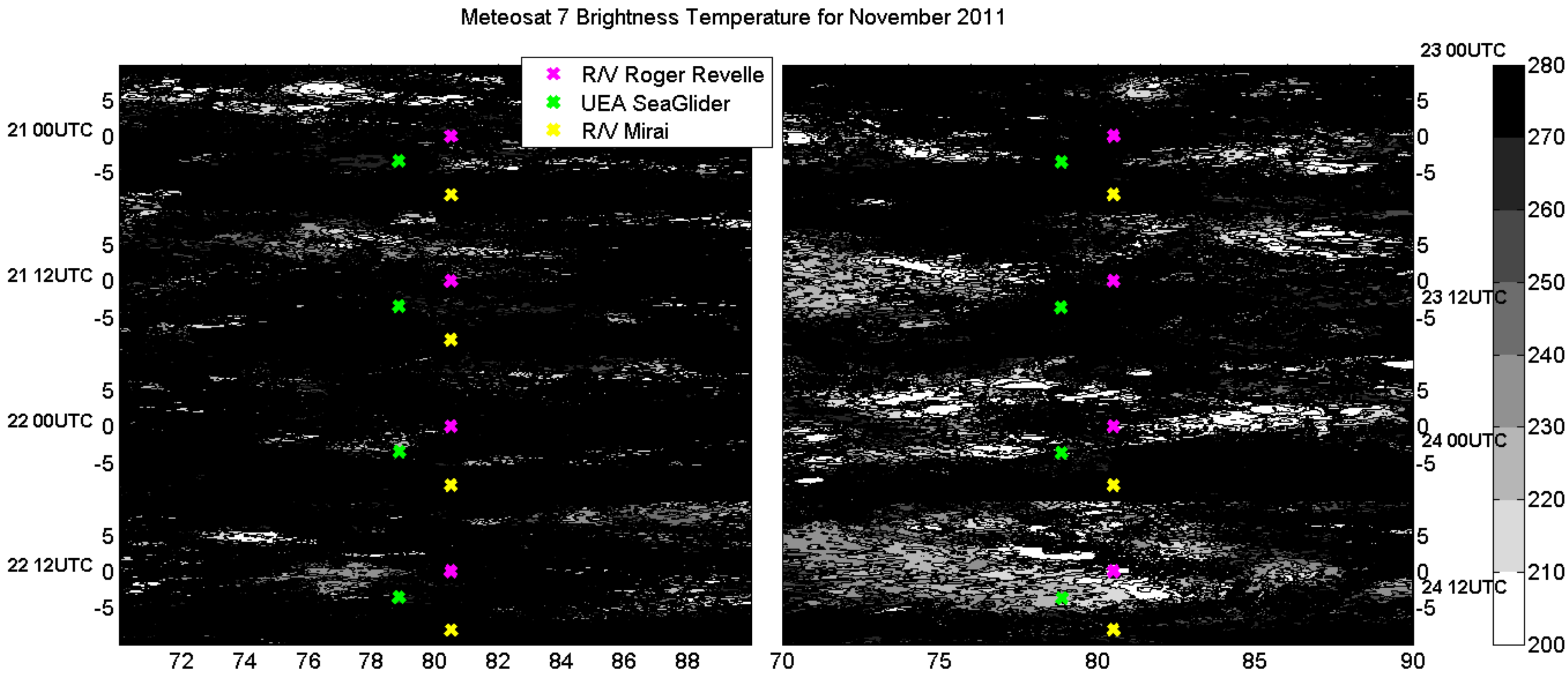
Temperature based MLD criteria: $\Delta T=0.2°C$, $D_{ref} = 1m$

Density based MLD criteria: $\Delta\sigma_t=0.125kg/m^3$, $D_{ref} = 2m$

Temperature and Salinity observations



November MJO case study



UEA SeaGlider observations of November MJO