Tropical DISGO: Tropical Diurnal and Intraseasonal Variability: SeaGliders in the Indian Ocean

UK component of CINDY2011

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Diurnal cycle in the MJO

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- Strong diurnal cycle of SST in suppressed phase of MJO
- Leads to diurnal cycle in depth of atmospheric boundary layer, and premoistening of troposphere prior to active MJO convection
- Resolving diurnal cycle in ocean model (need $\Delta z \sim 1$ m) leads to larger amplitude intraseasonal SST anomalies and more accurate simulation of MJO (Bernie et al., 2005, 2007, 2008)
- Diurnal cycle strongly dependent on fine vertical structure of ocean

Ocean teleconnection feedback mechanism for MJO

Triggering the next-but-one MJO

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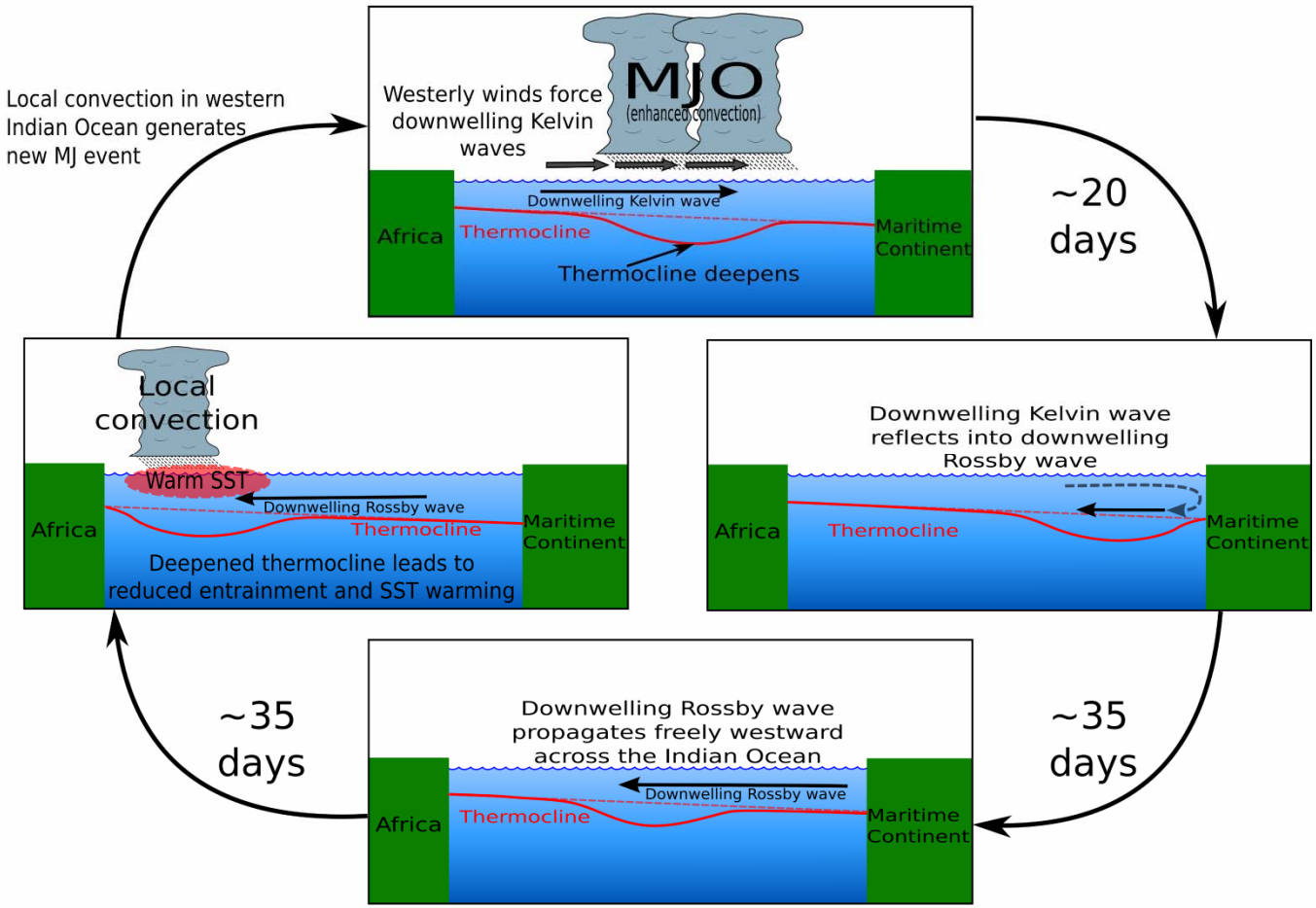

In situ measurements in Indian Ocean

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- Very few
- Not enough to resolve diurnal cycle or detailed structure of equatorial waves during MJO
- Need high temporal and spatial resolution measurements of ocean temperature and salinity
- Co-located with high density of atmospheric measurements

Seagliders

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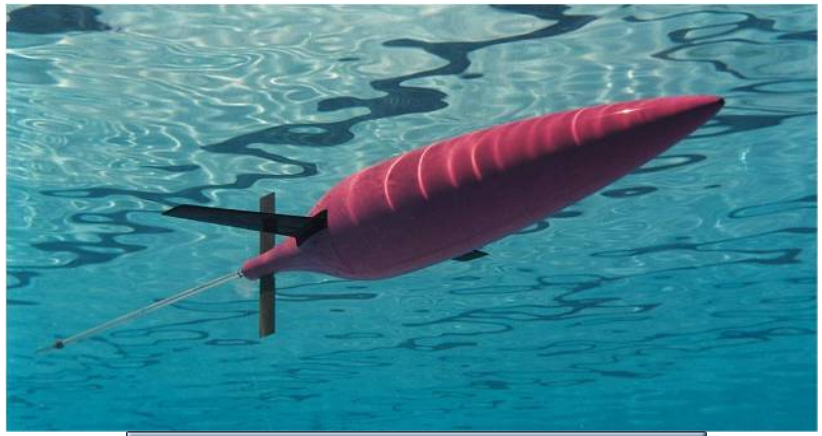
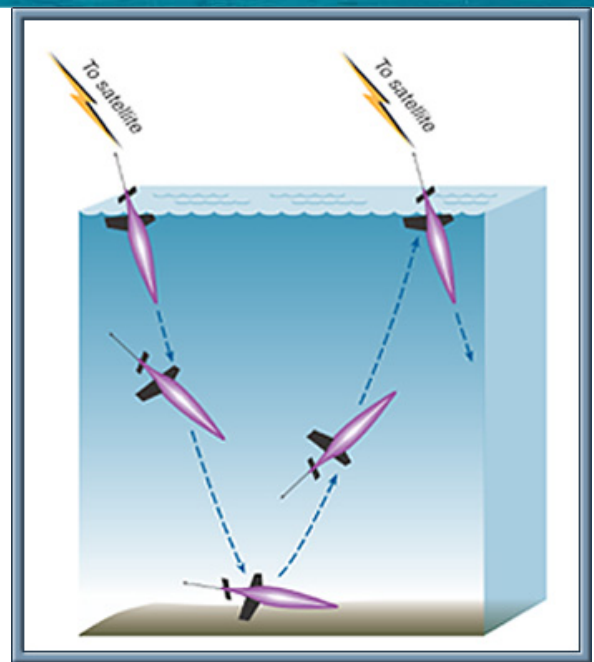
- Autonomous underwater vehicles
- No propellor
- Oil-filled bladder controls buoyancy
- Shifting internal ballast (battery) controls pitch and roll
- On surface, sends data and receives new instructions through Iridium satellite phone network
- Real-time upload to GTS
- Speed 0.25 m s^{-1} (20 km day^{-1})
- Maximum depth 1000 m
- Temperature, salinity, chlorophyll, dissolved oxygen sensors
- Vertical resolution 0.25 m





Main observation locations for CINDY2011

Including 3 UEA Seagliders

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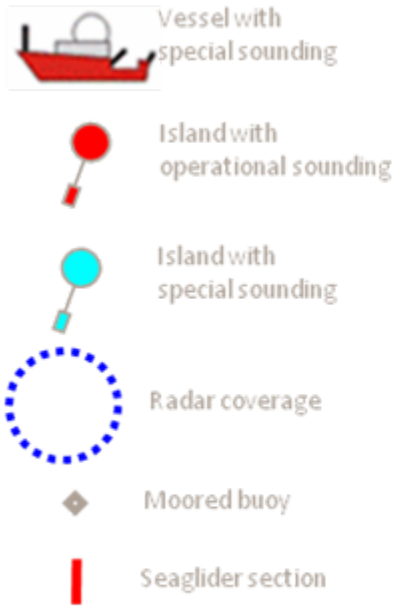
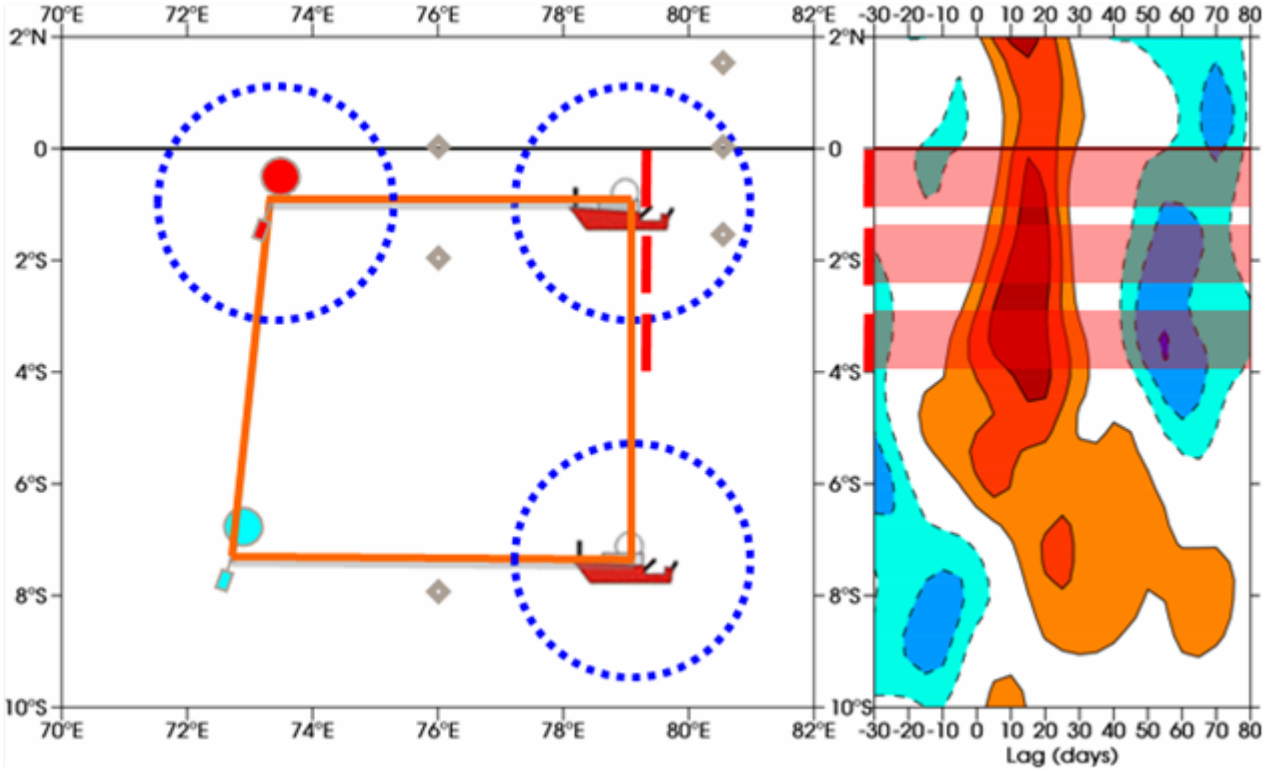
- 4 month deployment (October 2011 to January 2012)



SSH anomalies at 79°E



Proposed Seaglider flight profiles

Sampling diurnal and intraseasonal variability

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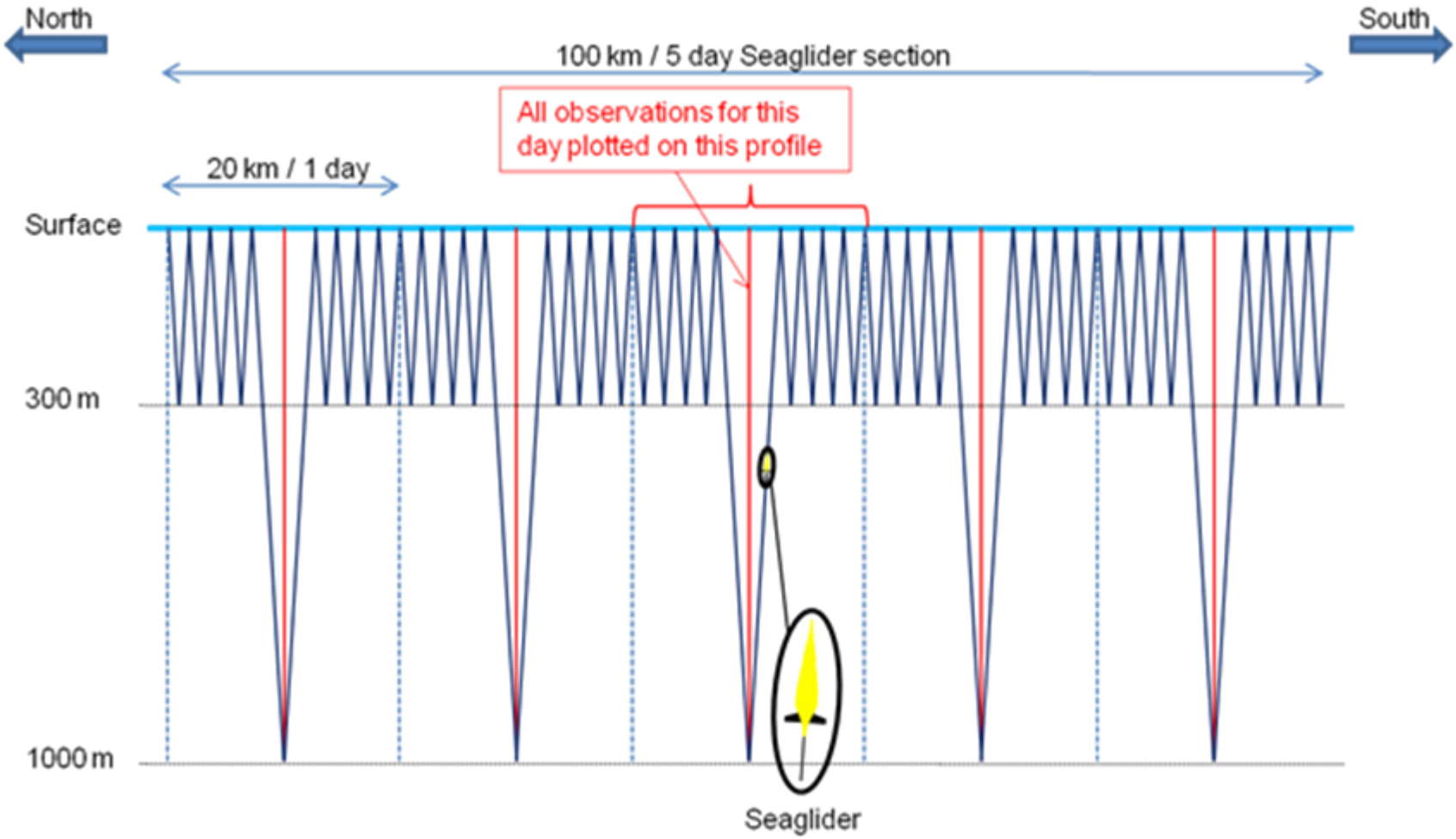

Modelling of Tropical DISGO / CINDY2011 period

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- Assess importance of ocean thermodynamical and dynamical processes in simulation and prediction of MJO during CINDY2011 period, validating on Seaglider and other CINDY data
- 1-D mixed layer modelling
- GCM modelling (HadGEM3H; 0.83 x 0.56 degree atmosphere, ¼ degree NEMO ocean with 1 m resolution near surface):
  - Ocean-only (initialised with UK Met Office FOAM analysis)
  - Coupled
- Sensitivity experiments include:
  - Diurnal averaging
  - Surface fluxes replaced by (diurnally varying) climatology
  - Ocean dynamical fields replaced by climatology

Tropical DISGO and CINDY2011

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- NERC proposal submitted 10 June 2010
- Decision expected December 2010
- Project partners:
  - Kunio Yoneyama (CINDY PI, and deployment from M/V Mirai)
  - Eric Schulz (CAWCR, retrieval on M/V Southern Surveyor
  - Chidong Zhang (DYNAMO PI)
  - Matthew Martin (UK Met Office, data assimilation into FOAM)