What is ITF?

Joke about Arnold removed.....but

Can We think of it as a Capacitor linking
the two Warm Pools?
The ITCZ moves north over the maritime continent to create seasonality.
SSTs off Java and Sumatra hover around convective thresholds. Can ITF push SSTs to trigger feedbacks?
What is the role of the ITF in SOI and ENSO? Cause or Effect?
Where do the dominant timescales come from?
Can ISV in ITF produce coupled positive feedbacks?
ISVs in ITF can be generated from Both Indian and Pacific Oceans

Figure 1. MJO cycle of precipitation anomalies (CMAP data set). The life cycle is calculated from MJO events in the November-April (northern hemisphere winter) season only. Composite maps were calculated for each of the 8 RMM phases, and linearly interpolated for the intermediate days to give a smooth cycle. In addition to the colour shading, a thick solid contour at 1 mm day$^{-1}$ outlines the region of enhanced rainfall, and a thick dashed contour at -1 mm day$^{-1}$ outlines the region of suppressed rainfall. These contours are reproduced in subsequent animations below to indicate the main regions of MJO precipitation. Animations stolen from Adrian Matthews, UEA, UK.
Seasonal variability of ISVs: The exit region of the ITF is a hotspot

Figure 4: Standard Deviation (cm) of 30-90 day mode of variability of SSHA for 1996, 2001, 2006 and 2009

Suyash Bire - 2012
Fig. 5. Maps of intraseasonal SST anomalies (a), intraseasonal SSH anomalies (b), and intraseasonal D20 (c). The unit of SST anomalies is °C, the unit of SSH anomalies is cm, and the unit for D20 is m. The black contours in (a) are the barrier layer depths, starting from 16 m with an interval of 2 m.

Fig. 6. (a) Correlation between significant daily PC1 (PC1 > 2) and the corresponding intraseasonal SST anomalies. (b) Correlation between distinct daily PC2 (PC2 < -2) and the corresponding intraseasonal SST anomalies. (c) Correlation between significant MJO events (MJO index > 2) and the intraseasonal SSH anomalies. The values in (b) are reversed, so that positive values represent sea surface warming and negative values represent sea surface cooling in both (a) and (b). Only statistically significant correlations at the 95% confidence level are shown.
Fig. 10. Intraseasonal meridional currents at 50 m (a) and 150 m (b) in the Lombok Strait. The zeroth day is the day with a peak MJO index, which are marked with circles in Fig. 1.

Fig. 11. Intraseasonal zonal currents at 50 m (a) and 150 m (b) in the Ombai Strait. The zeroth day is the day with a peak MJO index, which are marked with circles in Fig. 1.
Small errors in transports or winds in the Indonesian Seas can have large impacts on the SWIO. We have no idea how they may be amplified by coupled feedbacks with IndoP.

Each strait has a unique impact on the Indian Ocean. Coupled feedbacks may be opening and closing different valves..
Fig. 2 Vertical structures of the annual mean (4°S–0°N meridional mean) of (a) the control and (b) the MJO simulations. The black lines indicate the concentration of Log10NO3 (contour interval is 0.5), and purple lines indicate mixed layer depth (MLD, solid), the isothermal depth (ITD, long dash), and the 24°C isotherm depth (D24C, short dash). The units for Log10Chl and Log10NO3 are log10(mg/m³) and log10(mmol/m³), respectively.
MJOs produce a seasonal-rectification and a thermocline-intensified response

Fig. 14. (a) Correlations between the 5-day MJO index and the zonal velocity, as well as correlations between the 5-day MJO index and zonal temperature advection. (b) Correlations between the annual MJO index and the annual mean zonal velocity, as well as correlations between the annual MJO index and annual mean temperature advection. The zonal velocity and temperature advection are averaged between 10°S and 15°S at 114°E. The correlations are statistically significant at a confidence level of 95%.
ITF waters induce baroclinic instability in the Southern IO.

Fig. 5. (a) Barotropic and (b) baroclinic energy conversions averaged over 20 yr and above the thermocline in the SWIO.

Fig. 7. Longitude–depth plots of baroclinic energy conversions for January, April, July, and December. The contour interval is $1 \times 10^{-3}$ W m$^{-3}$. Regions with positive values are shaded.
We can use the PV conservation equation to calculate spatio-temporal scales of the Eady waves - ISVs.

Fig. 7. (a) Wavelength of the maximum instability ($L_{max} = 3.9L_d$) and (b) the inverse of the corresponding maximum growth rate ($\sigma_{max} = 0.3U/L_d$), both in December.
Warm Entrainment in late fall – early winter months because of ITF

Impact on MJO genesis?
Both SWIO and SEIO have strong thermocline-SST interactions with potential for coupled feedbacks – via MJO genesis and maritime rainfall.

**Fig. 12.** Intraseasonal entrainment (solid line, K month$^{-1}$) and intraseasonal SSHAs (dashed line 10 cm) at 8°S, 63°E for 18 yr.

**Fig. 13.** Correlations between the intraseasonal entrainment and the intraseasonal SSHAs, which are statistically significant at the 95% confidence level.
The pathways in the Indonesian Seas are like valves that determine the properties of waters being injected into the Indian Ocean which in turn determine the ISVs in the southeastern and southwestern Indian Ocean.
But there is interannual to decadal variability of source waters coming into the Indonesian Seas.
And their pathways in the Indian Ocean also vary from interannual to decadal timescales.
ISVs in warm SSTs are small because convection smooths them out. But Winds and currents can have large ISVs to produce ITF ISVs.

Fig. 1 Standard deviation (std) of band-pass filtered (30-120 days) zonal wind (m/s) and annual mean SST (°C) in the latitude range 23°S–23°N. (Upper panel) u wind std is color shaded, and mean SST is contoured. Contour level is 1°C. (Lower panel) Scatter plot between SST annual mean and u wind filtered std. Black squares indicate average of wind std on each SST bin the size of which is 0.5°C. Black dash lines indicate the average plus/minus one std, and black bar is std of u wind std.

Fig. 2 Same as Fig. 1 except meridional wind (v) instead of zonal wind.
SSTs are an integrated response to momentum, heat, and freshwater fluxes – but feedbacks can be critical.
MJOs produce equatorial and Coastal Kelvin Waves leading to ISVs in ITF which can propagate as Rossby waves to the MJO genesis region. Is there a potential feedback loop? Is ITF just a passive player or an active participant in the ENSO-monsoon-MJO dynamics?