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Research on Air sea interaction modeling for YMC

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Development - BMKG

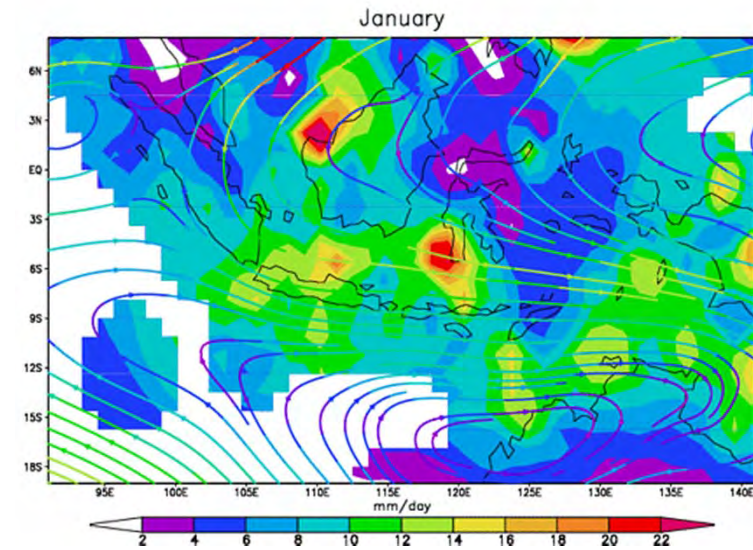
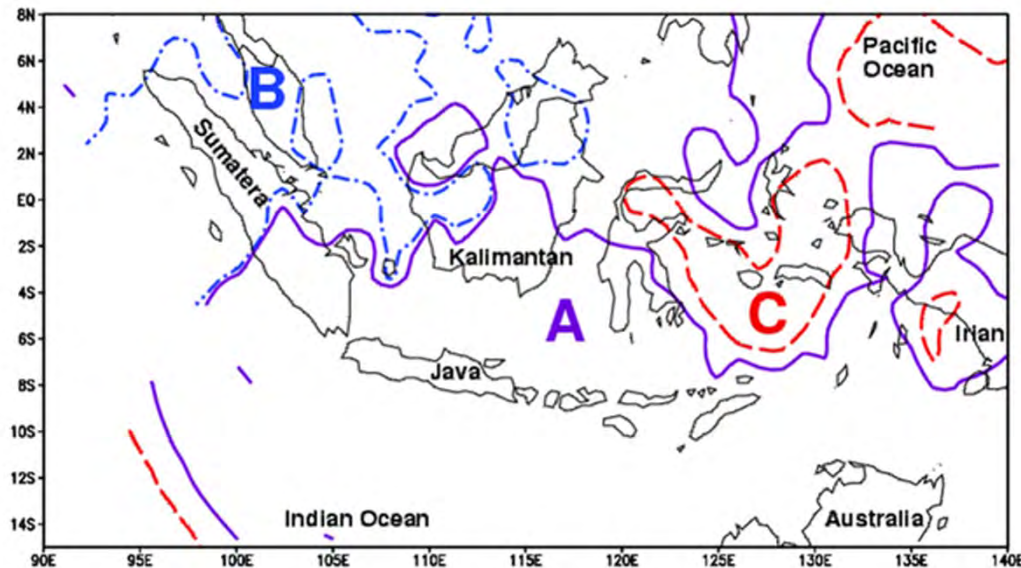
First Scientific and Planning Workshop on Year of Maritime Continent, Singapore 27-31 January 2015



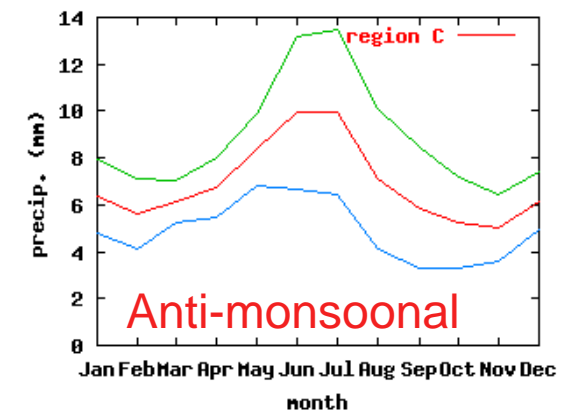
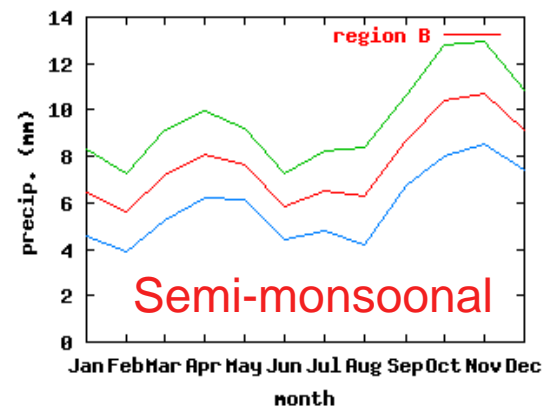
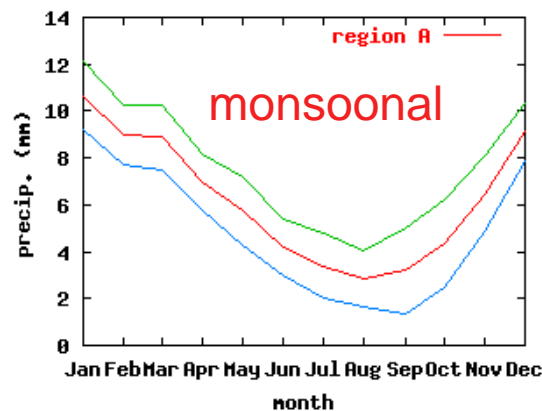
Climatology of regional rainfall

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- Mainly monsoonal
- Three distinct rainfall climate regions



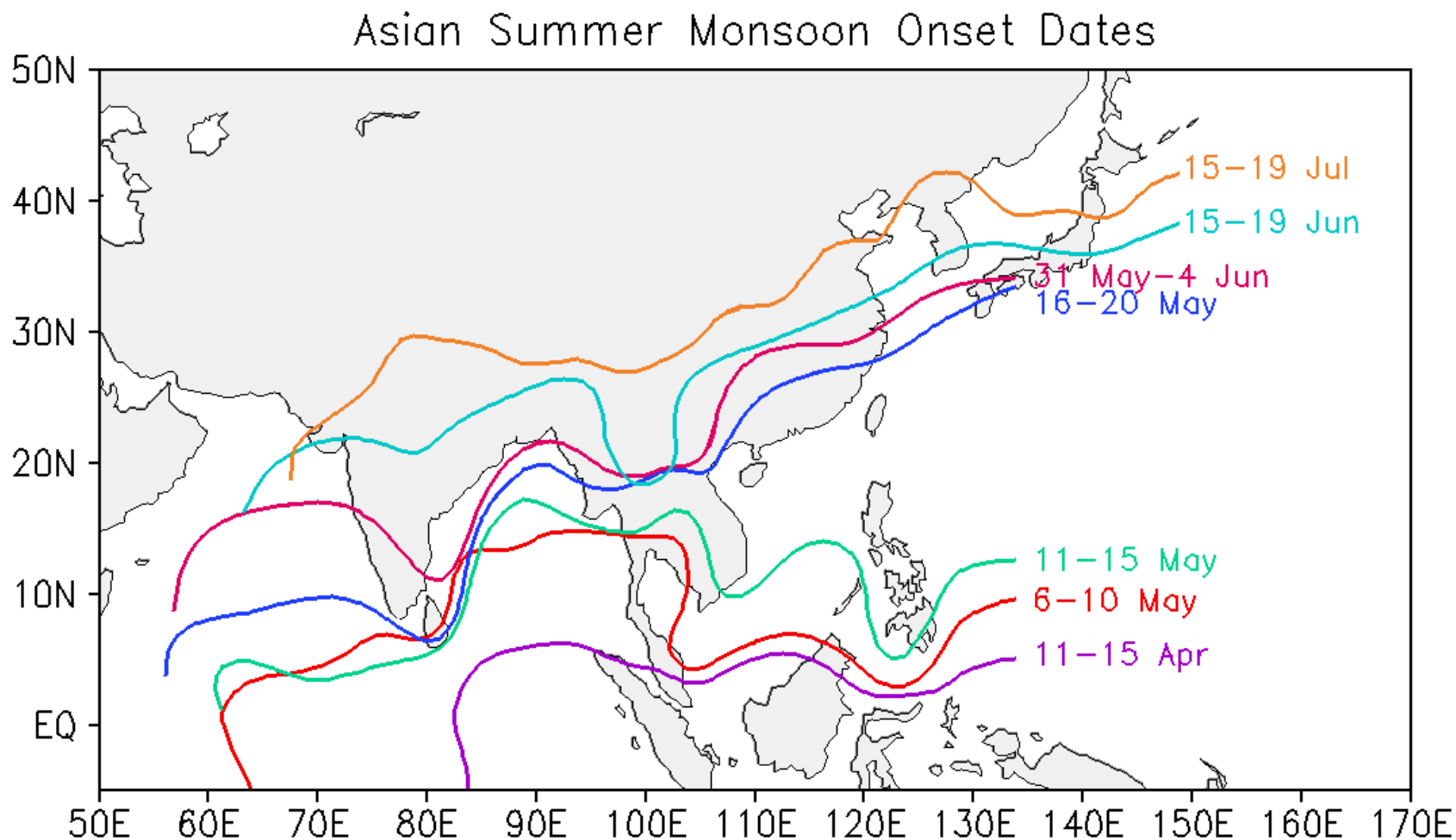
Three climate regions update
previous work by Wyrski, 1956





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Onset Dates of Asian Summer Monsoon

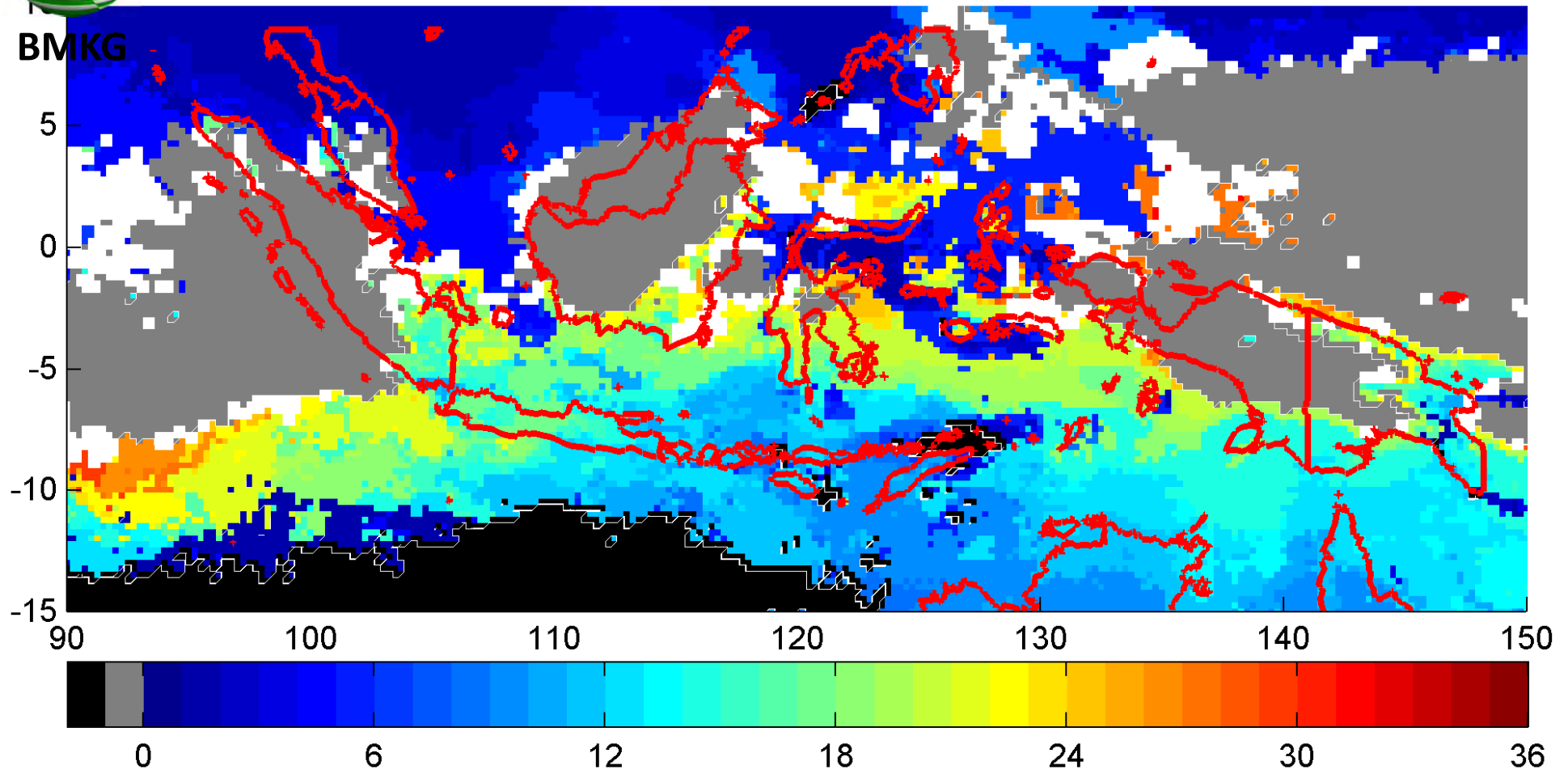


Data Source: Climatological (1979–2007) NCEP CMAP Precipitation

Criterion: $P \geq 6\text{mm/day}$



Dry Season onset (TRMM data 1998-2010)

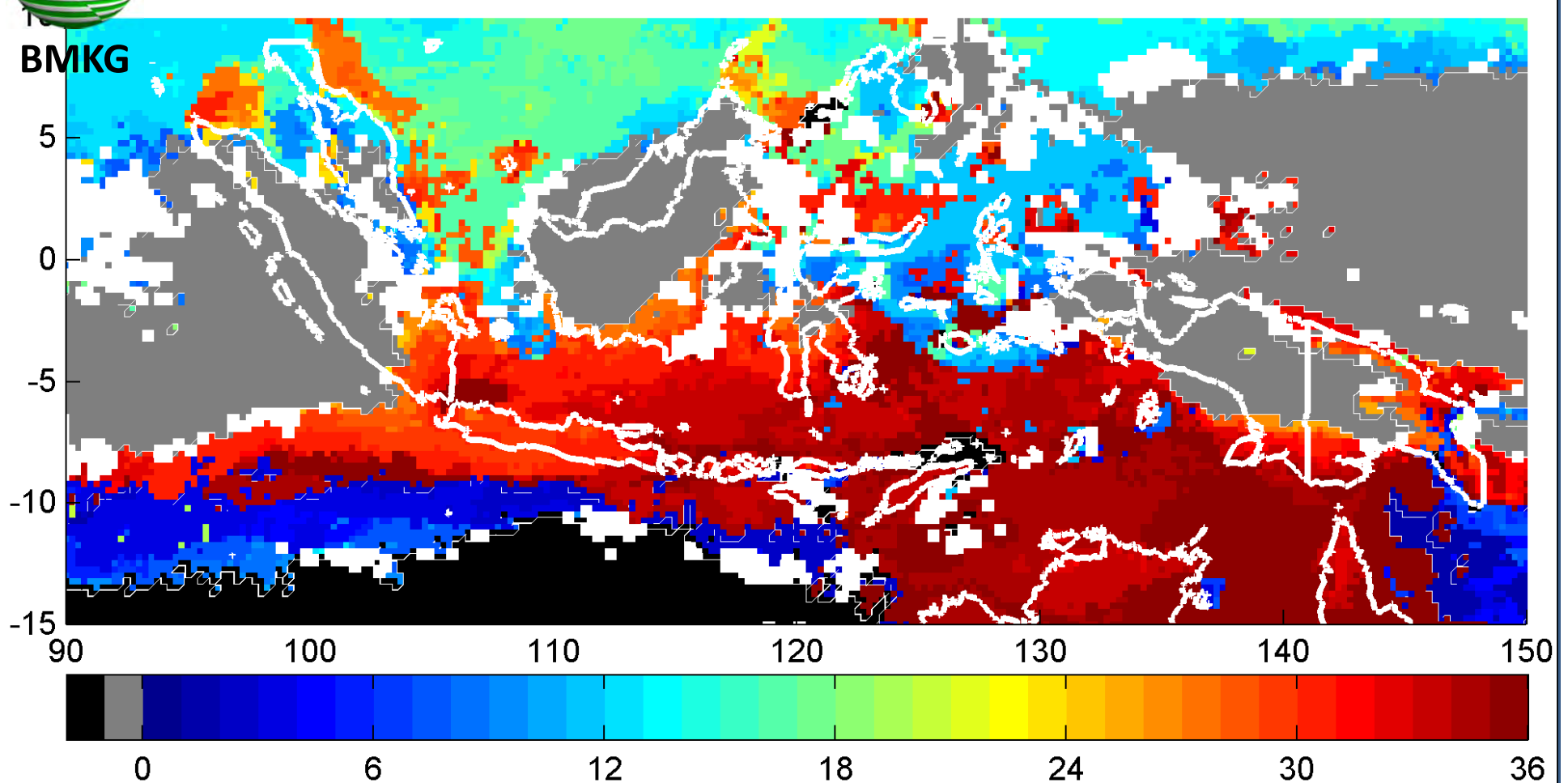


- Area with rainfall $> 50\text{mm}/10$ days (Non Monsoon)
- Areas with rainfall $< 50\text{mm}/10$ days (Non Monsoon)

Colour indicates 10 days



Rainy Season onset (TRMM data 1998-2010)

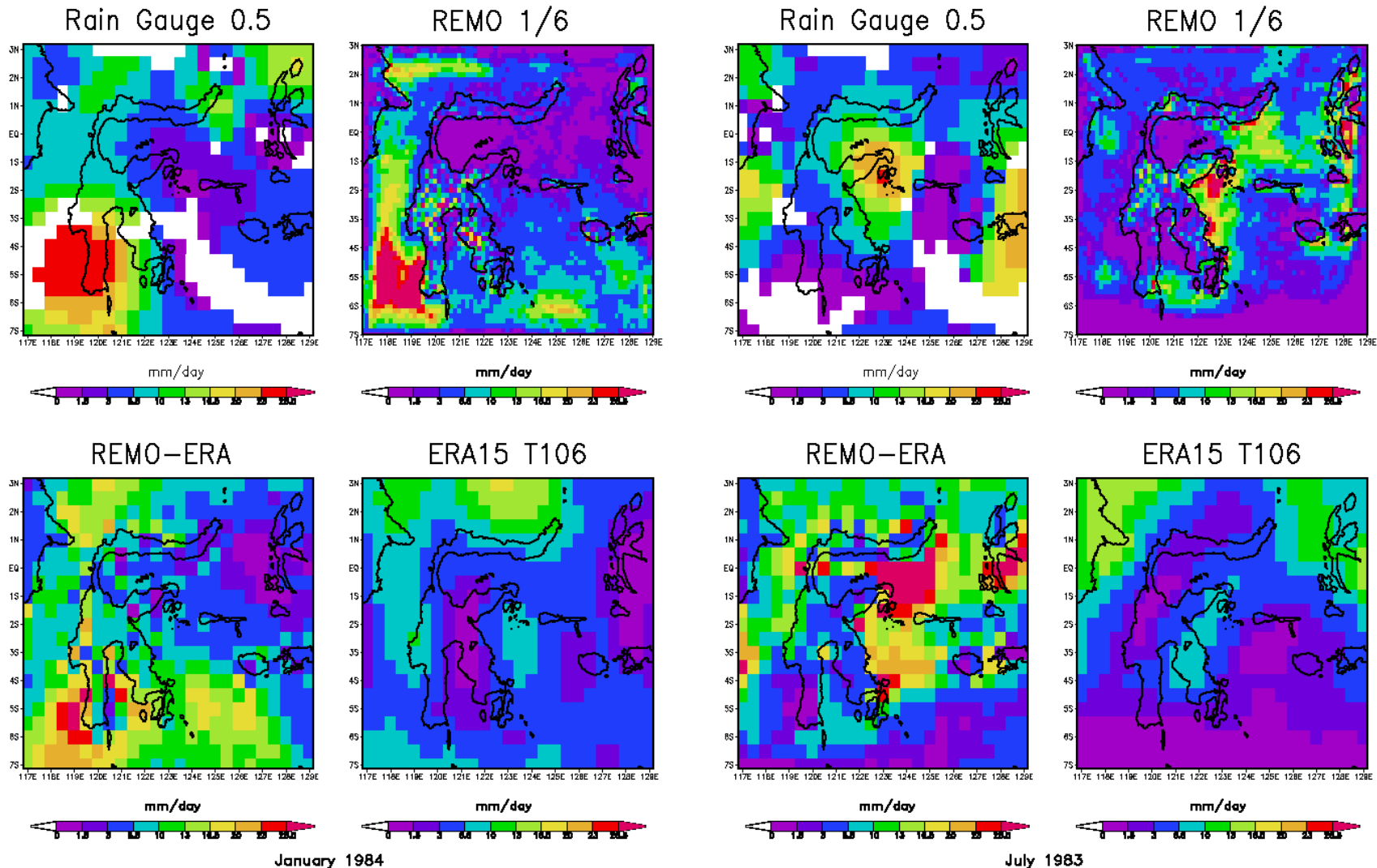


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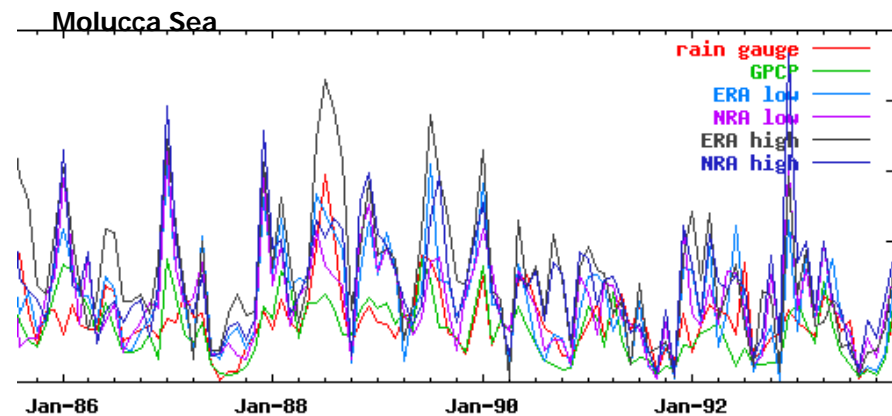
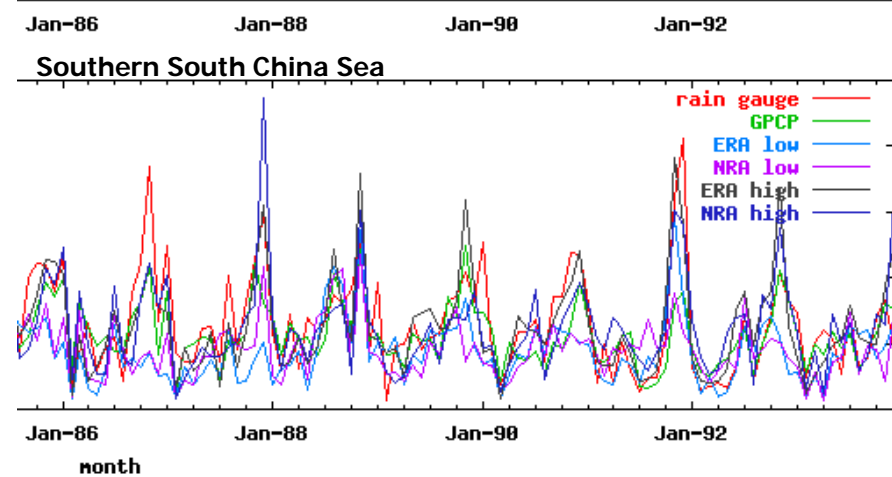
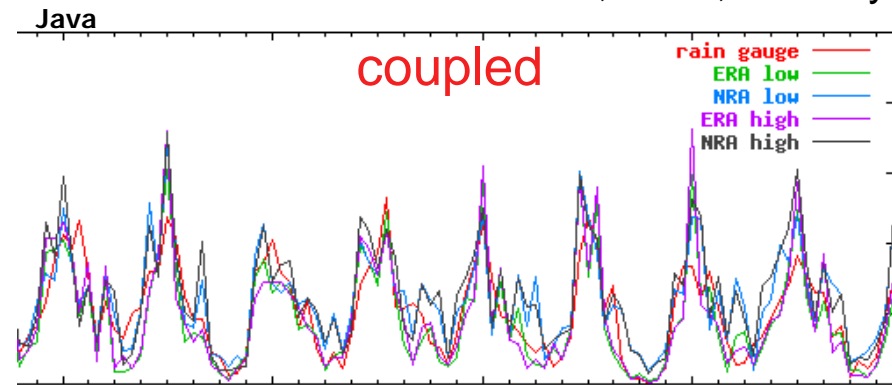
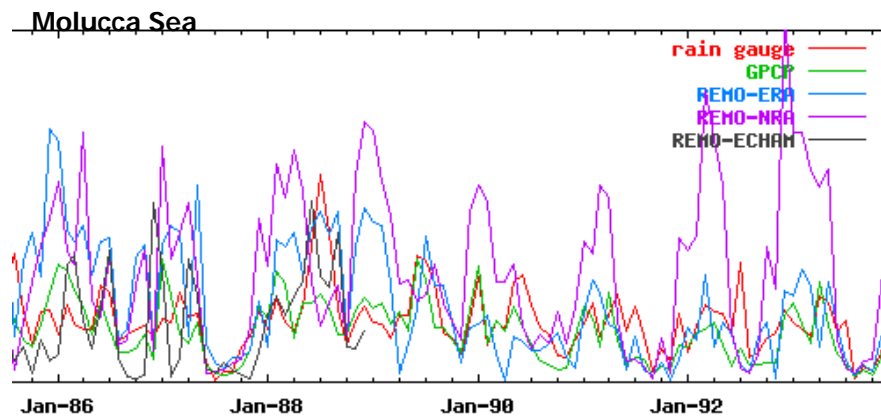
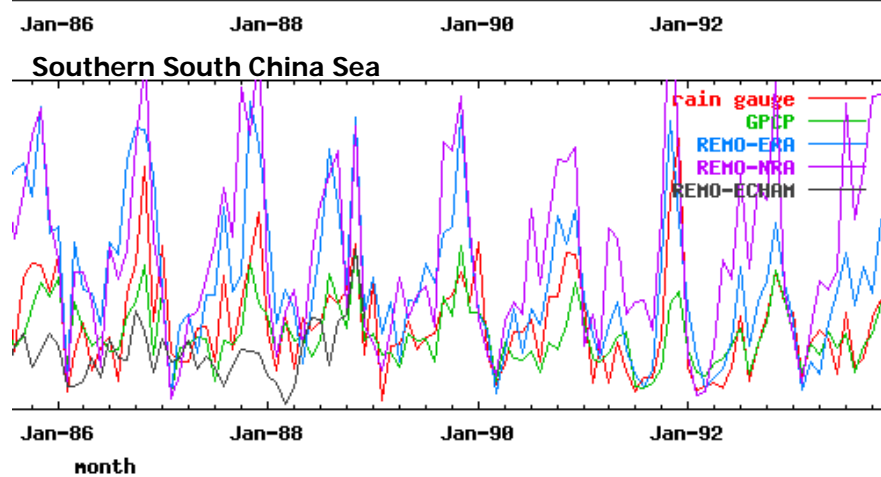
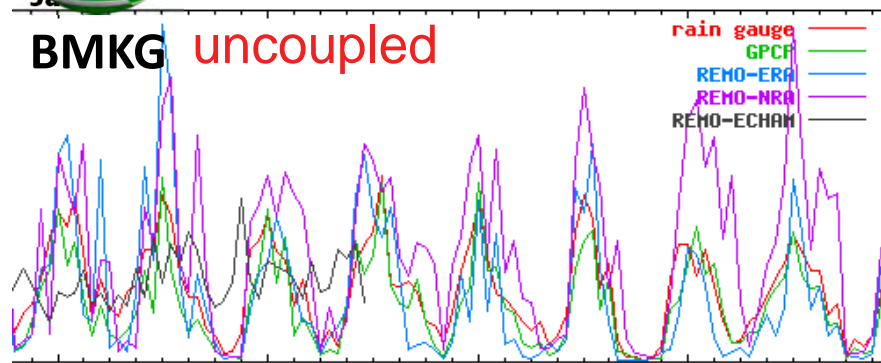
Improvement by higher resolution with regional model





Improvement by coupling with ocean model

Aldrian et al, 2005, Clim Dyn.

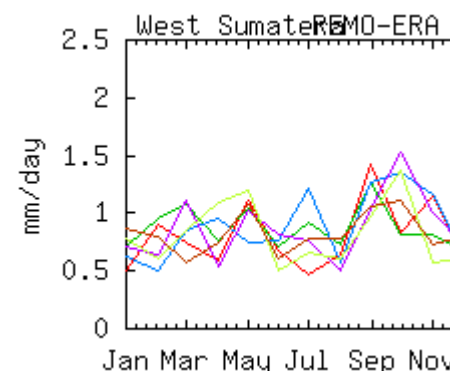
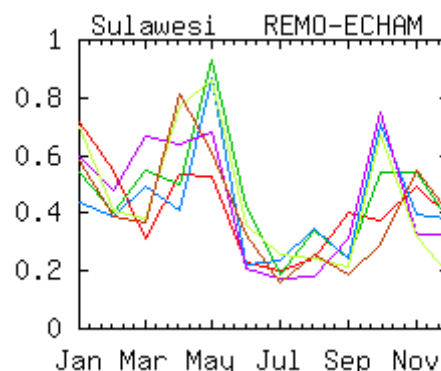
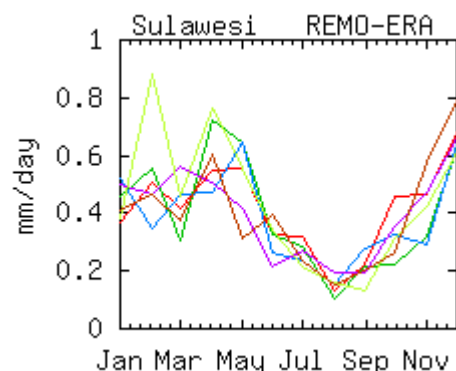
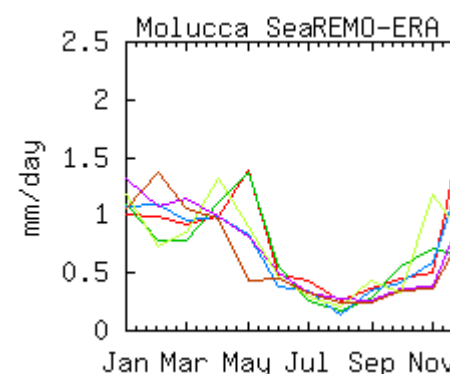
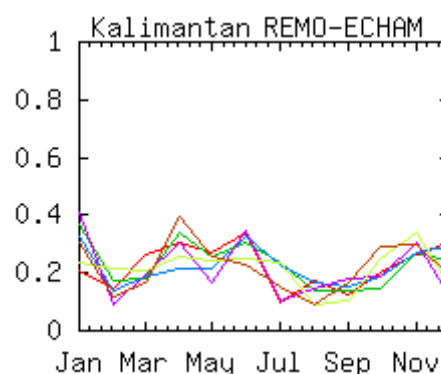
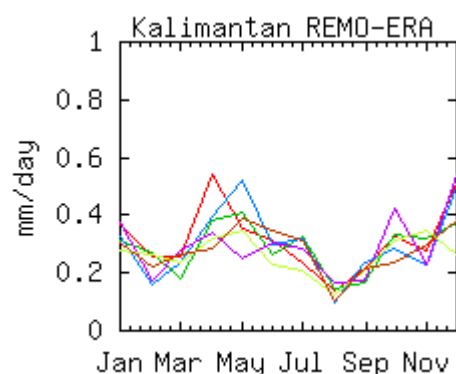
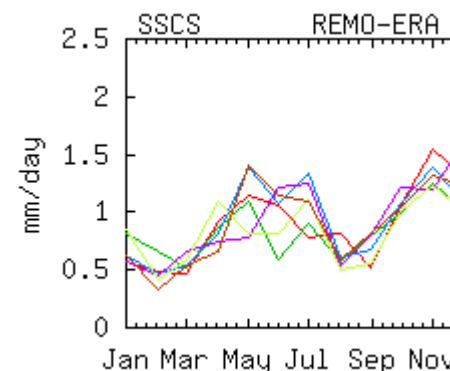
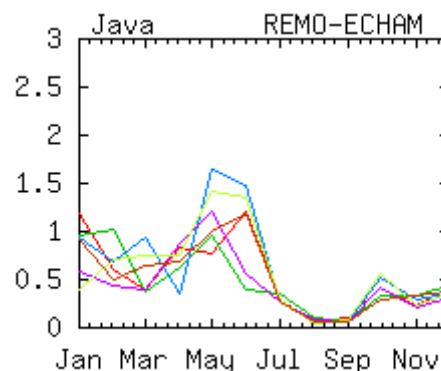
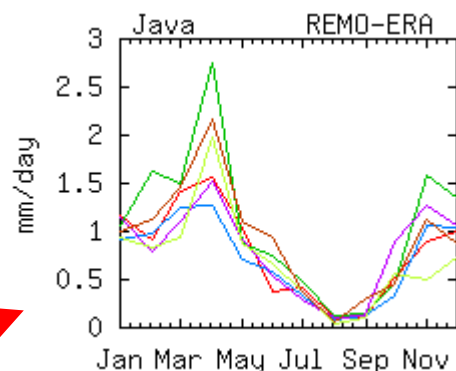




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Rainfall Predictability by regional model

RMS
Error
against
control
run



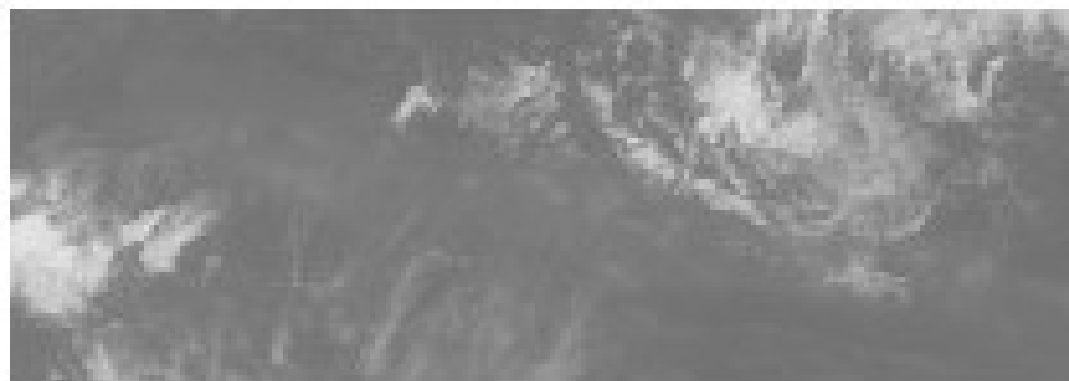
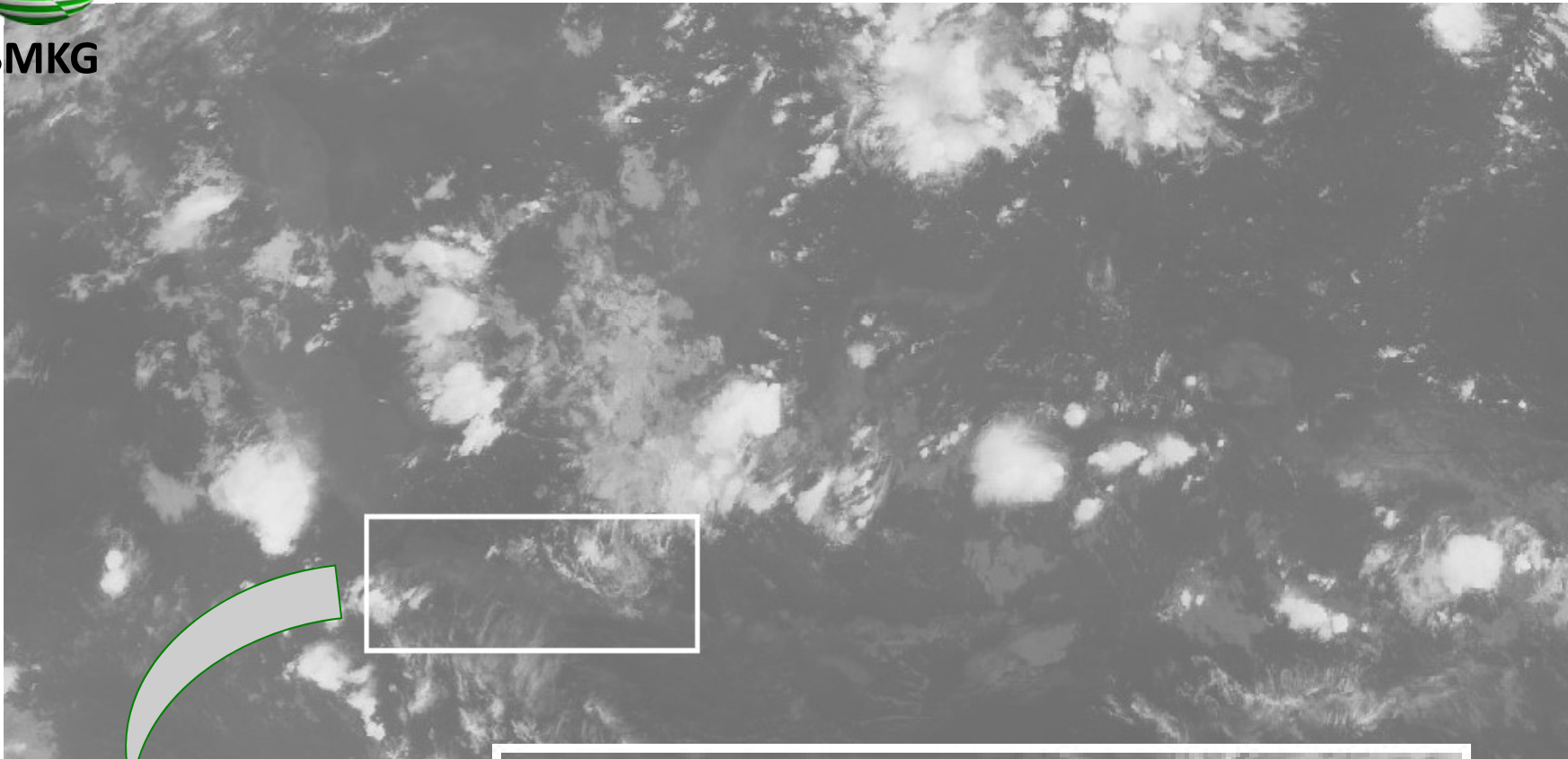
Ensemble runs with REMO-ERA and REMO-ECHAM: 6 members with 12 hr diff. in initial condition



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Studying Land sea interaction

with Satellite Observation ----- results of diurnal process between land and sea



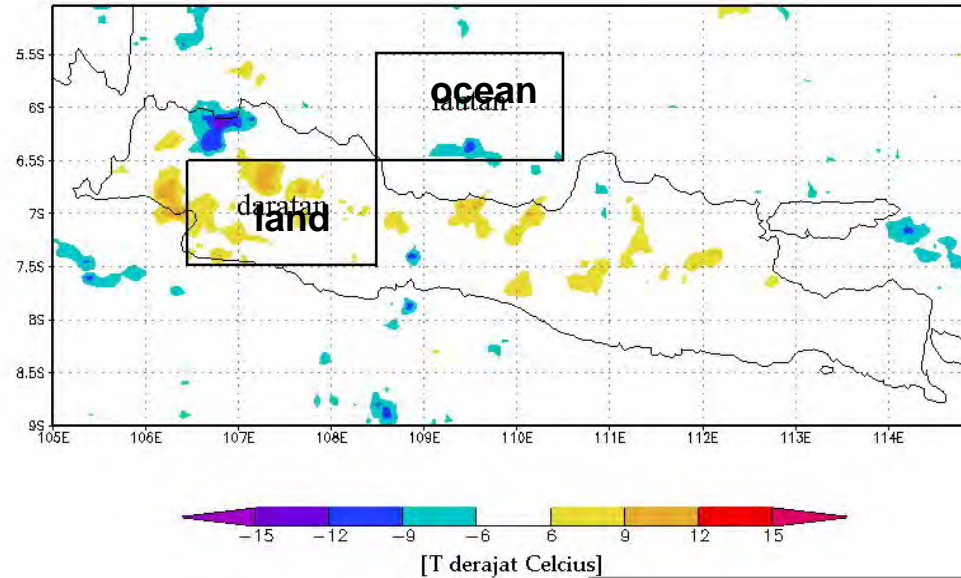
Study area (105–115 °E AND 5–9 °S)



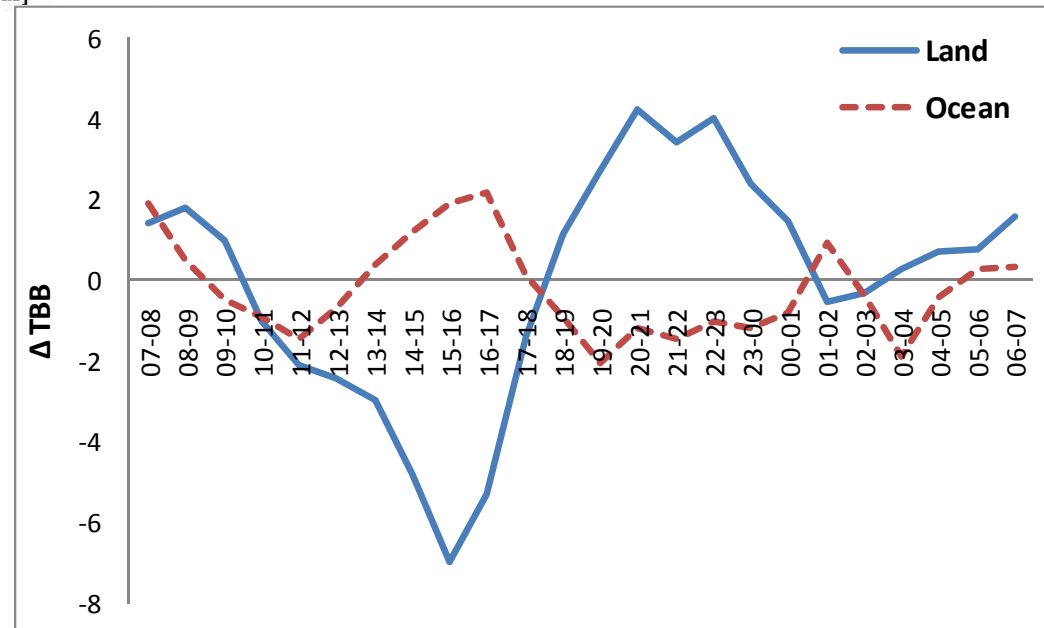
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Studying Land sea interaction

with Satellite Observation ----- results of diurnal process between land and sea

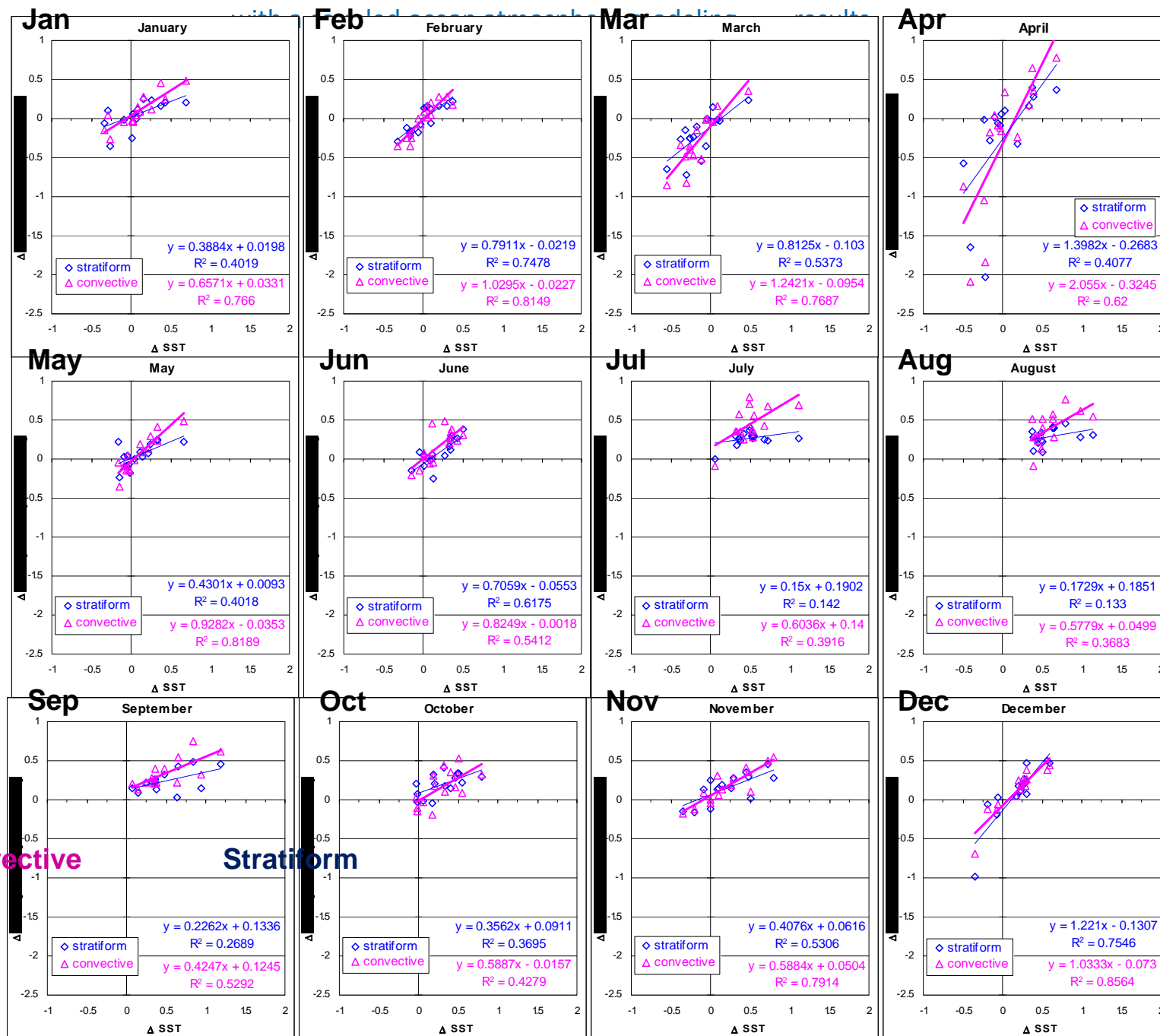


- There is a reverse diurnal mechanism of cloud development and precipitation processes over land and surrounding ocean





Studying Sea – Air interaction (stratiform convective cloud model)



Convective

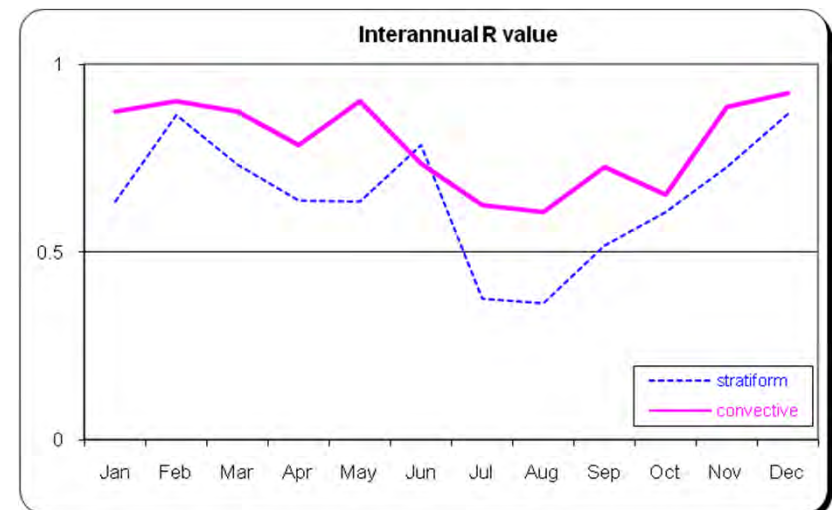
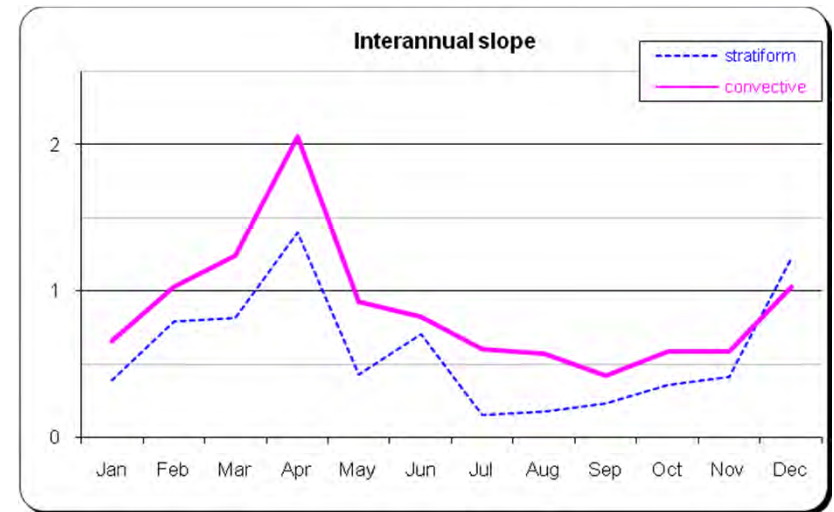
Stratiform



Studying Sea – Air interaction

with a coupled ocean atmosphere modeling ----- results

- April is the most sensitive month for change in SST against change in rainfall, while August, September and October are the less influential months for SST changes to rainfall.
- Changes of SST bring larger impacts on convective rainfall than on the stratiform rainfall.



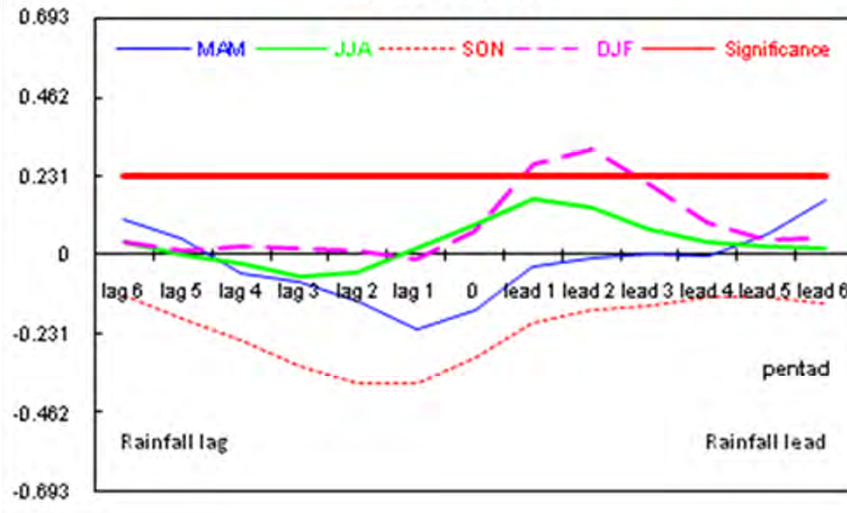


Studying Sea – Air interaction

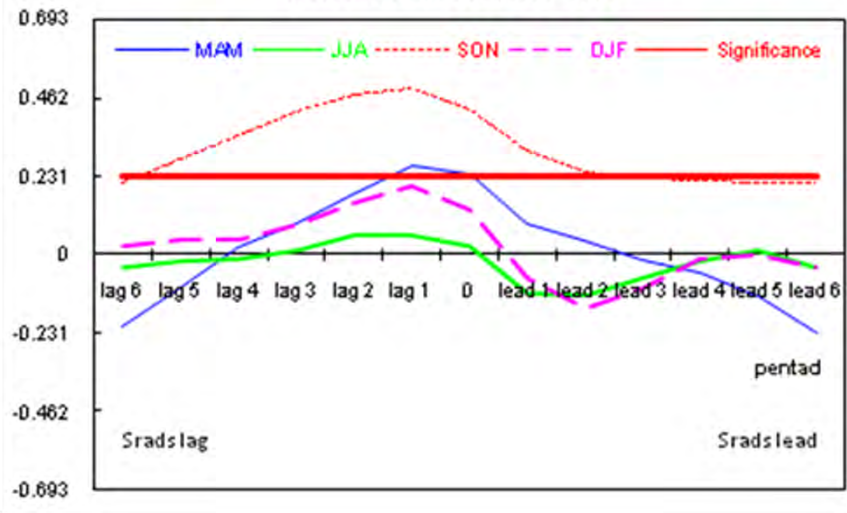
with a coupled ocean atmosphere modeling ----- results

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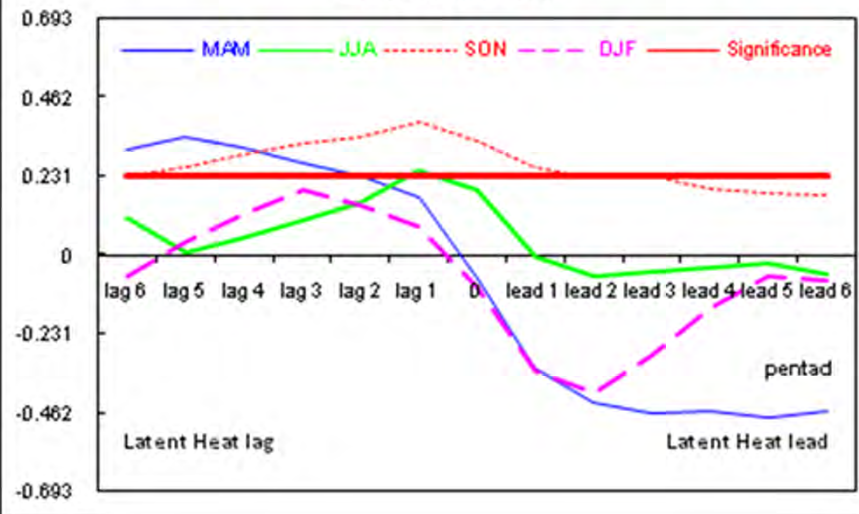
Average Lead-lag Correlation between Pentad Rainfall and SST, 1979-1993



Average Lead-lag Correlation between Pentad Shortwave Radiation and SST, 1979-1993



Average of Lead-lag Correlation between Pentad Latent Heat and SST, 1979-1993



Pentad (five-days) lag and lead correlation



Studying Sea – Air interaction

with a coupled ocean atmosphere modeling ----- results

No	Correlation variables	Correlation type		Period	remarks
		lag	lead		
1	Rainfall vs SST			SON	↓
				DJF	↑
2	Laten Heat vs SST			MAM	↻
				JJA	↑
				SON	↑
				DJF	↻
3	Shortwave surface radiation vs SST			MAM	↑
				SON	↑



Studying Sea – Air interaction

with a coupled ocean atmosphere modeling ----- conclusions

- When using the abovementioned relationship, mechanism of sea air interaction is define. The sea air interaction is defined for each season or three monthly analyses.
- Significant relationship of sea air interactions are given by SST to latent heat release near surface.
- The results indicate clearly that in most cases the ocean affecting the atmosphere or the sea air interaction is significant than the air sea interaction. For this type of analysis only the coupled on simulation is used, while possible extension of the work include study on the differences between similar analyses of coupled on and coupled off simulations.



Some thoughts for YMC

- The Maritime Continent is mostly covered by ocean thus air sea interaction should be one of major focus. There are aspect of diurnal to seasonality time scale in air sea interaction.
- Improvement of sea air flux processes are needed
- Proposed activity should covered Java Sea, Karimata Strait (between Sumatera and Borneo), Banda Sea and Flores sea.



Instrumentations from BMKG

In addition to existing observation network

- Sea glider
- X band doppler weather radar
- WindCube wind profiler,
- Mini Sodar
- Lidar
- Portable air quality (PM2.5, 10)
- Sun photometer, sun tracker, uv photometer
- Net Radiometer dan Sensible Heat Flux
- Quadrotor UAV





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THANK YOU