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Impacts of Fires on Convective Cloud Features in Southeast Asia: Variability with ENSO

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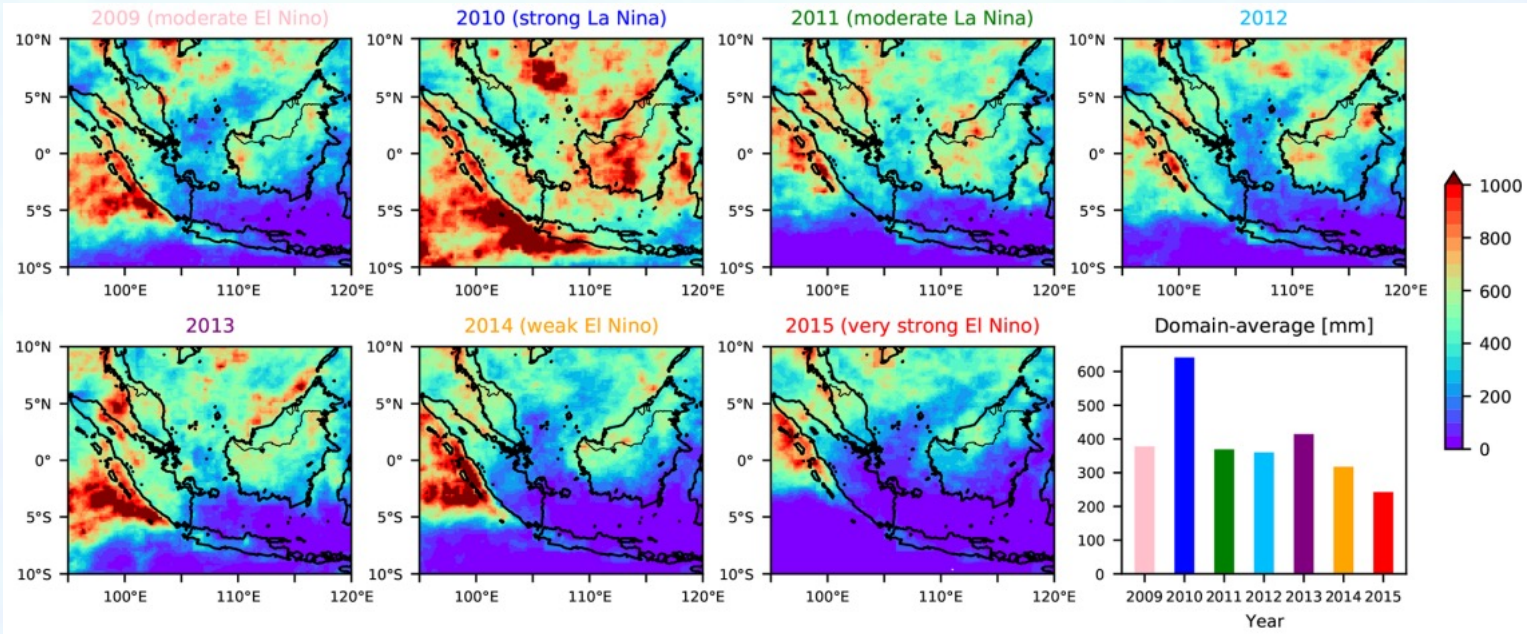
Southeast Asia

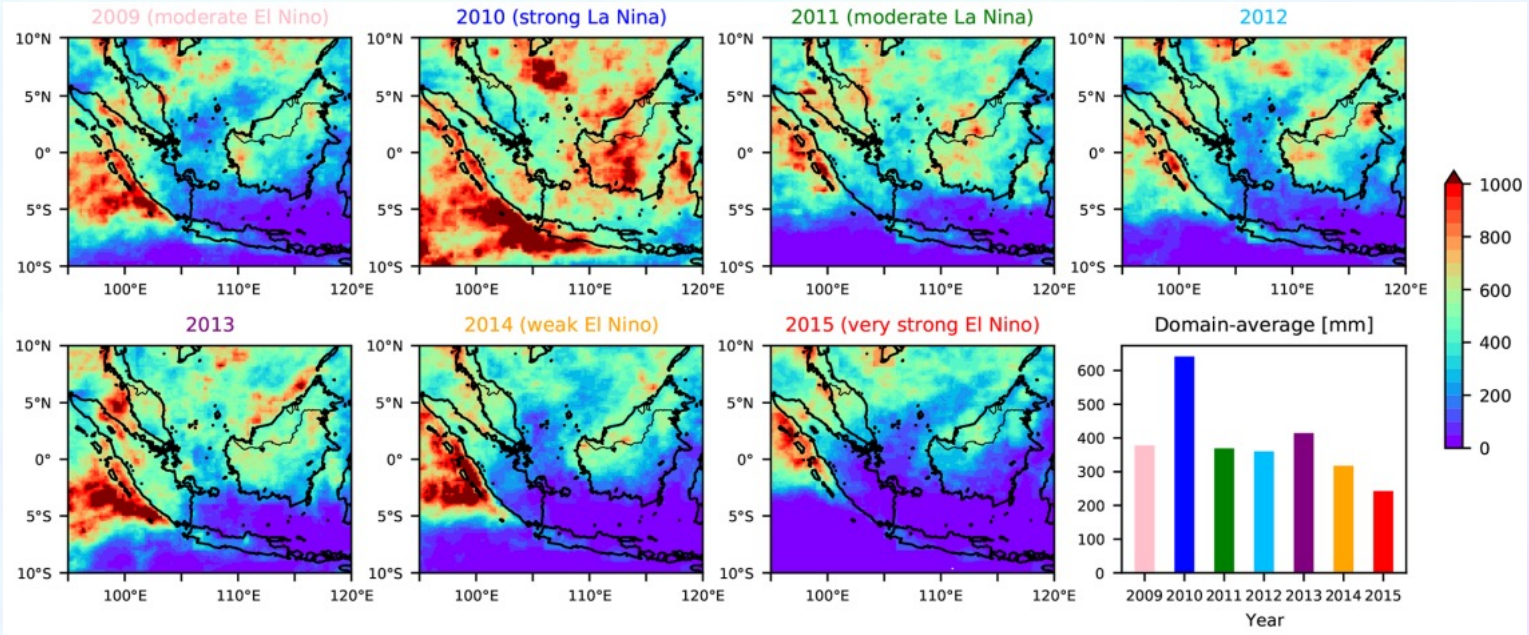
- Indochina peninsula & <u>Maritime Continent</u>
- Amounts of rainfall & dryness largely controlled by ENSO



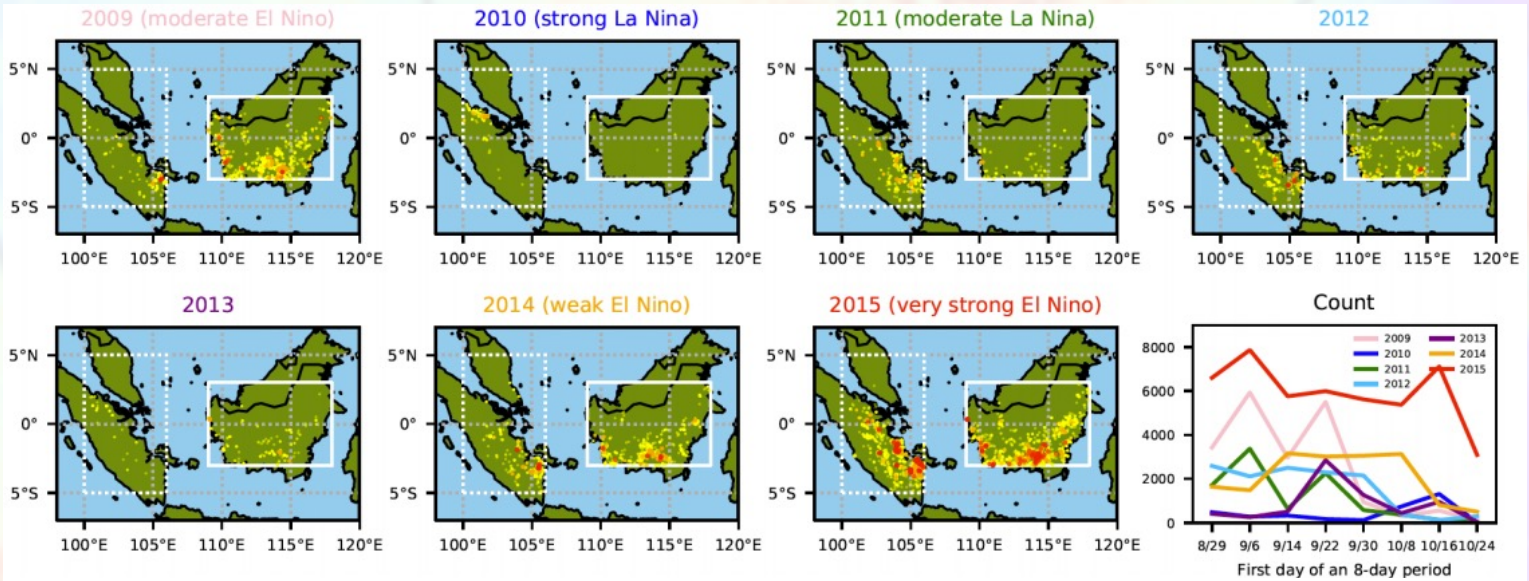
↑ Figure: TRMM-observed 2-month accumulated precipitation [mm] (Sep. & Oct.)

Southeast Asia

- Indochina peninsula & Maritime Continent
- Amounts of rainfall & dryness largely controlled by ENSO
- As a result, emissions and lifetime of biomass burning particles also vary with ENSO



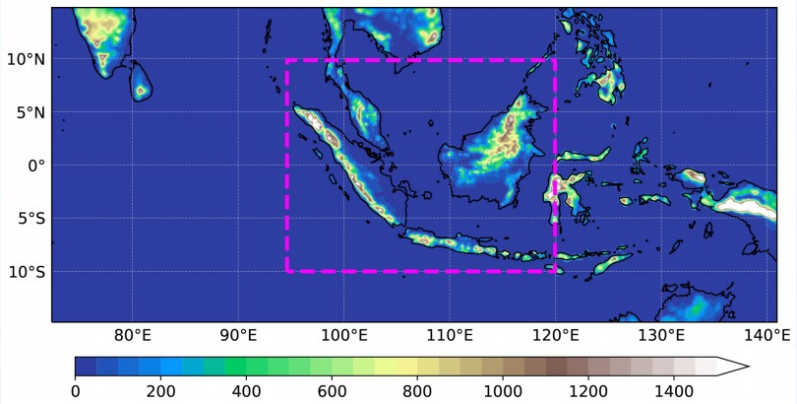
↑ Figure: TRMM-observed 2-month accumulated precipitation [mm] (Sep. & Oct.)



↑ Figure: MODIS-observed 8-day fire counts (2-3 counts, 4-5 counts, >5 counts)

Our Previous Study for 2015

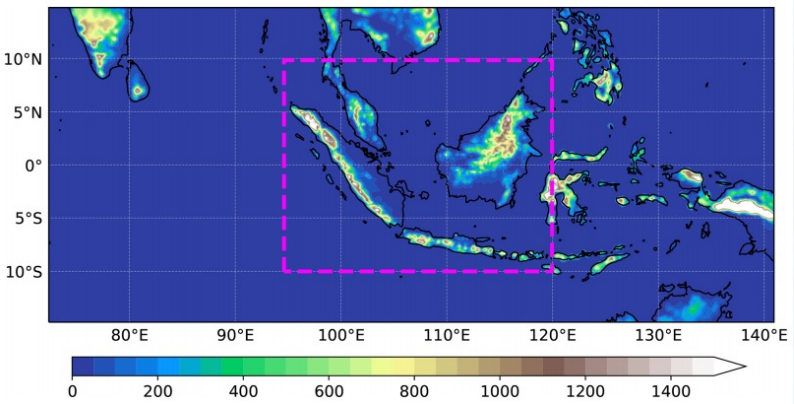
- Year of 2015: Very strong El Niño
  → Extreme dryness
- WRF-CHEM cloud-resolving (4km) simulations: NOFIRE vs. FIRE



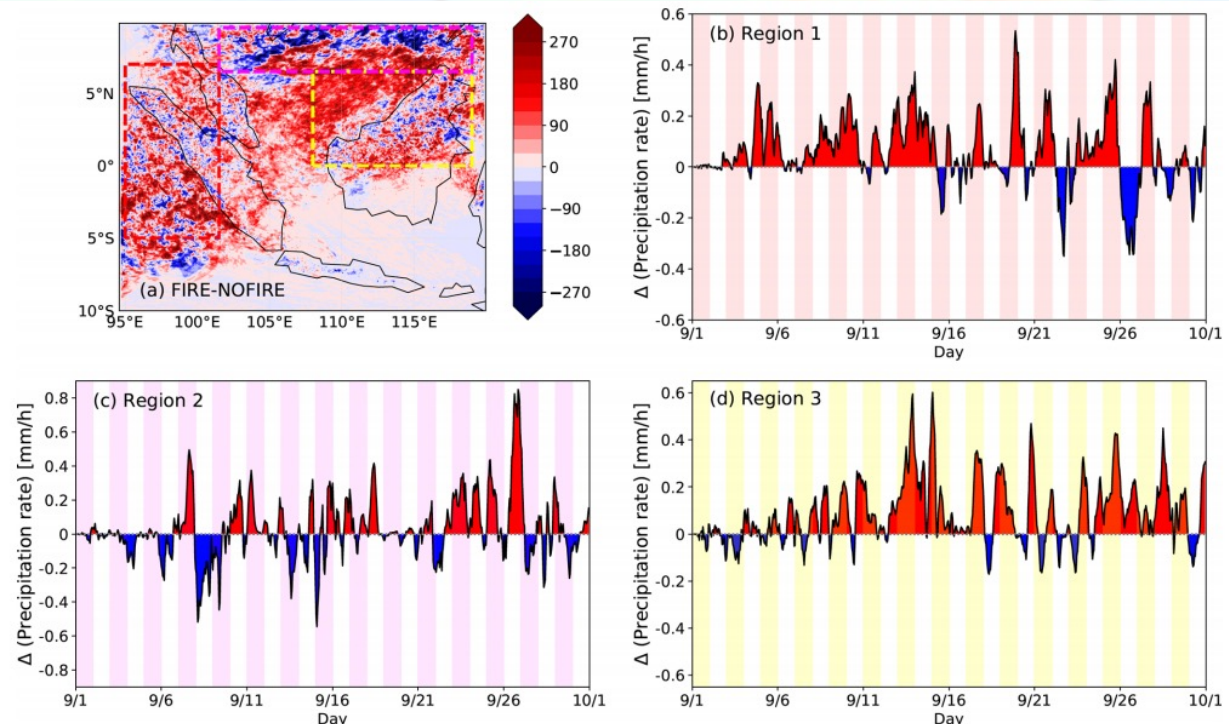
↑ Figure: Topography height in the simulation domain

Our Previous Study for 2015

- Year of 2015: Very strong El Niño
  → Extreme dryness
- WRF-CHEM cloud-resolving (4km) simulations: NOFIRE vs. FIRE
- We found an increase in surface rainfall when biomass burning particles were included in the simulations (Takeishi and Wang, *ACP*, 2022)



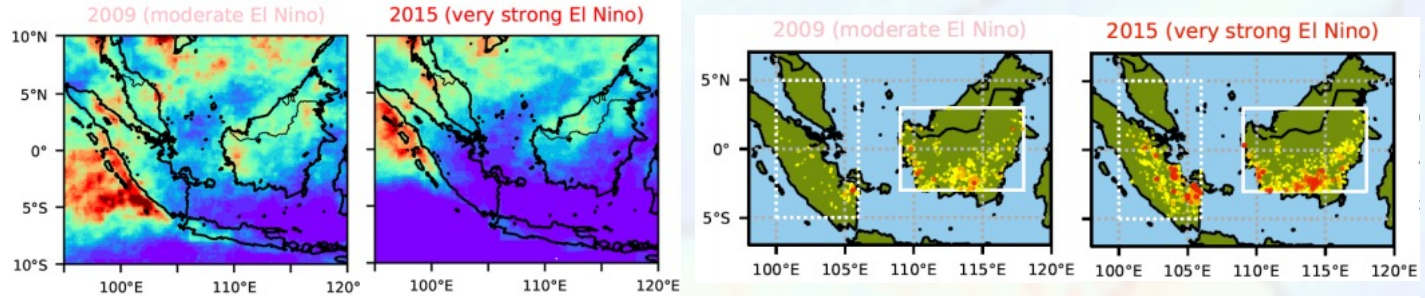
↑ Figure: Topography height in the simulation domain



↑ Figure: Distribution & time series of rainfall differences [mm] (FIRE-NOFIRE)

How about 2009?

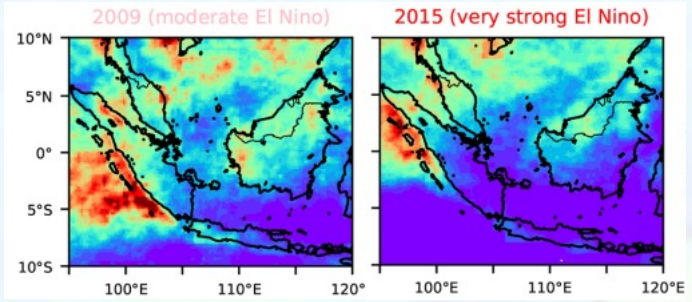
- Moderate El Niño in 2009
- Do we see a similar/weaker increase in rainfall due to increased biomass burning particles?

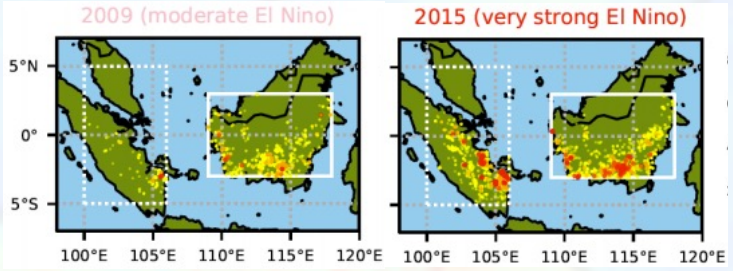


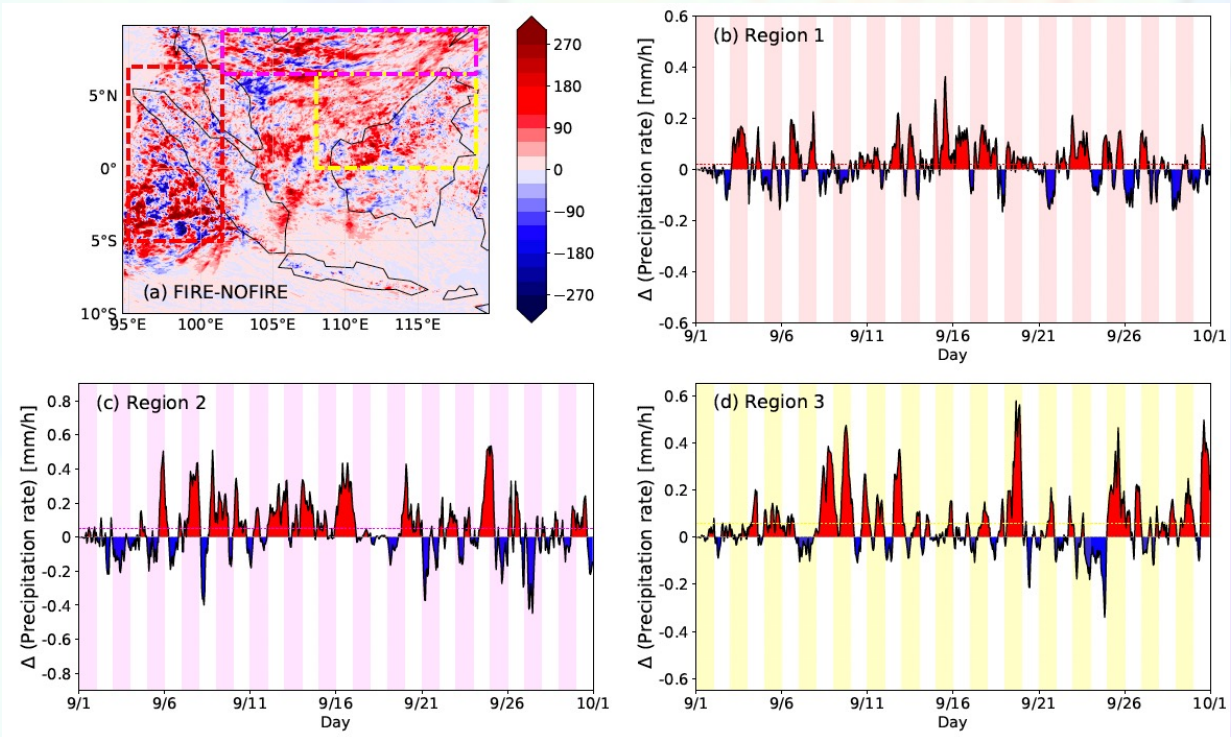
↑ Figure: TRMM-observed rainfall (left) & MODIS-observed fire counts (right) in 2009 & 2015

How about 2009?

- Moderate El Niño in 2009
- Do we see a similar/weaker increase in rainfall due to increased biomass burning particles? → Yes.
- Conclusion: El-Niño-driven increase in aerosols seems to increase rainfall







↑ Figure: Distribution & time series of rainfall differences [mm] (FIRE-NOFIRE) 2009