

Trajectory analyses of air mass origins for the Guam deployment

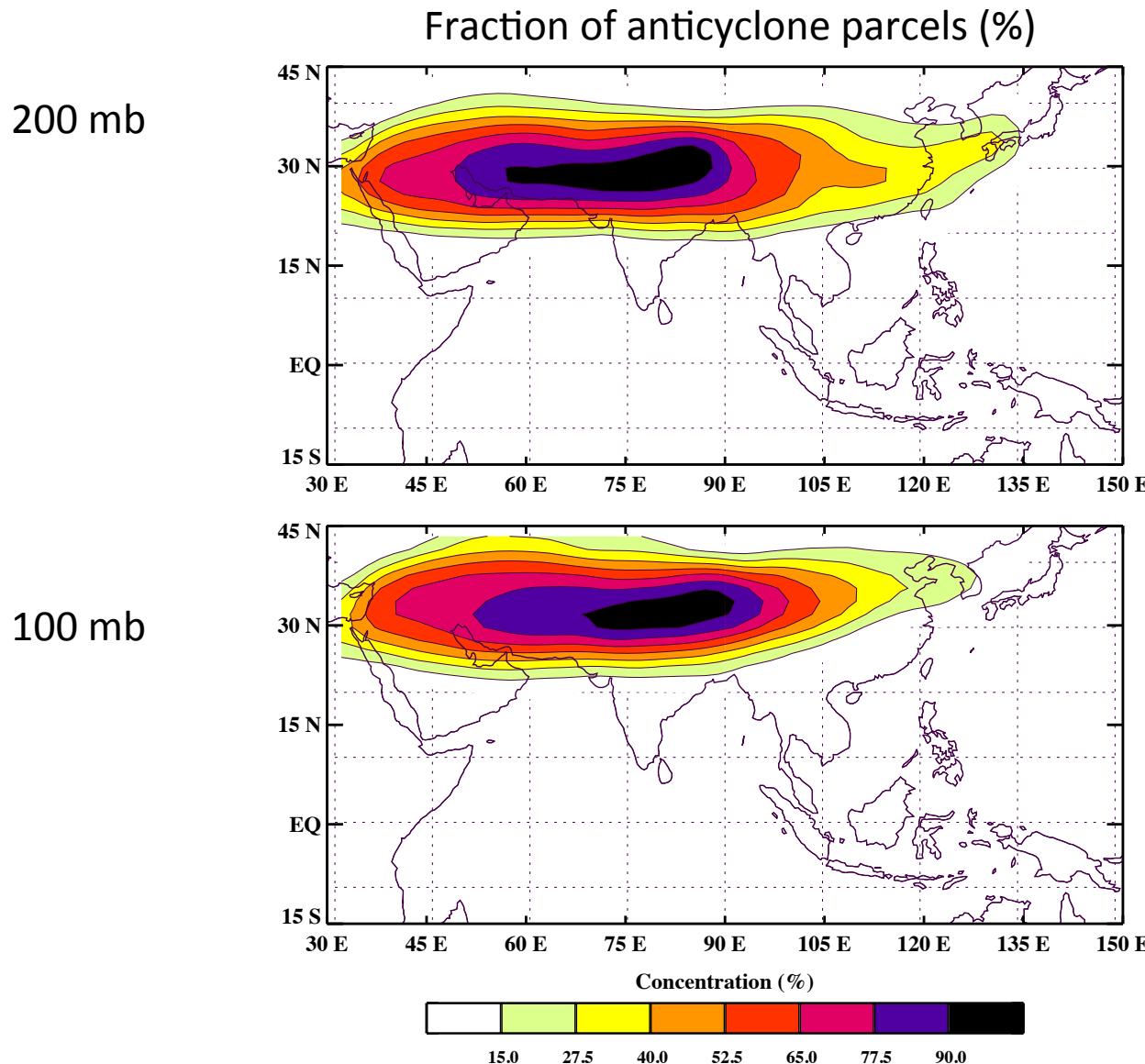
Collaborators: E. Jensen, L. Pfister, F.
Fierli, L. Pan, C. Bardeen

Outline

- Examine back trajectories from 100 (200) mb
- Where is the BL source for air in the Guam deployment region?
- Which statistics are robust?

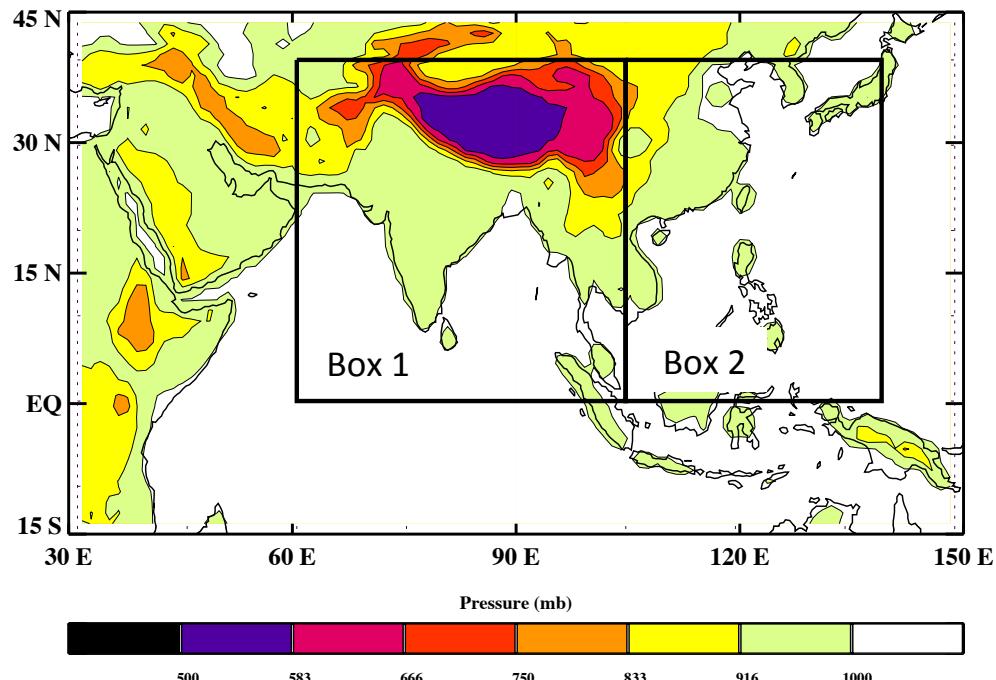
Results from SEAC⁴RS Study

Anti-cyclone parcel density



Source Sub-Regions in the Greater SEAC⁴RS Area

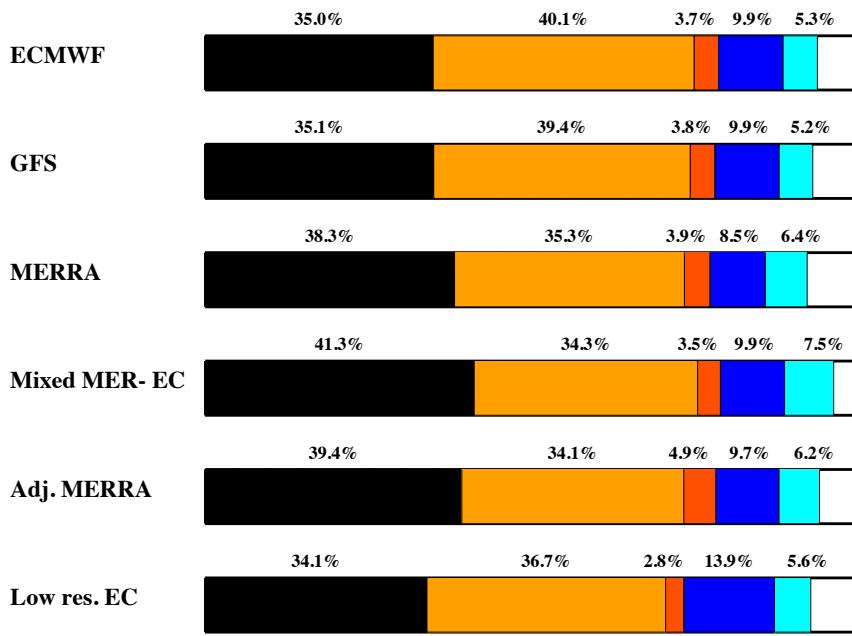
August 2011 mean surface pressure



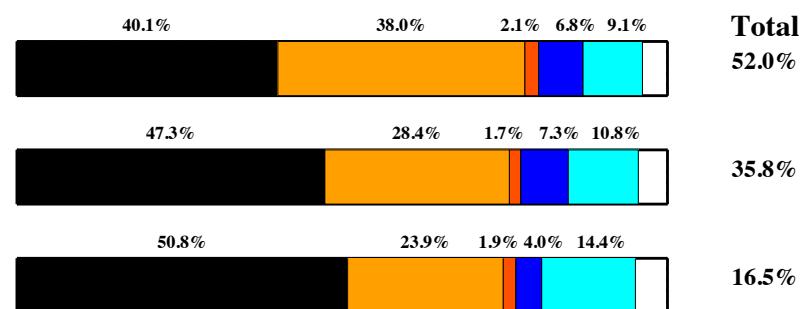
Region	Box	Land/Ocean	Surface Pressure
Tibetan plateau	1	Land	$P_s \leq 750$ mb
India/SE Asia	1	Land	$P_s > 750$ mb
E. China/Philippines	2	Land	all
Indian Ocean	1	Ocean	all
W. Pacific	2	Ocean	all

BL source contributions by region

200 mb



100 mb

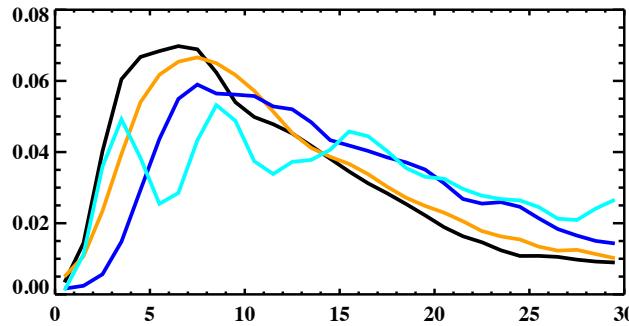


Normalized contributions tell a consistent story –
despite large differences in total BL contribution

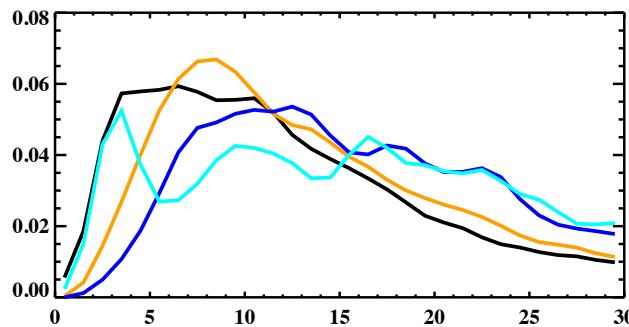
Discrepancies for 200 mb results are largely resolved
via vertical velocity adjustments

Normalized Age of Air Spectra

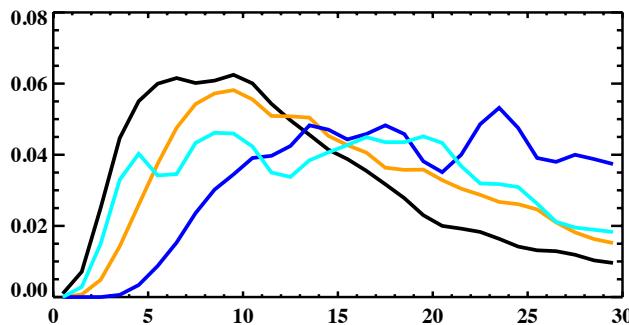
(a) ECMWF



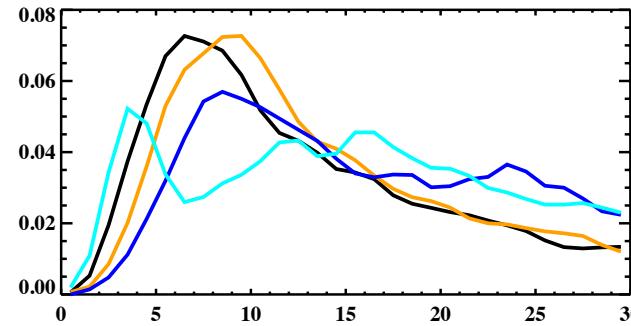
(b) GFS



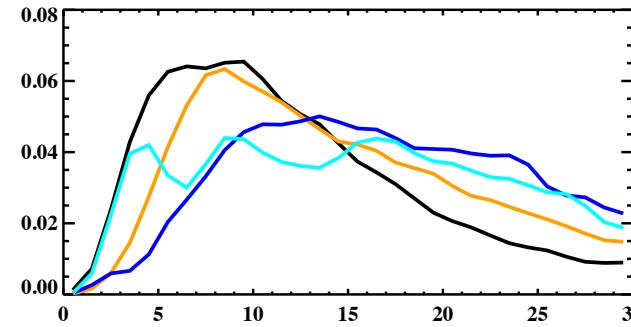
(c) MERRA



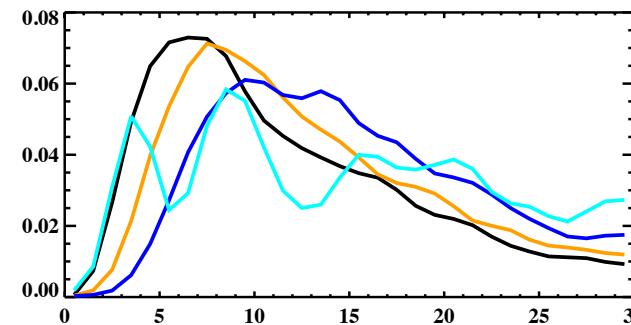
(d) MERRA with ECMWF omega



(e) MERRA with omega adjustment



(f) ECWMF at MERRA resolution



Time (days)

Tibetan Plateau

India

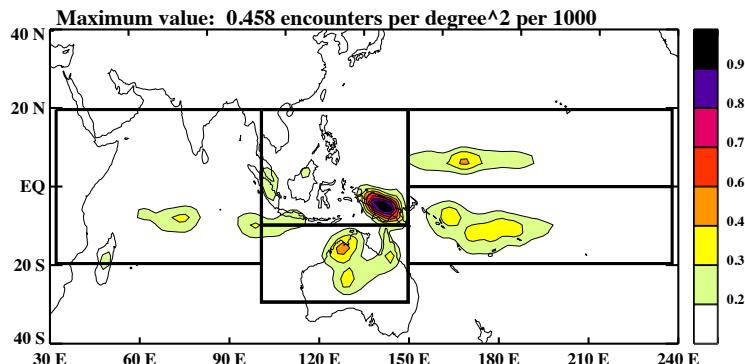
Indian Ocean

West Pacific

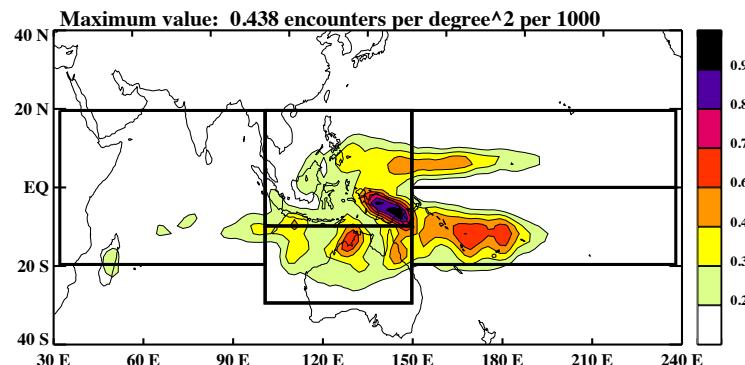
200 mb

MERRA

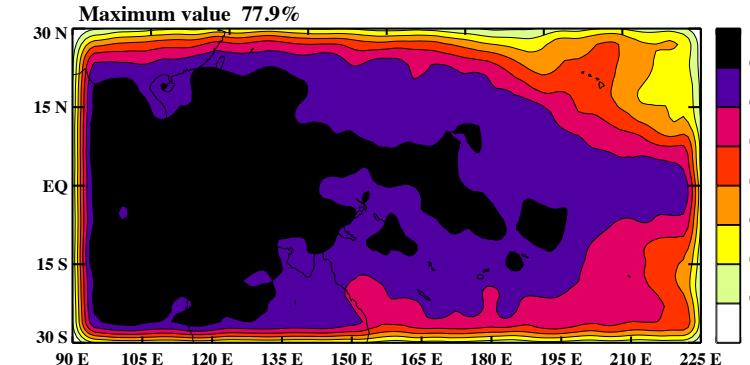
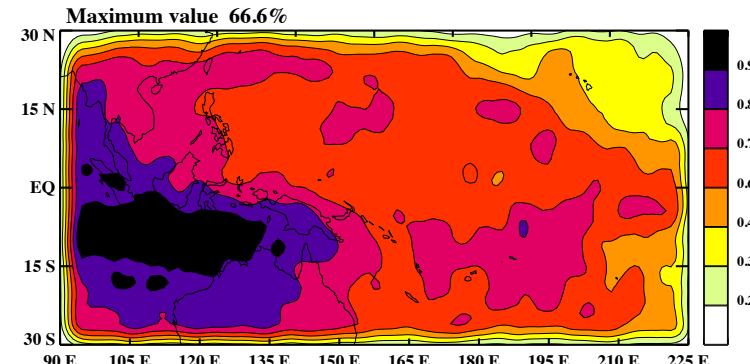
Boundary layer sources



ECMWF



New air concentration



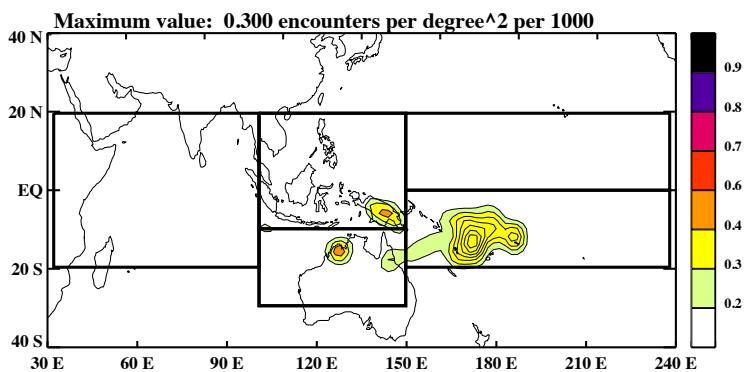
Amplitudes are in better agreement than for SEAC⁴RS study

Spatial patterns do not agree quite as well

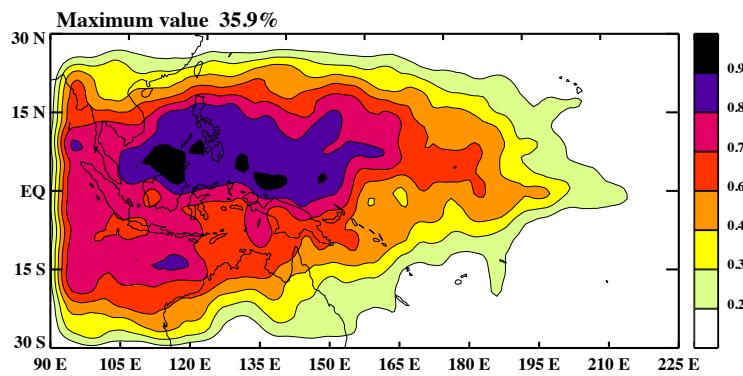
100 mb

MERRA

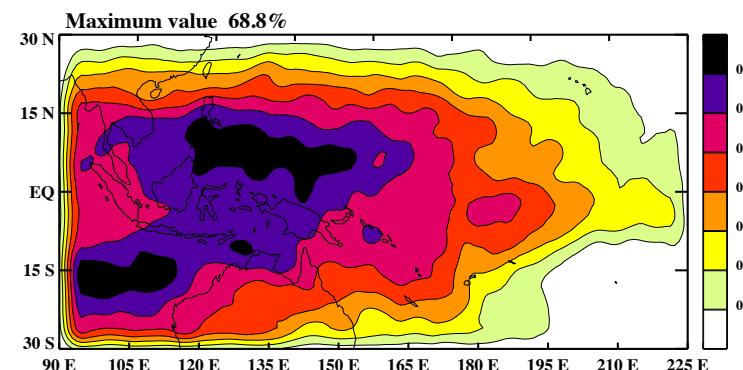
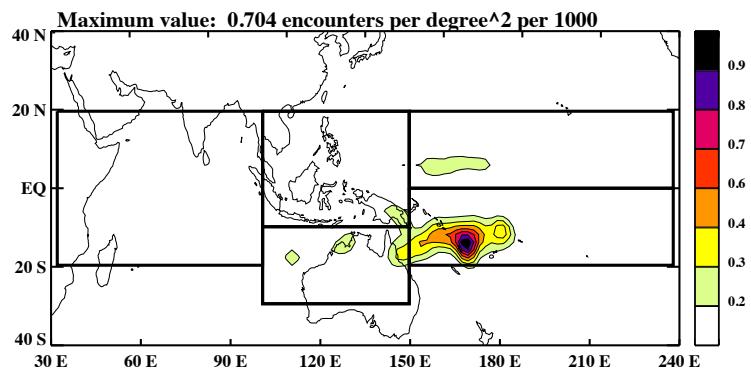
Boundary layer sources



New air concentration

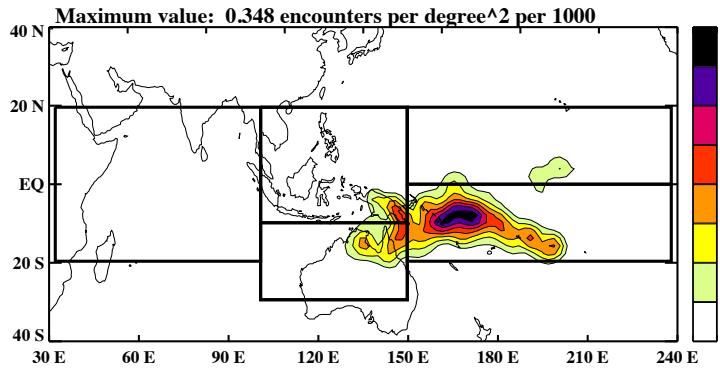


ECMWF

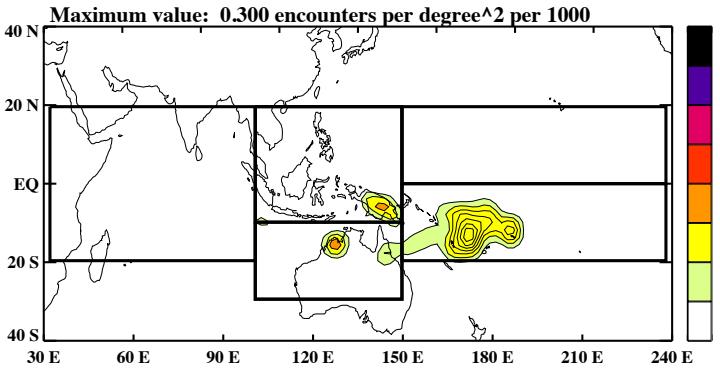


Interannual variations for MERRA trajectories initiated at 100 mb

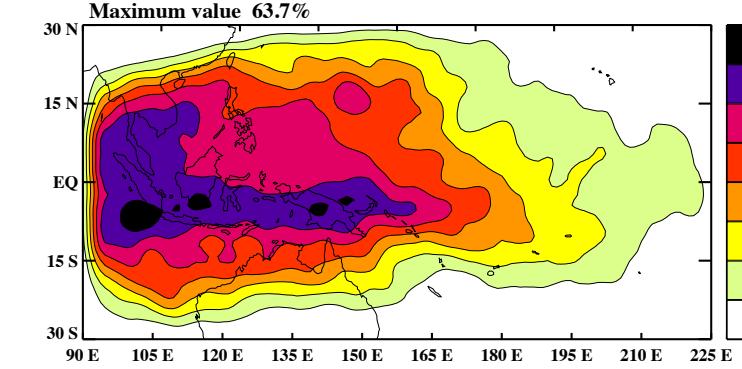
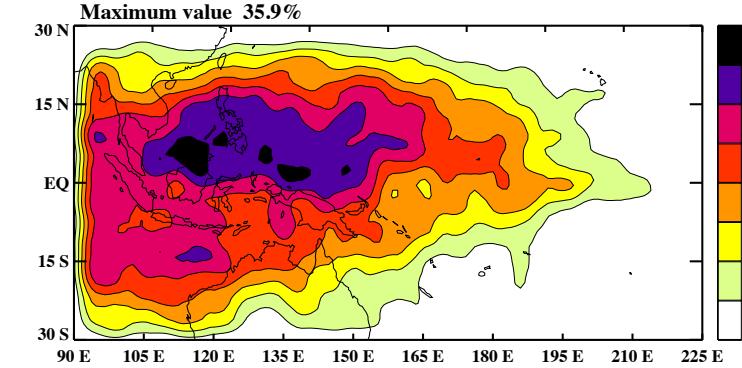
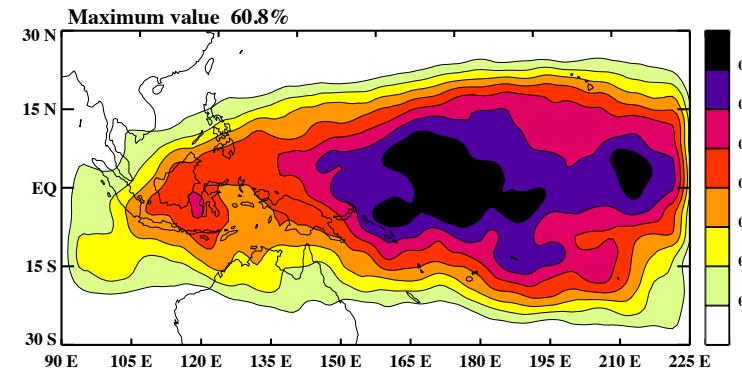
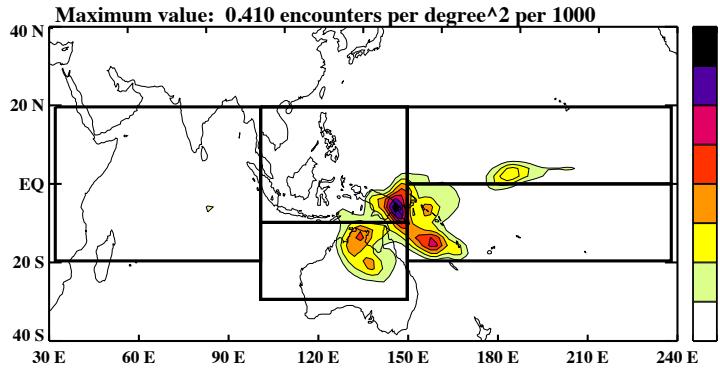
2010
Mild El Nino



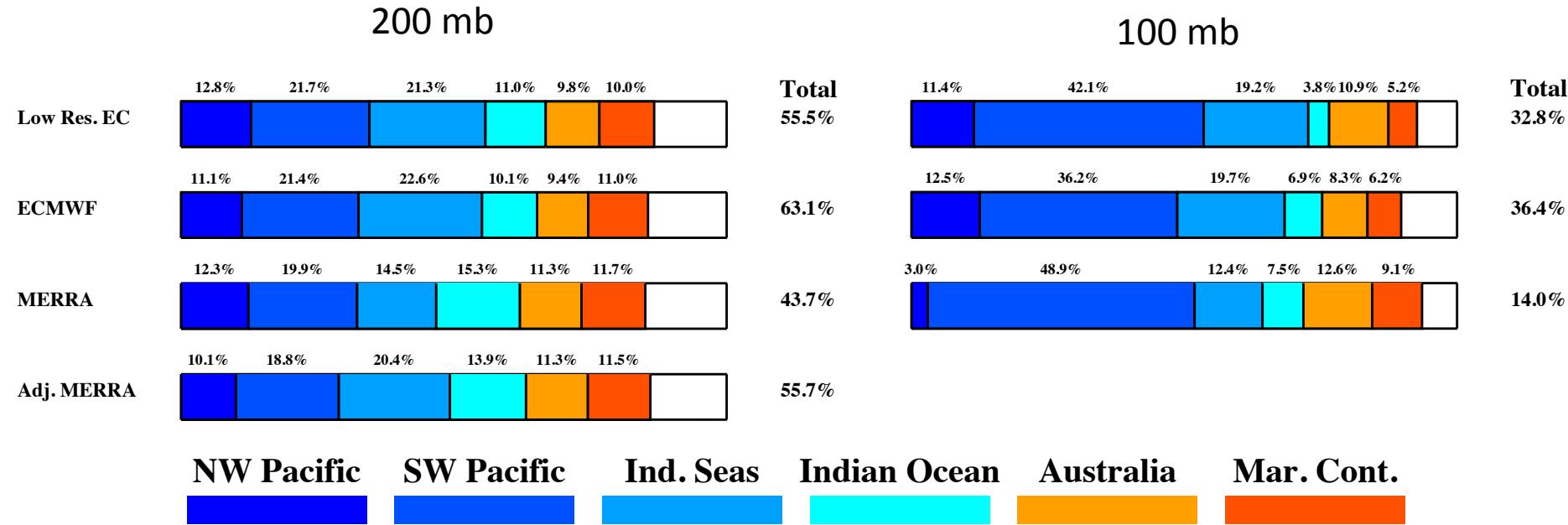
2011
Mild La Nina



2012
Neutral



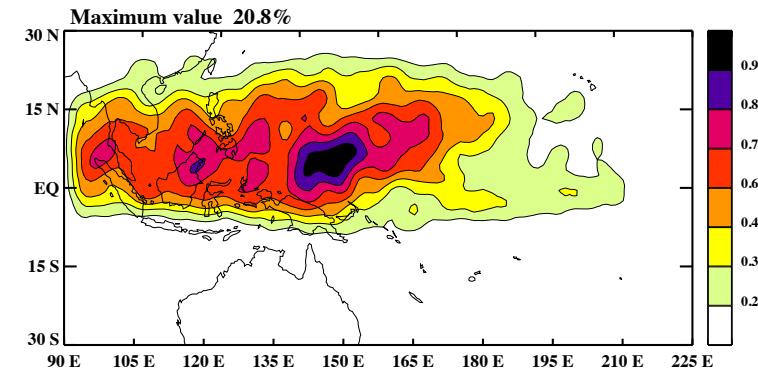
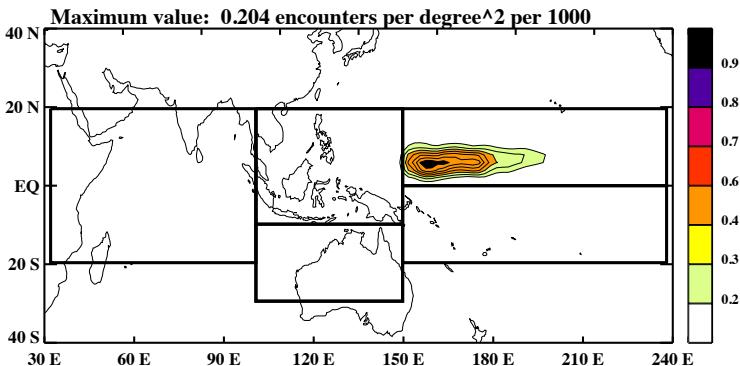
Regional contributions



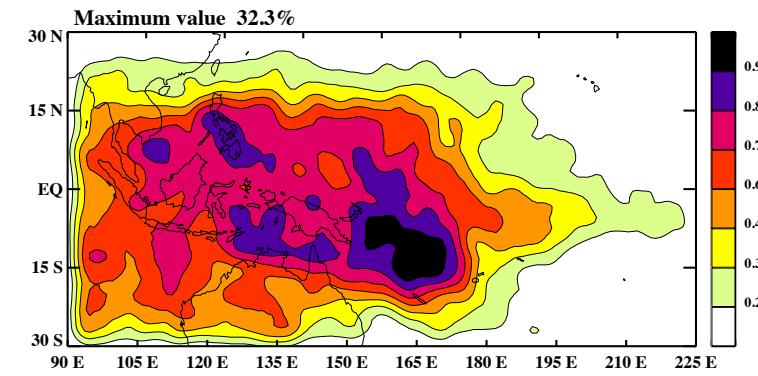
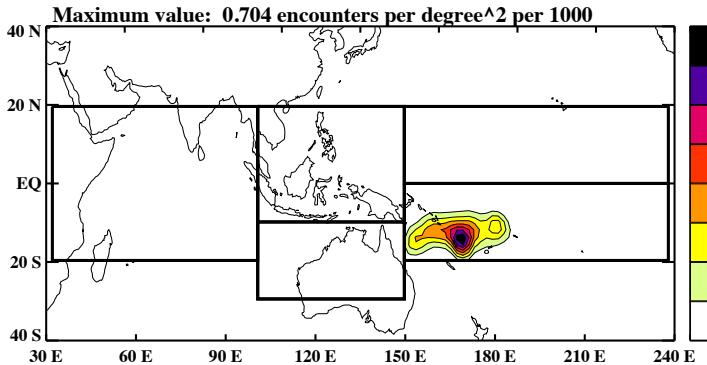
Spatial patterns for regional Contributions

ECMWF trajectories initiated at 100 mb

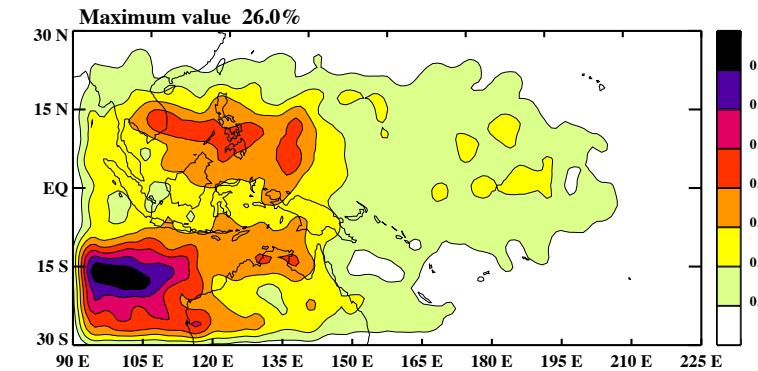
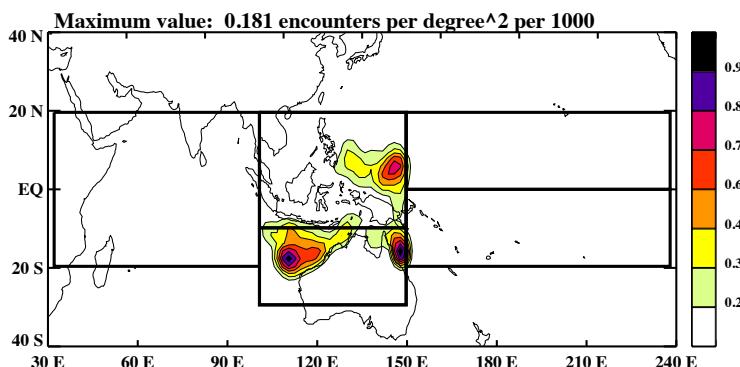
NW Pacific



SW Pacific



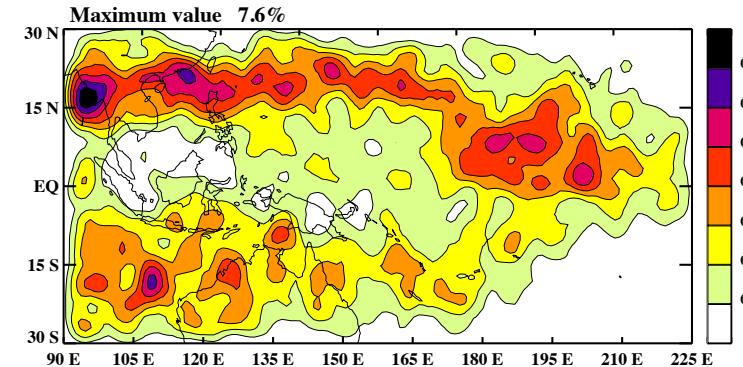
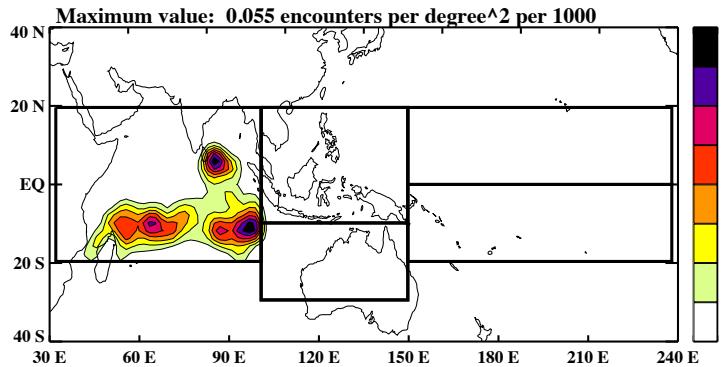
Indonesian
Seas



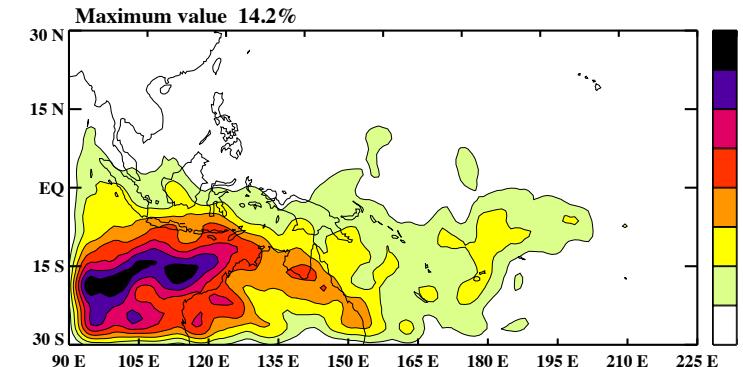
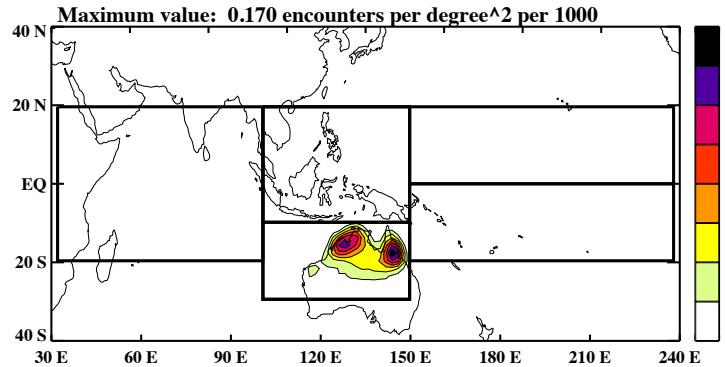
Spatial patterns for regional Contributions

ECMWF trajectories initiated at 100 mb

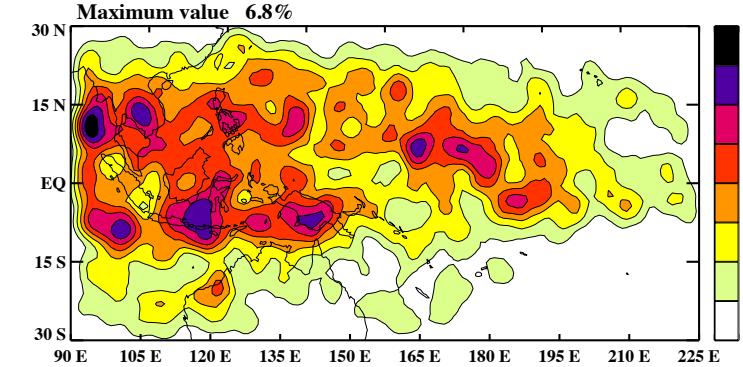
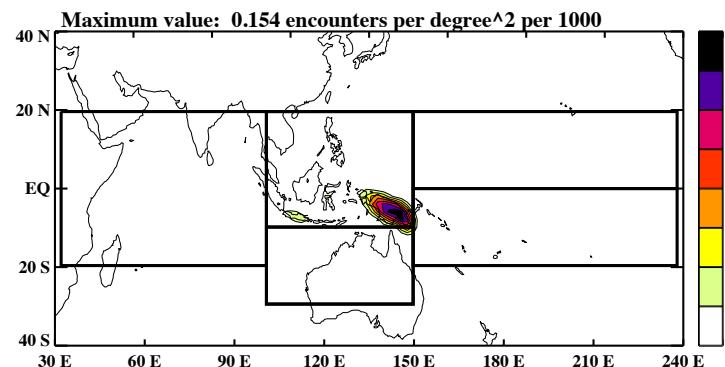
Indian Ocean



Australia



Maritime
Continent



SD-CAM simulations

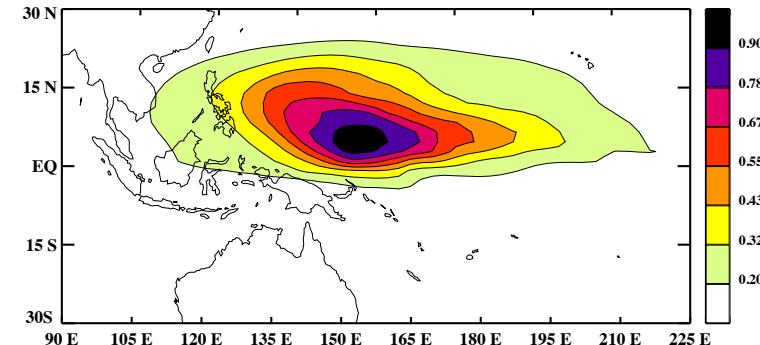
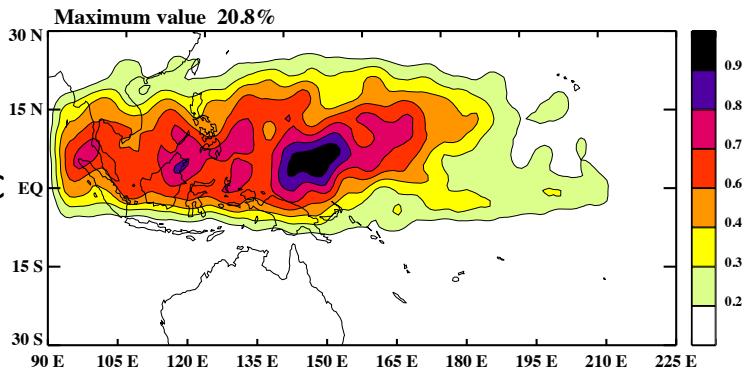
courtesy of C. Bardeen

- NCAR CAM with specified dynamics
 - relaxation to GEOS5 temperature, horizontal winds, some surface fluxes
 - Relaxation time scale ≈ 2 d
- Tracers released into surface layer – maintaining constant mass mixing ratio
- Release a different tracer every day for each region

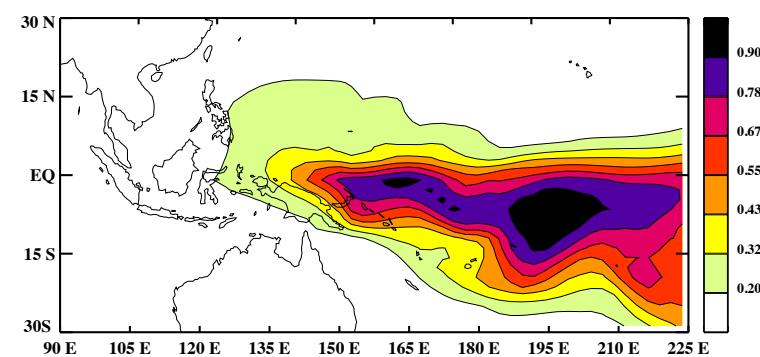
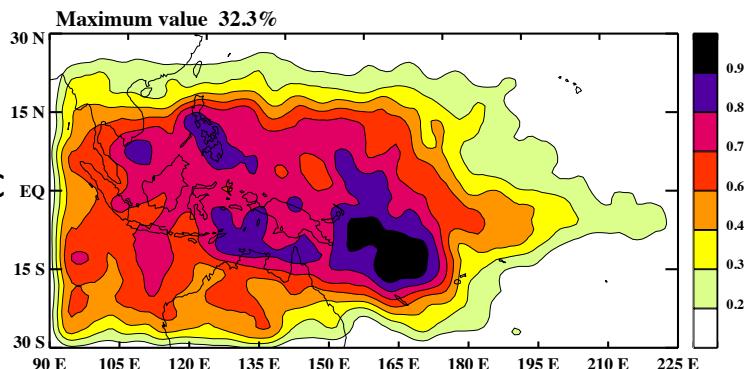
Model comparison

ECMWF trajectories initiated at 100 mb v. SD-CAM

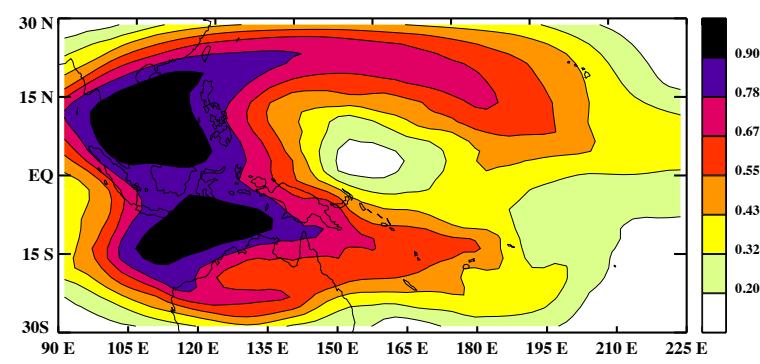
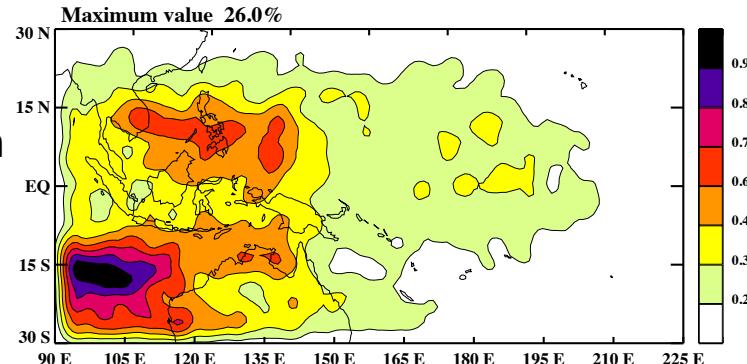
NW Pacific



SW Pacific



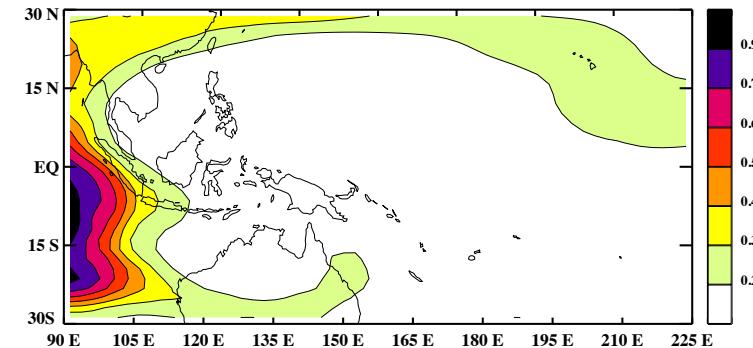
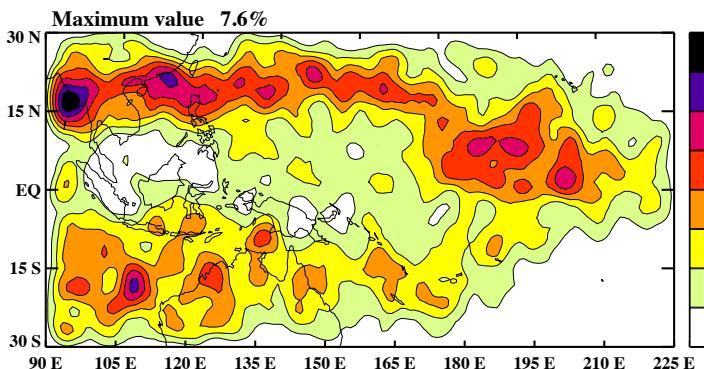
Indonesian Seas



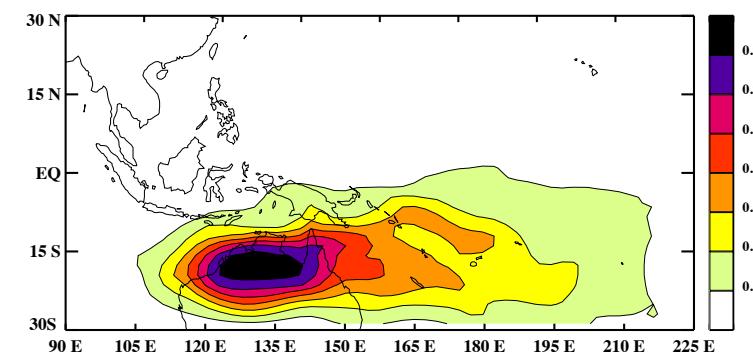
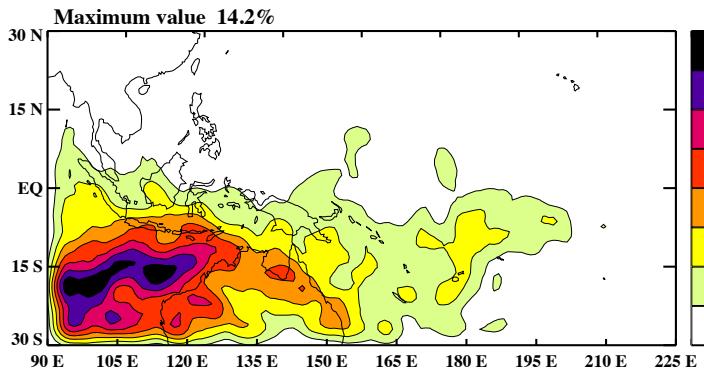
Model comparison

ECMWF trajectories initiated at 100 mb v. SD-CAM

Indian Ocean



Australia



Maritime
Continent

