NATIONAL INSTITUTE OF METEOROLOGY AND HYDROLOGY (INAMHI)

INTENSE RAINFALL EVENT IN ECUADOR

NAME: VLADIMIR ARREAGA

Washington, March 24 / 2015

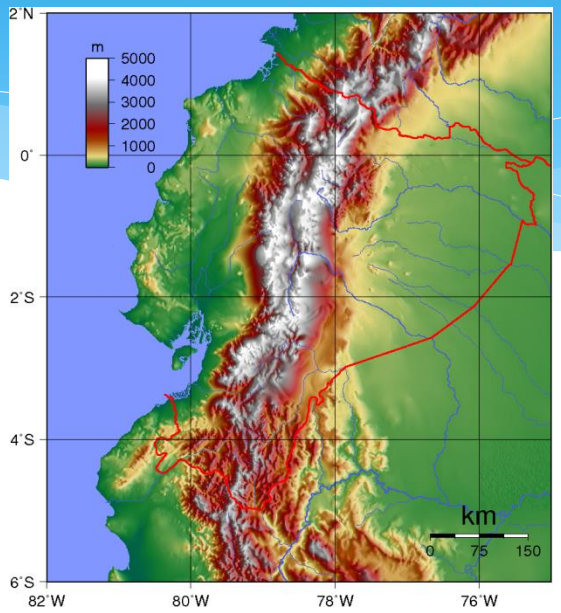
LOCATION

- LOCATED IN THE NORTHWEST OF SOUTH AMERICA

REGIONS:

- ✓ COAST
- ✓ ANDES
- ✓ AMAZON
- ✓ GALAPAGOS ISLANDS

OROGRAPHY



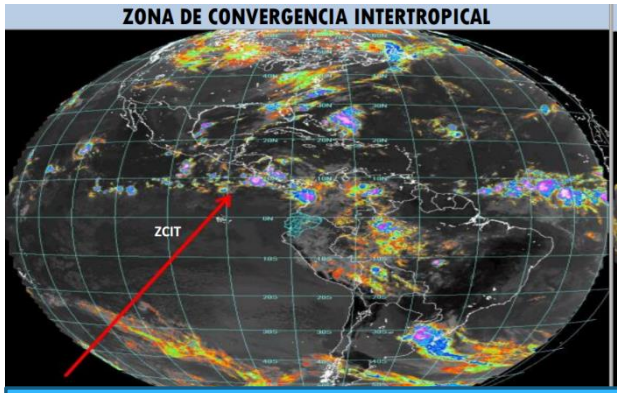
MAIN ELEVATIONS

WESTERN RANGE	
CHILES	4.720 m.
ILINIZA	5.266 m.
PICHINCHA	4.787 m.
CHIMBORAZO	6.310 m.

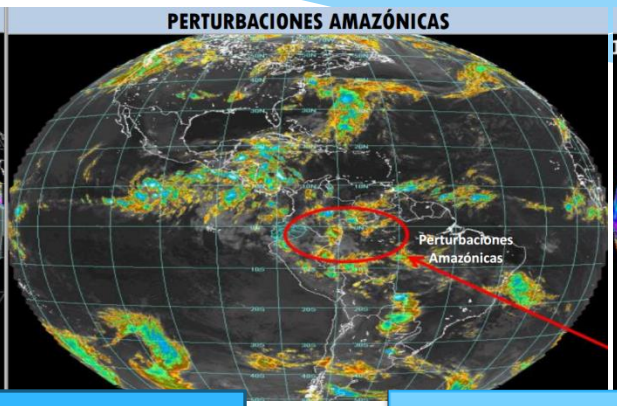
CENTRAL RANGE	
CAYAMBE	5.840 m.
ANTIZANA	5.790 m.
COTOPAXI	6.005 m.
TUNGURAHUA	5.016 m.
ALTAR	5.319 m.

ATMOSPHERIC SYSTEMS THAT MODULATE RAINFALL IN ECUADOR

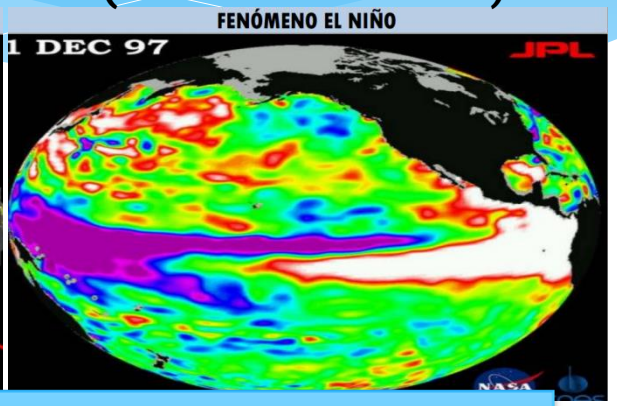
ITCZ



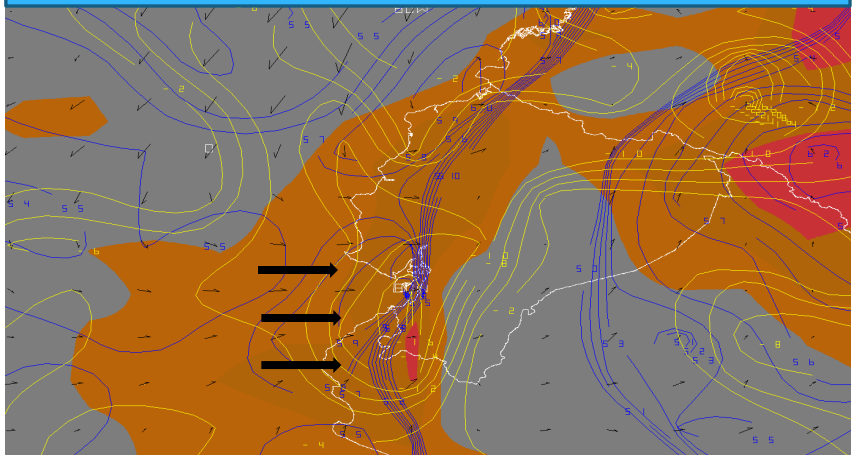
MESOSCALE PERTURBATIONS ARRIVING FROM THE AMAZON



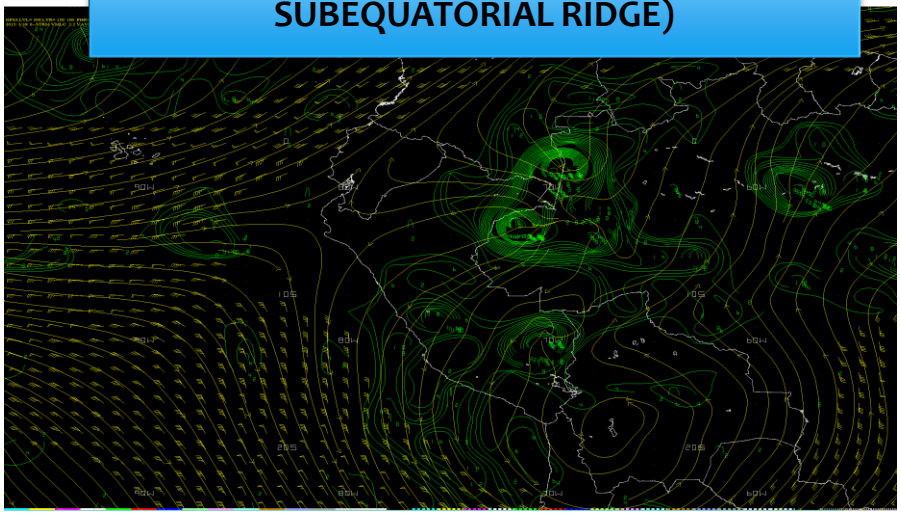
WARM STT (ESPECIALLY ENSO)



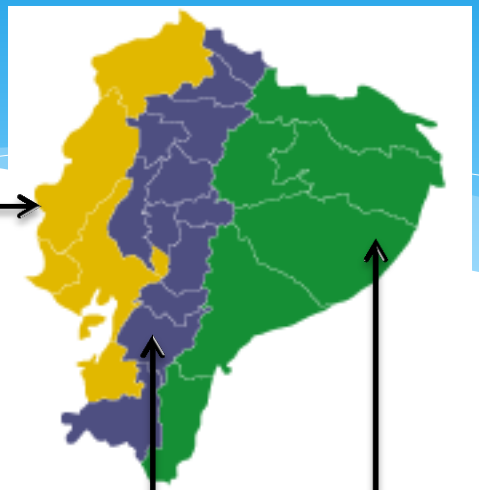
850 hPa WESTERLY BURSTS ALONG COAST

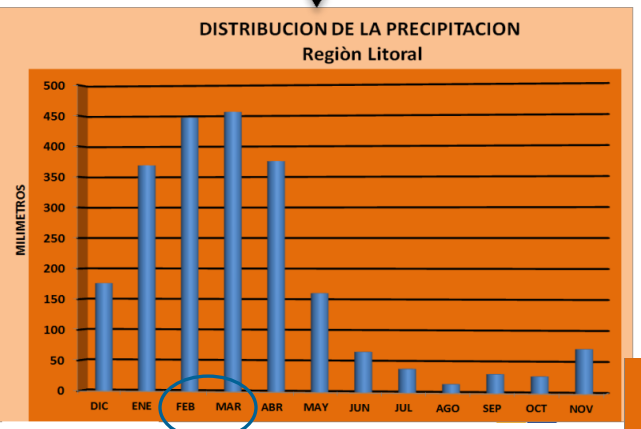


UPPER VENTILATION (SUBTORPICAL RIDGE – SUBEQUATORIAL RIDGE)

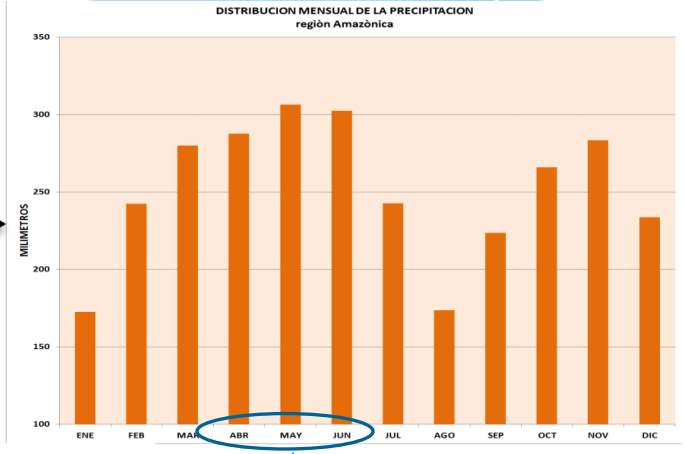


DISTRIBUTION PRECIPITATION IN ECUADOR

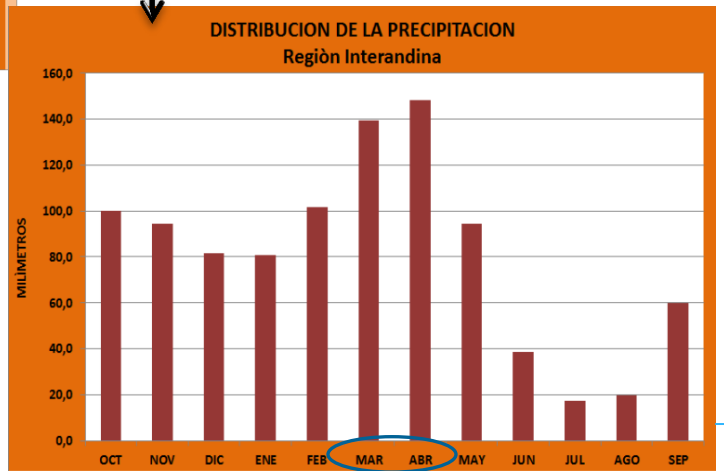




MAXIMUM PEAK
FEB - MAR



MAXIMUM PEAK
APR - MAY - JUN



MAXIMUM PEAK
MAR - APR

TIME LINE OF HEAVY RAINFALL EVENT

MARCH 16 – 18 / 2015

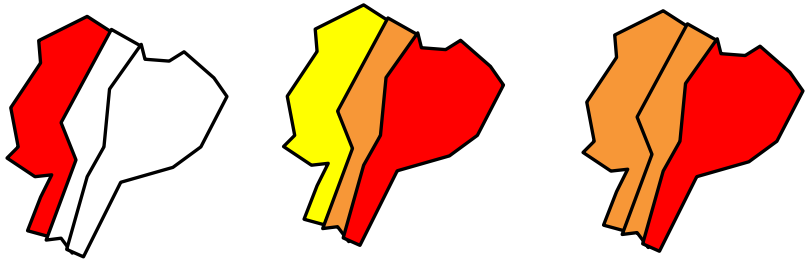
RAINFALL TOTALS IN mm /DAY

DAY/REGION	16	17	18
COAST	30 - 194	0 -30	5 -60
ANDES	0 - 5	15 - 35	5 - 35
AMAZON	0 - 5	10 - 78	10 - 80

LIGHT

MODERATE

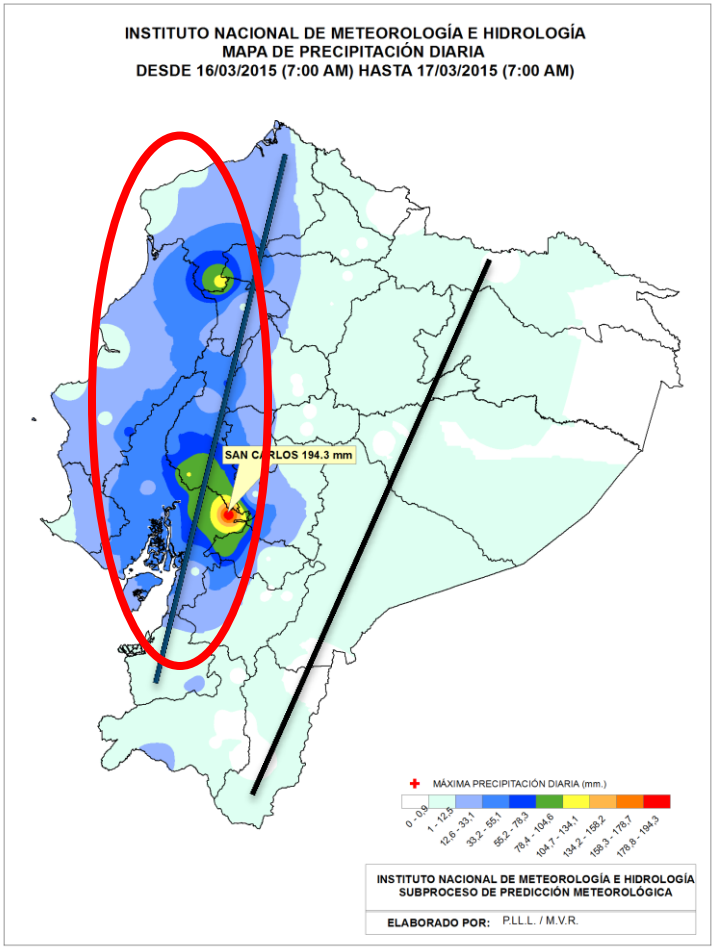
HEAVY

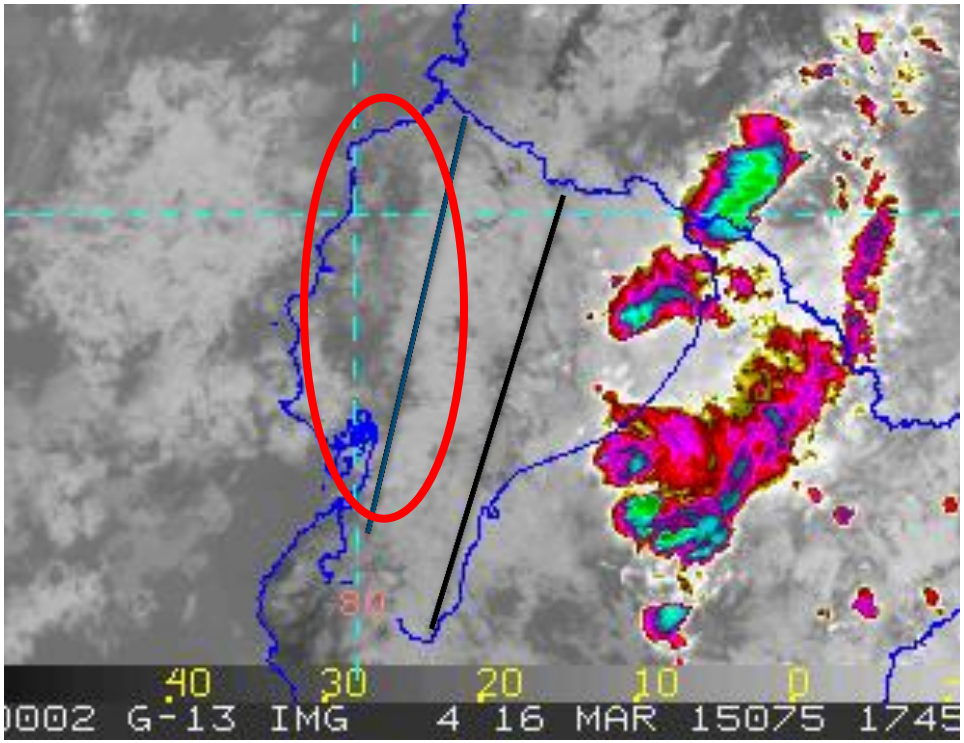


D1 D2 D3

IMAGES OF THE EVENT

DAY 1: HEAVY RAINS OVER THE COAST





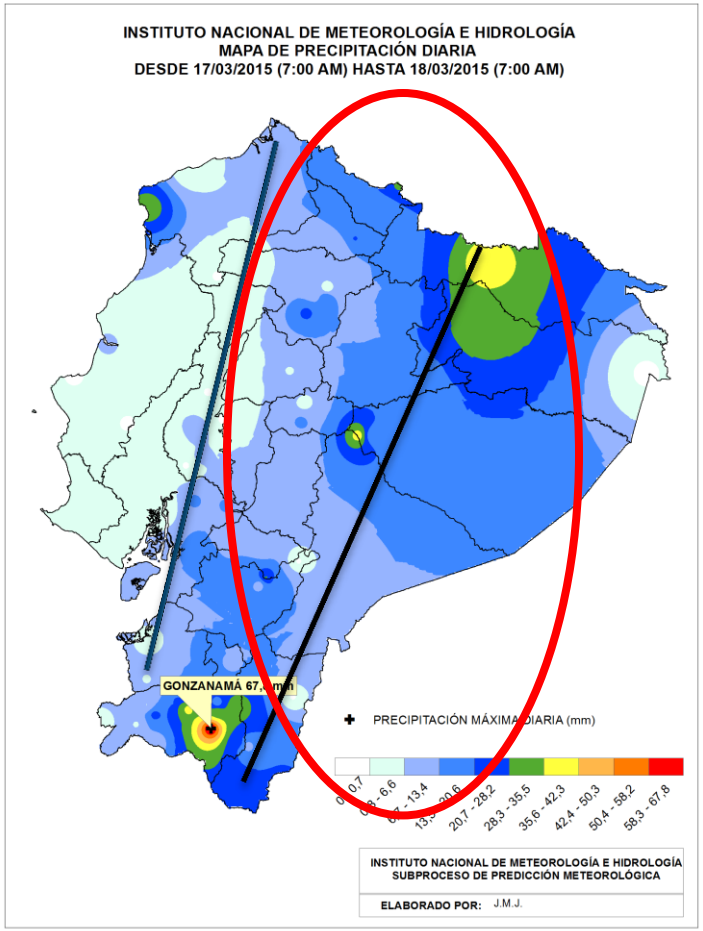
DAY/REGION	16
COAST	30 - 194
ANDES	0 - 5
AMAZON	0 - 5

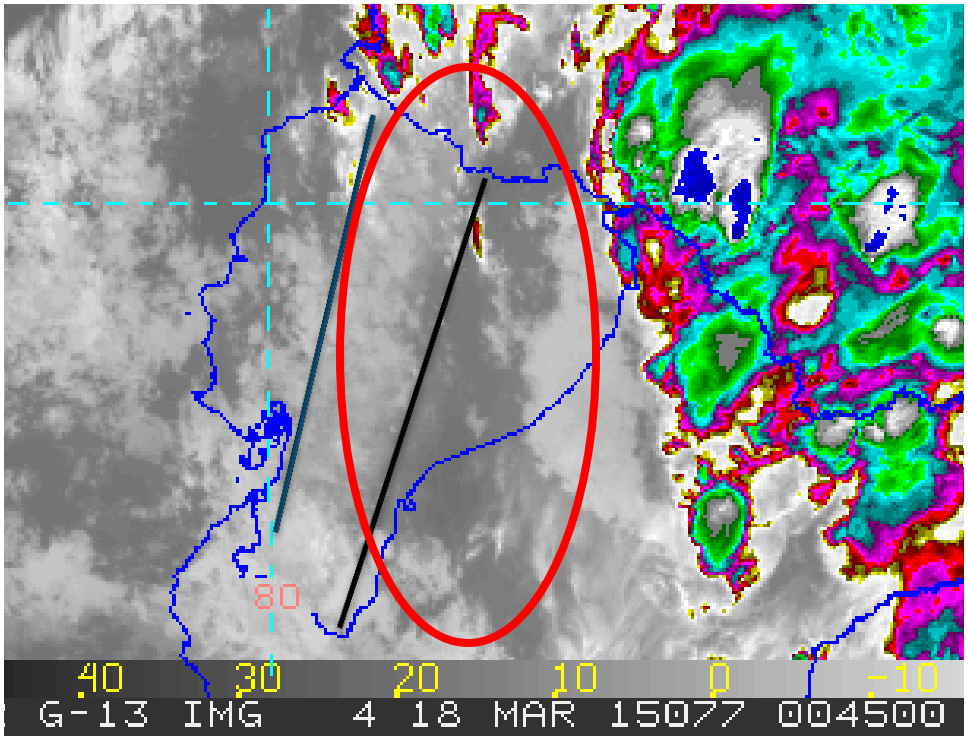
LIGHT

MODERATE

HEAVY

DAY 2: HEAVY RAINS OVER ANDES AND AMAZON





DAY/REGION	17
COAST	0 -30
ANDES	15 - 35
AMAZON	10 - 78

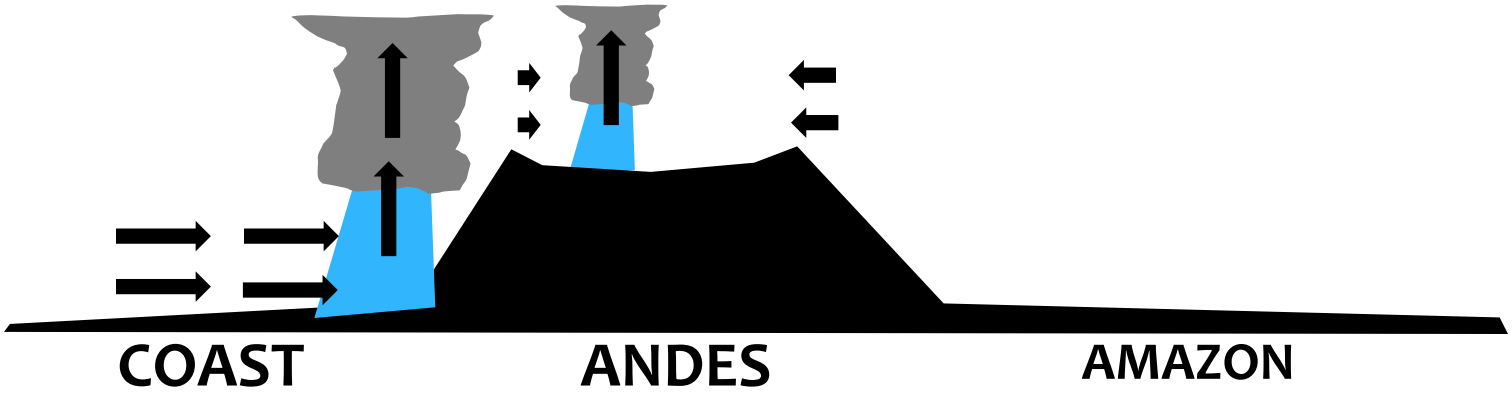
LIGHT

MODERATE

HEAVY

PREDICTORS ANALYZED

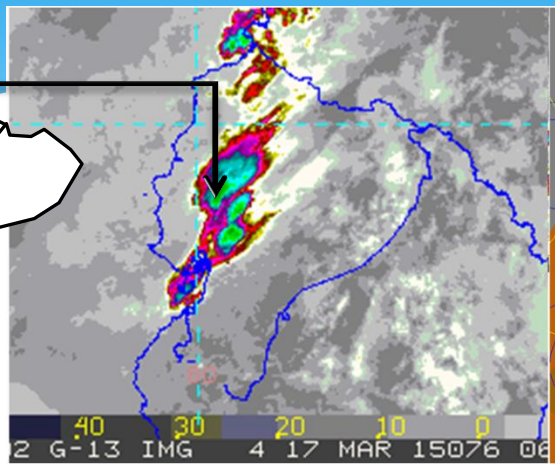
INSTABILITY	GDI	GDI	GDI
UPPER-LEVEL DIVERGENCE	200-300 hPa DIVERGENCE	200-300 hPa DIVERGENCE	200-300 hPa DIVERGENCE
LOW-LEVEL CONVERGENCE	925-850 hPa CONVERGENCE	**500-600 hPa** CONVERGENCE	925-850 hPa CONVERGENCE
MOISTURE	PRECIPITABLE WATER	DEWPOINTS 700-500 hPa	PRECIPITABLE WATER
FLOW	Westerlies > 10kt at 925-850 hPa (onshore flow)	(a) Weak 600-500hPa winds from moist region or (b) 600-500 winds that converge over Andes	Easterlies or convergent winds at 925-850 hPa Mesoscale perturbations



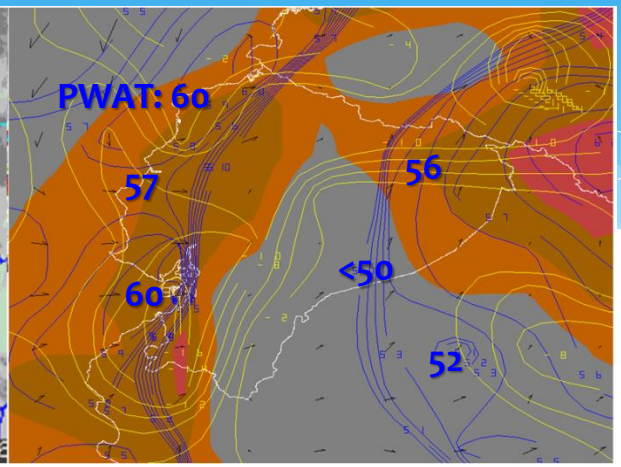
COMPARISON IR4 SATELLITE IMAGE vs GFS FORECAST

HEAVY RAINS

D1

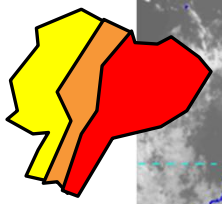


17 MARCH 06:15 UTC

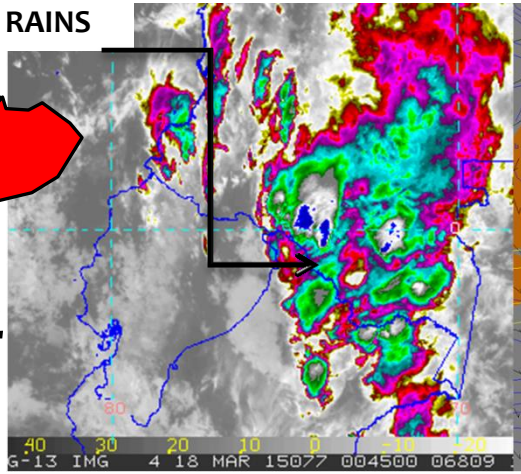


17 MARCH 06:00 UTC

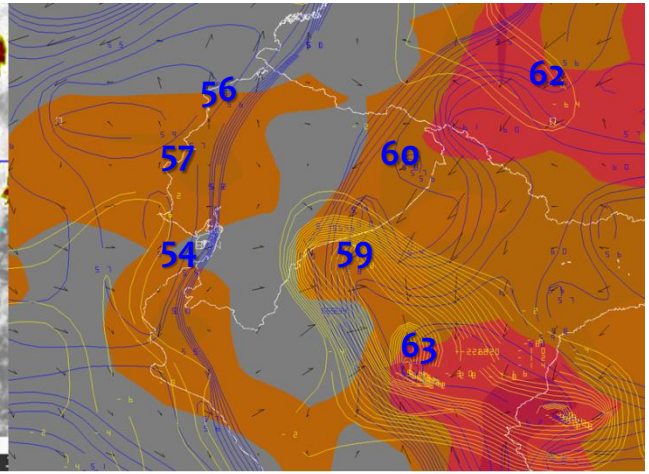
HEAVY RAINS



D2



18 MARCH 00:45 UTC



18 MARCH 00:00 UTC

LEGEND

STABILITY: GDI

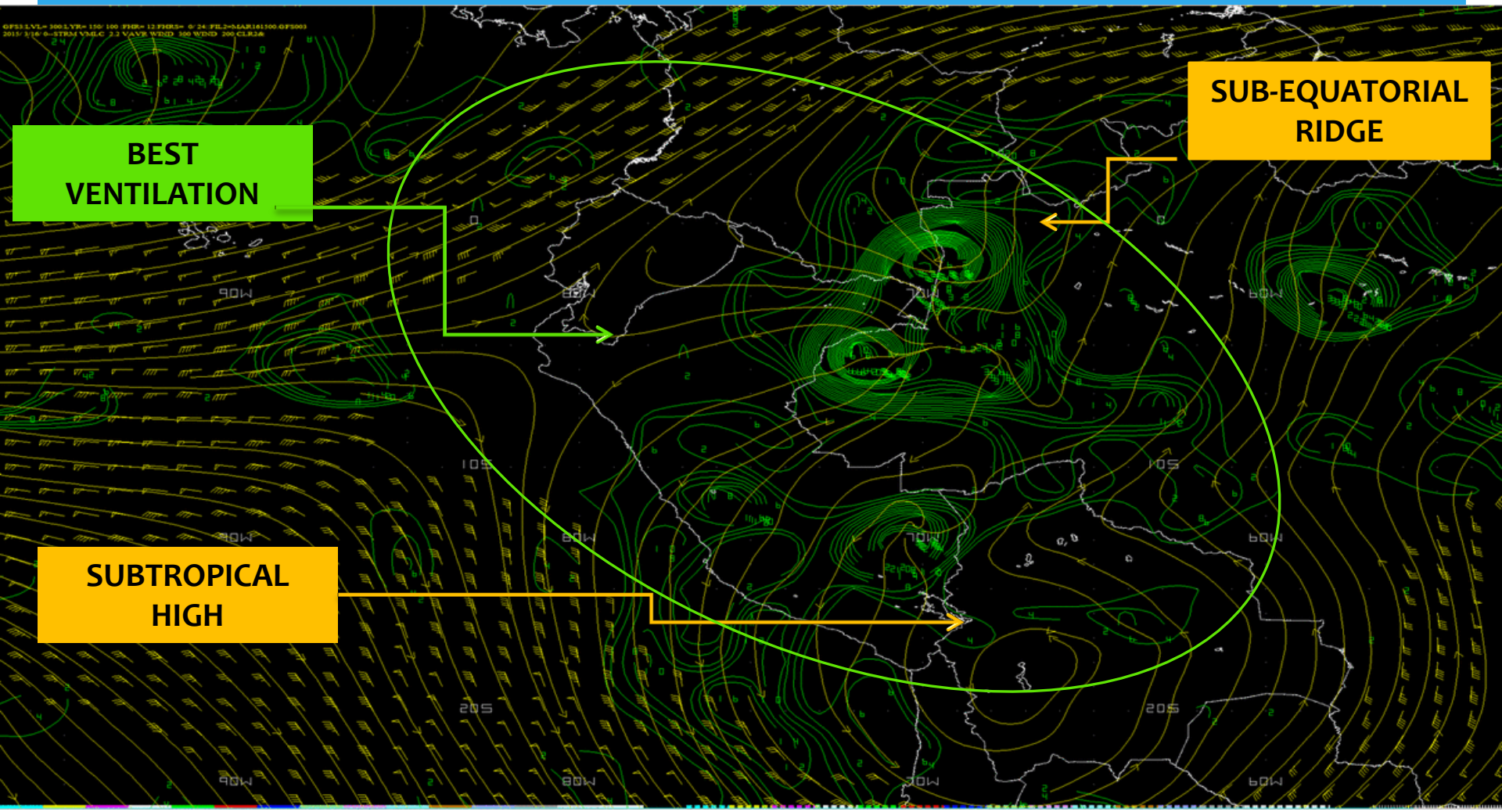
UNSTABLE
VERY UNSTABLE

PRECIPITABLE WATER
> 50 mm.

LOW LEVEL
CONVERGENCE
(925 – 850 MB)

WIND
925 – 850 MB

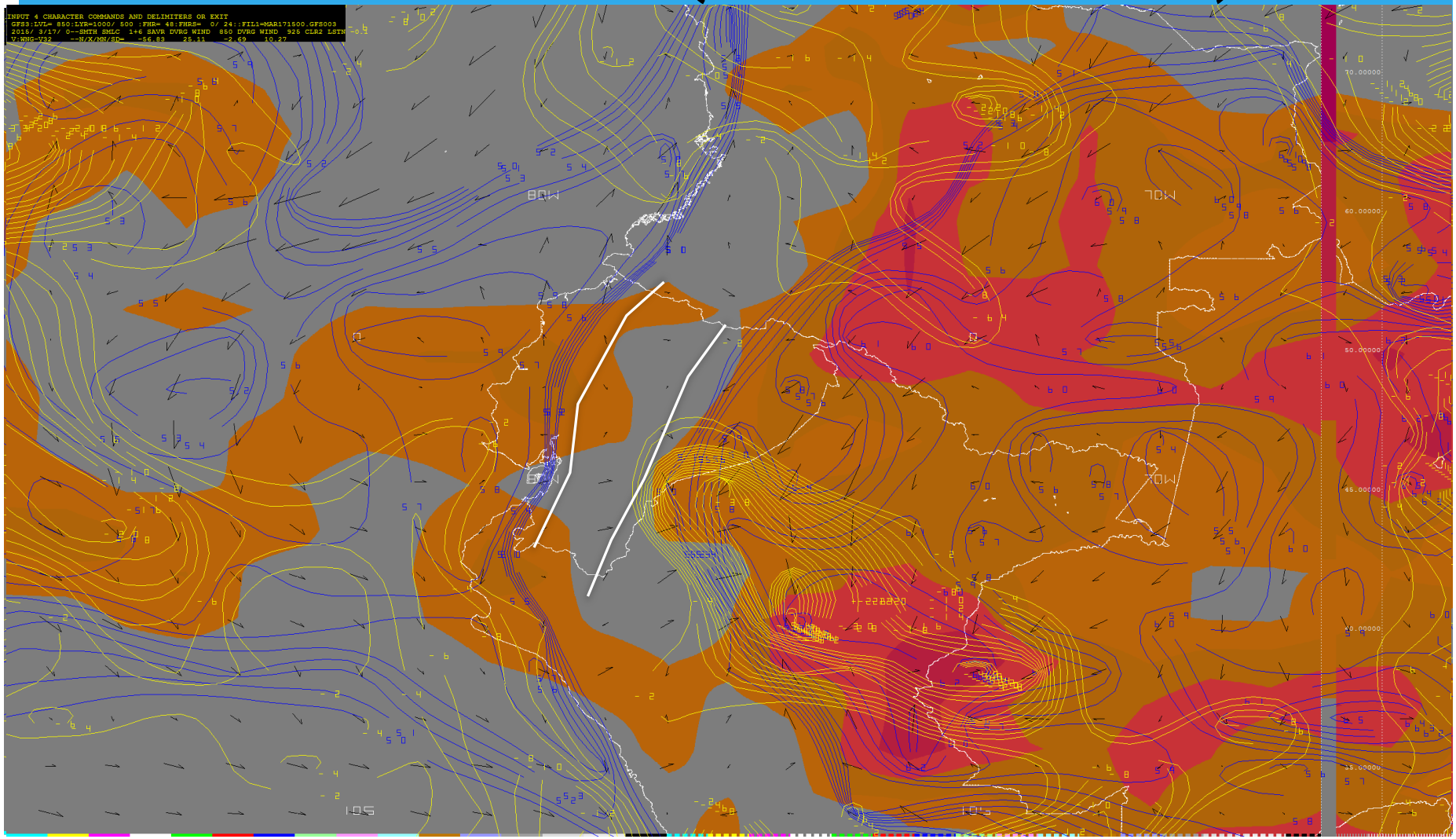
UPPER FLOW AND DIVERGENCE



UPPER WIND FLOW AND SPEED
300 – 200 MB

UPPER LEVEL DIVERGENCE
300 – 200 MB

EVOLUTION OF PREDICTORS FOR HEAVY RAINFALL IN LOW-LYING AREAS (COAST AND AMAZON)



STABILITY: GDI

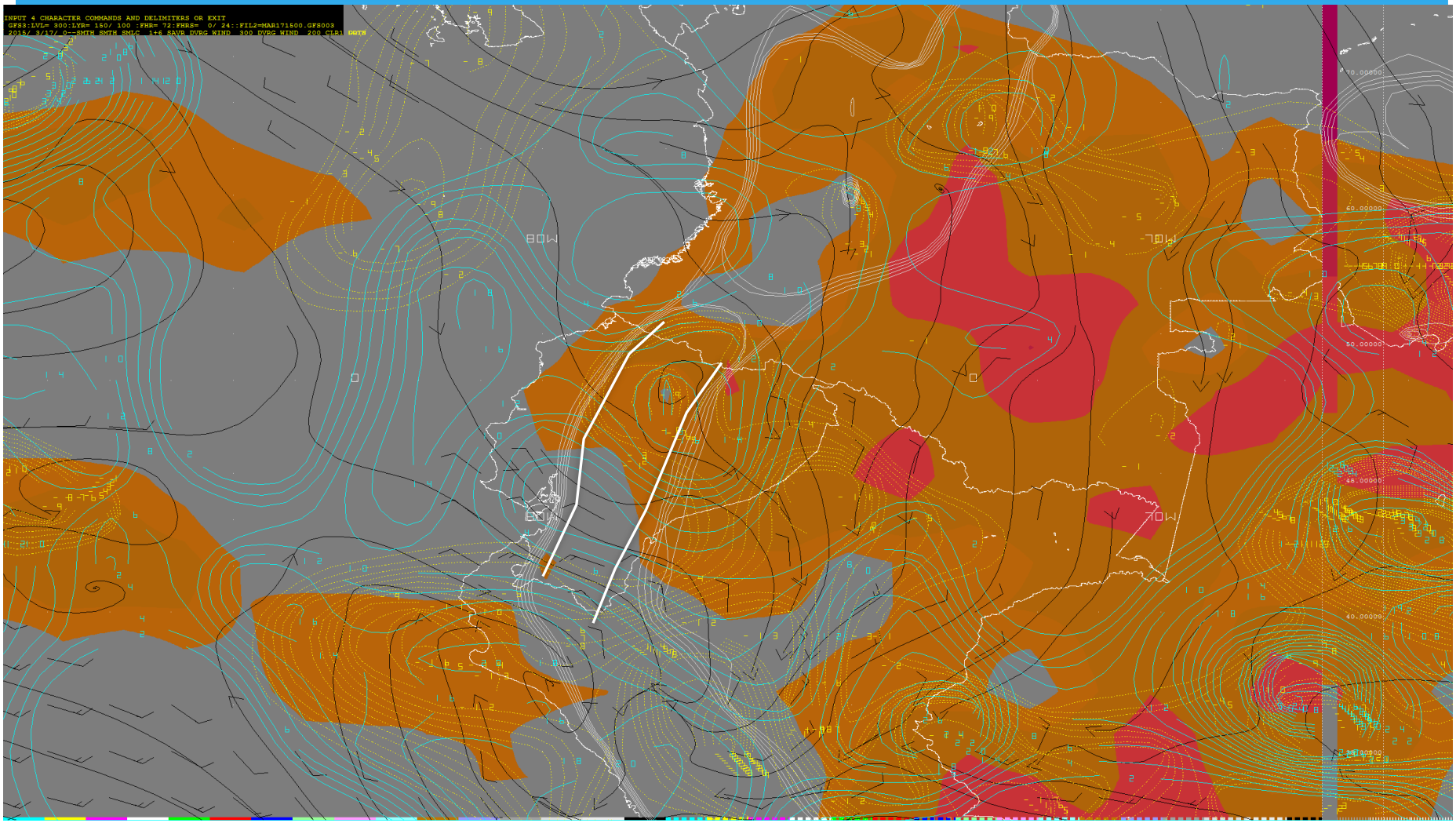
UNSTABLE
VERY UNSTABLE

PRECIPITABLE WATER
> 49 mm.

WIND
925 – 850 MB

LOW LEVEL
CONVERGENCE
(925 – 850 MB)

EVOLUTION OF PREDICTORS FOR HEAVY RAINFALL IN ANDES REGION



STABILITY: GDI

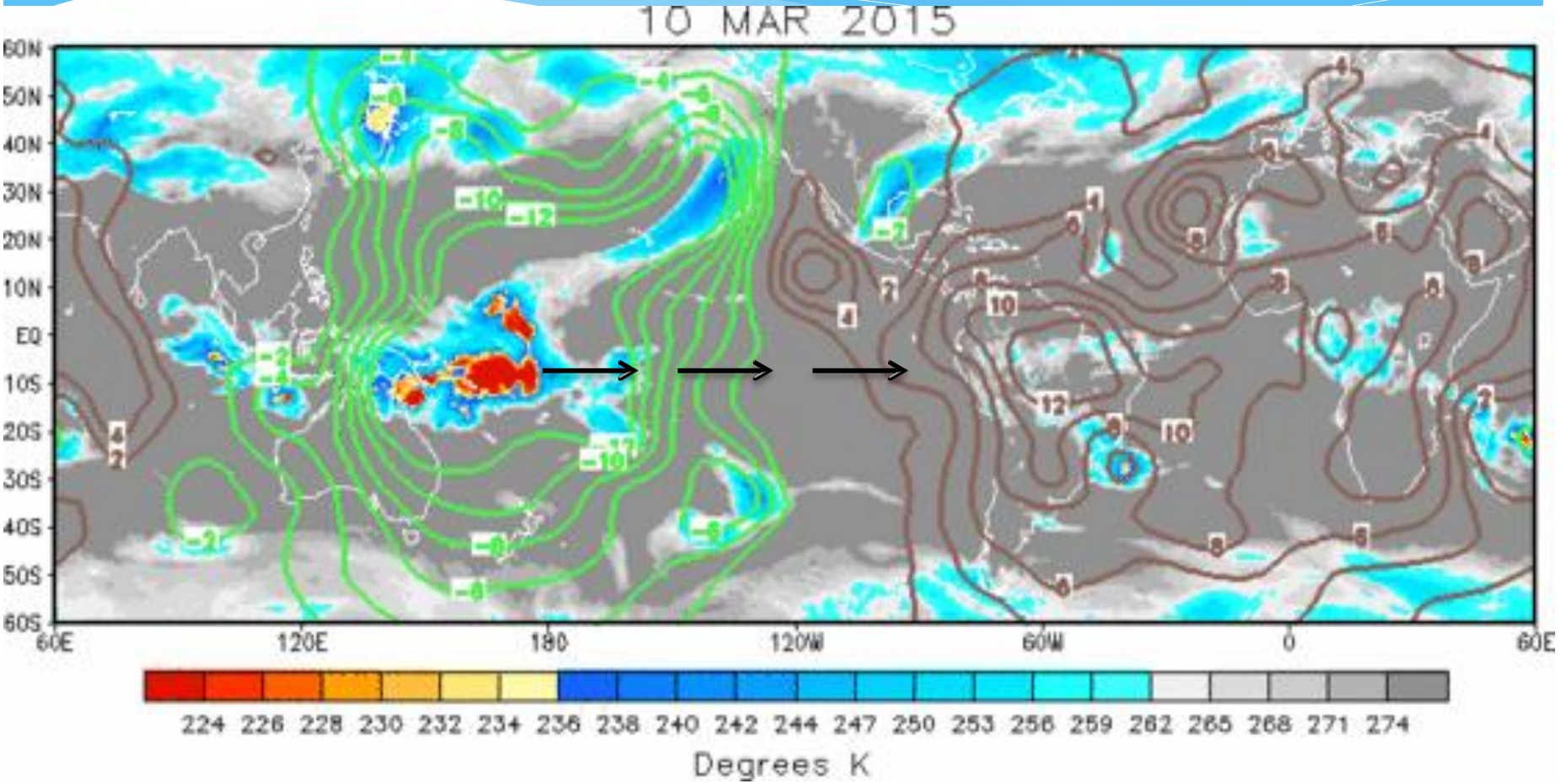
UNSTABLE
VERY UNSTABLE

WIND
600 – 500 MB

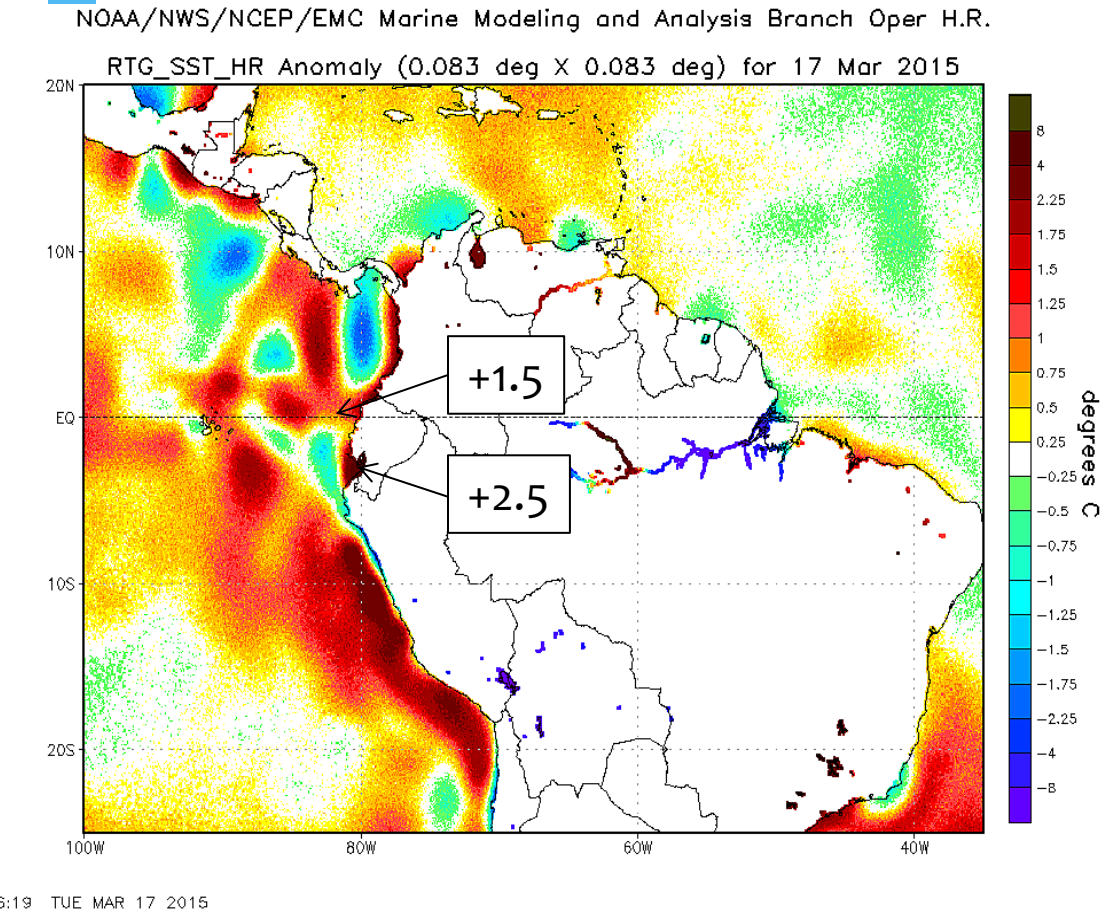
UPPER LEVELS
DIVERGENCE (300 – 200 MB)

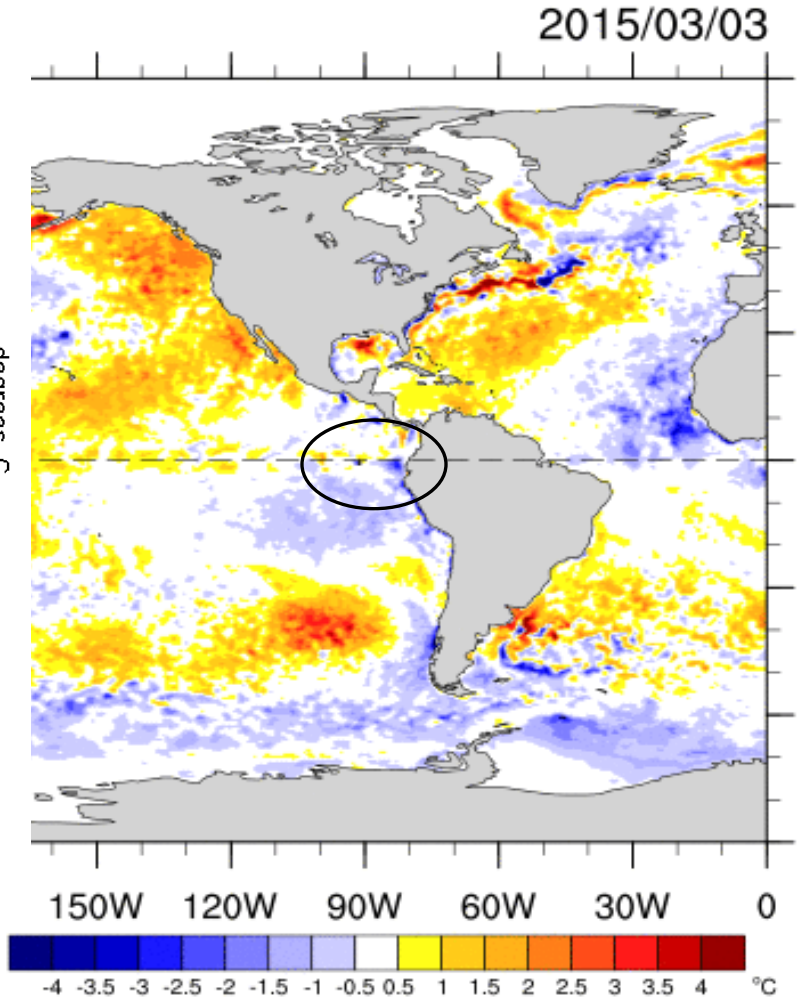
LOW LEVEL
CONVERGENCE
(925 – 850 MB)

IR 200 hPa – VELOCITY POTENTIAL ANOMALIES MADDEN JULIAN OSCILATION (MJO)



SEA SURFACE TEMPERATURE ANOMALIES AND EVOLUTION

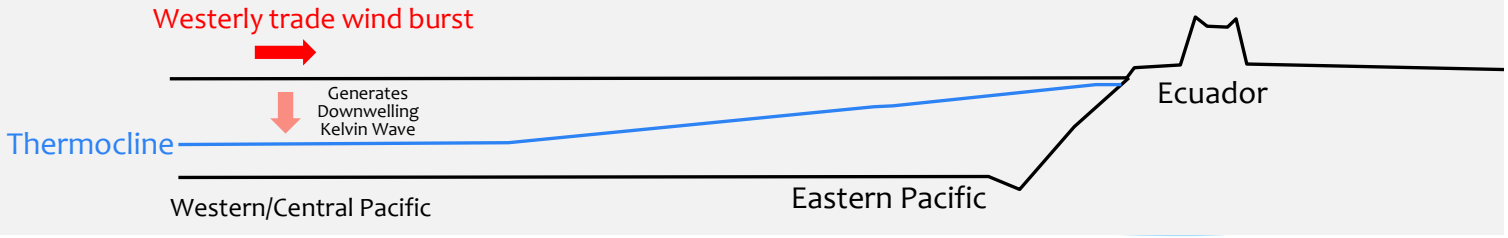




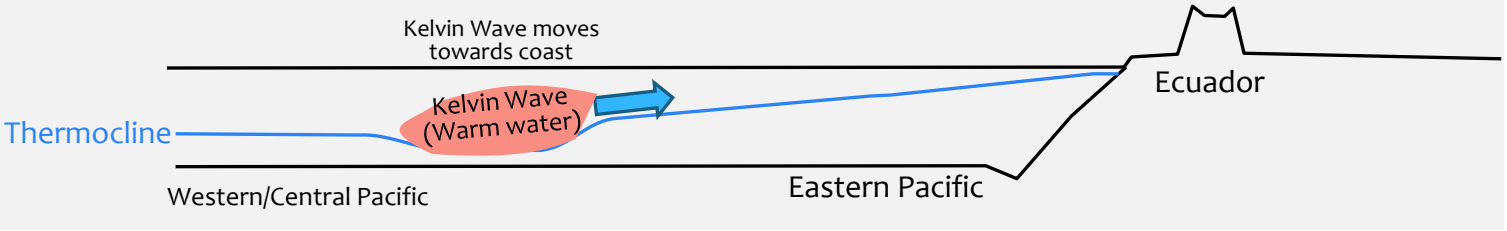
Oceanic Kelvin Wave Mechanism in Equatorial Pacific

1-3 month perspectives

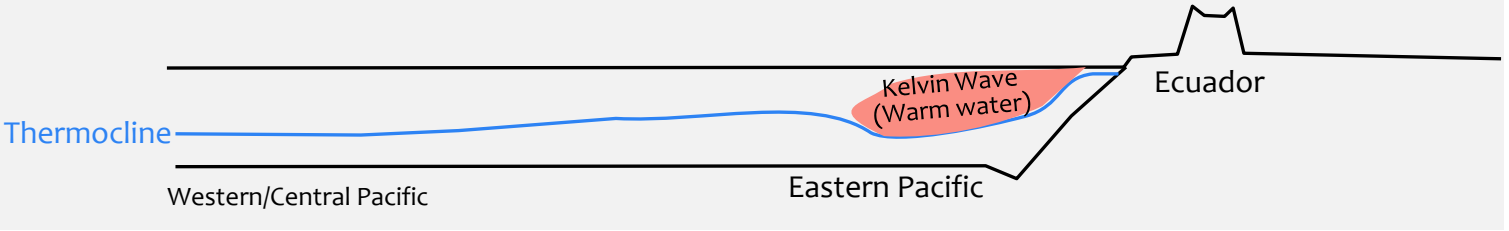
Westerly trade wind burst



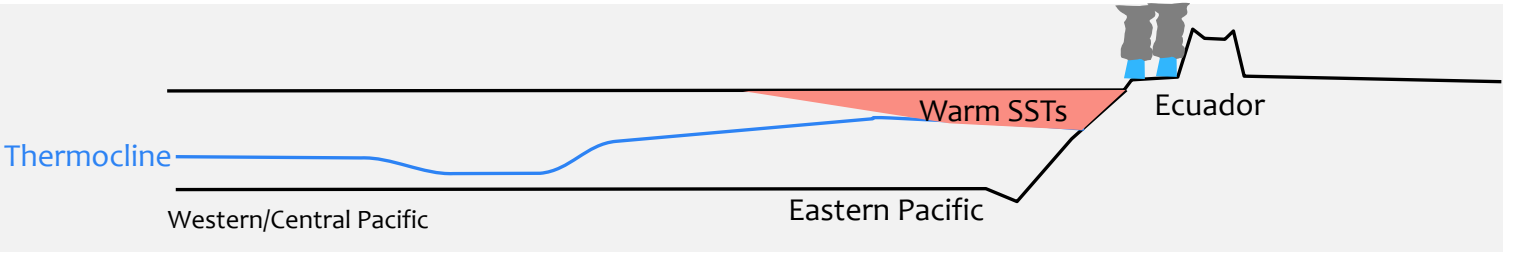
2-4 weeks later



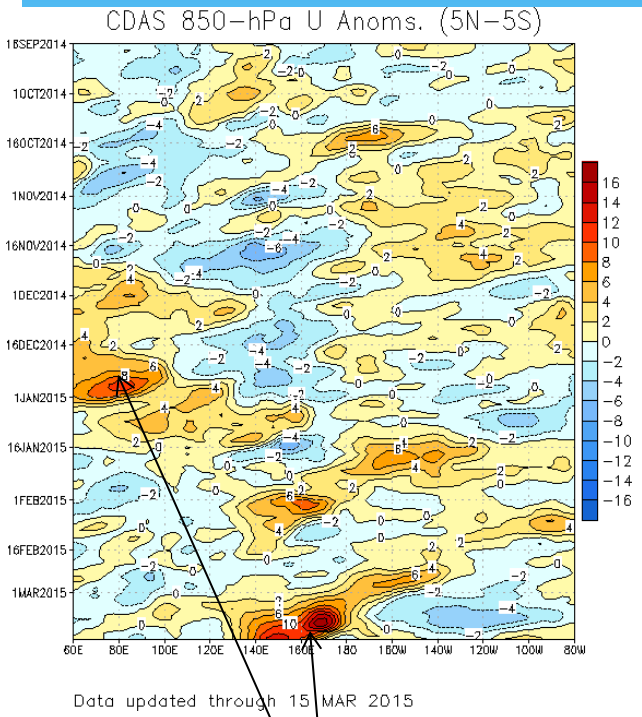
2-3 months later Kelvin arrives



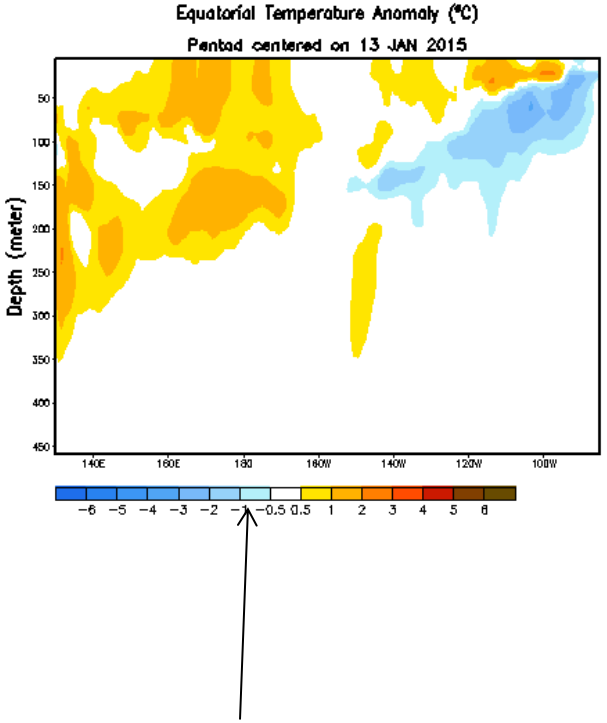
SSTs warm up and rains increase in Ecuador



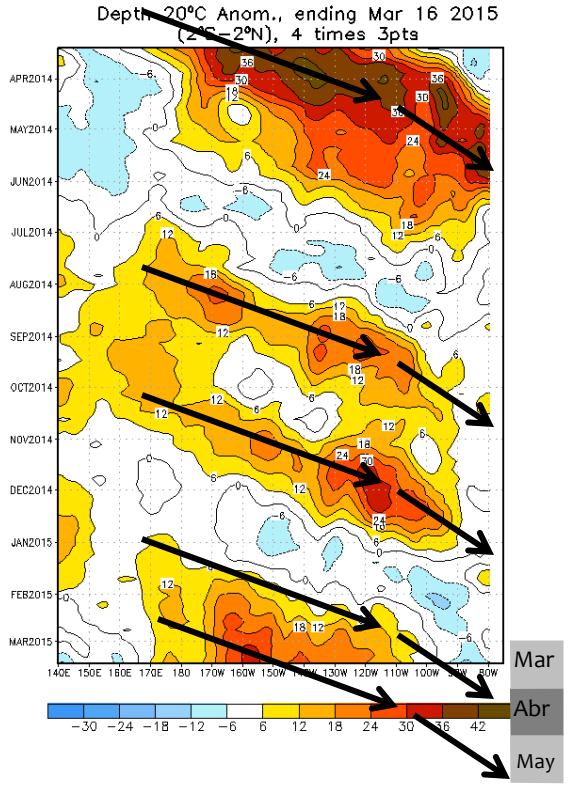
CURRENT PERSPECTIVES



Strong westerly wind bursts occurred in January and esp. March 2015



Current progression of Kelvin Waves (sea temperature anomalies)



ADDITIONAL SLIDES

LINKS

* http://polar.ncep.noaa.gov/sst/rtg_high_res/ ANOMALIAS SST
* http://www.ospo.noaa.gov/Products/ocean/sst/anomaly/ ANOMALIAS SST ARCHIVO
* http://www.esrl.noaa.gov/psd/map/clim/sst.anom.anim.week.html TSM ANIM
* http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/enso.shtml CPC EL NINO
* http://www.pmel.noaa.gov/tao/jsdisplay/ BOYAS MARINAS
* http://gifmaker.me/ ANIMACION DE IMAGENES