



NATIONAL INSTITUTE OF METEOROLOGY AND HYDROLOGY (INAMHI)

INTENSE RAINFALL EVENT IN ECUADOR



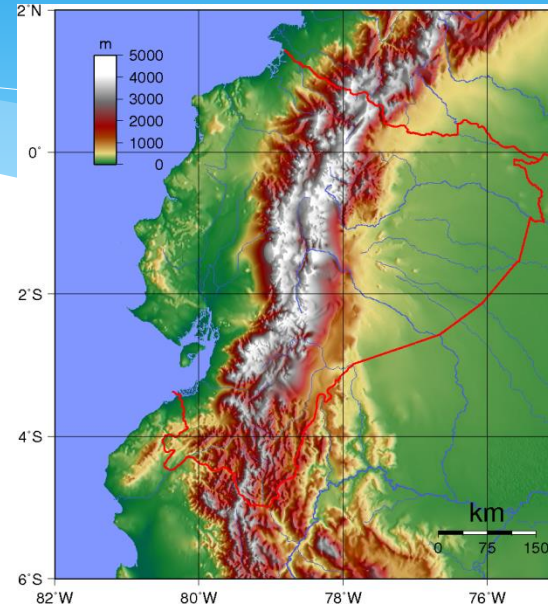
NAME: VLADIMIR ARREAGA

Washington, March 24 / 2015

LOCATION



OROGRAPHY



- LOCATED IN THE NORTHWEST OF SOUTH AMERICA

REGIONS:

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

MAIN ELEVATIONS

WESTERN RANGE

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

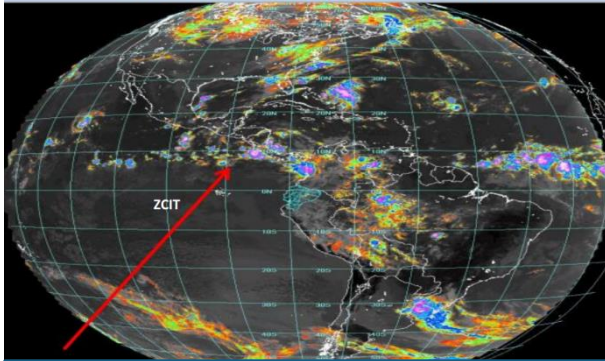
CENTRAL RANGE

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

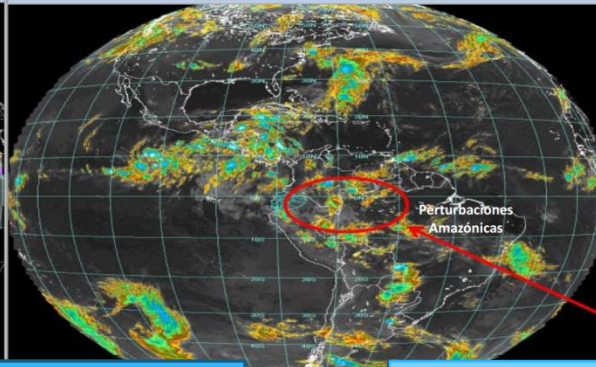
ITCZ

ZONA DE CONVERGENCIA INTERTROPICAL



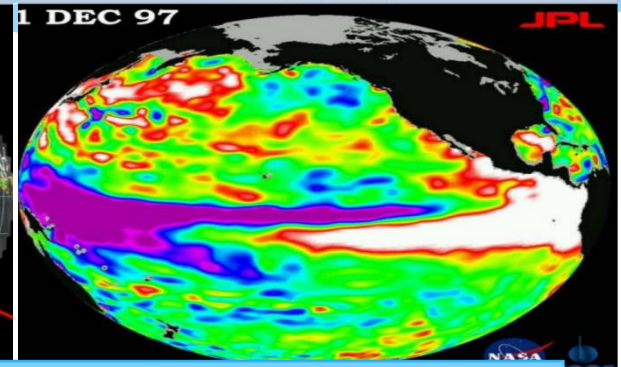
MESOSCALE PERTURBATIONS ARRIVING FROM THE AMAZON

PERTURBACIONES AMAZÓNICAS

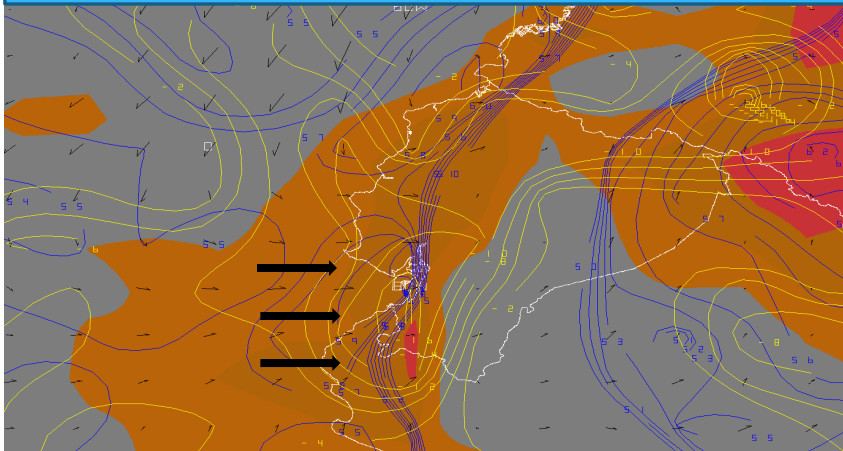


WARM SST (ESPECIALLY ENSO)

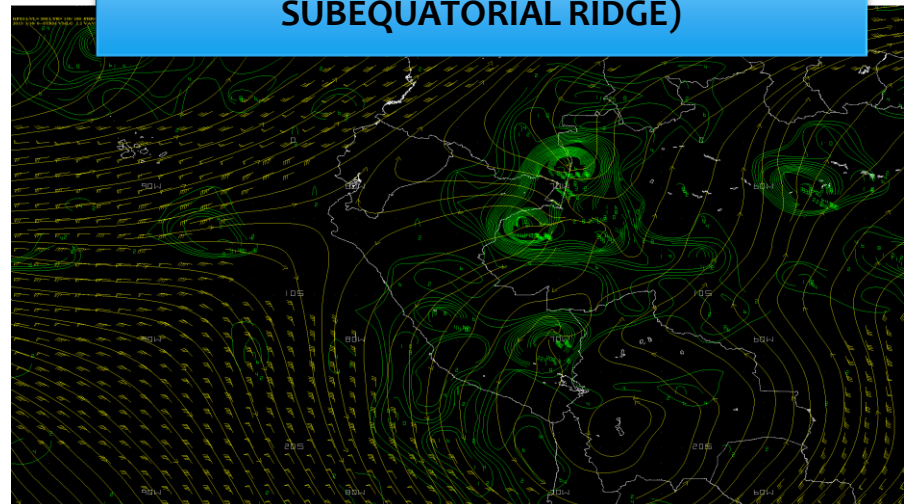
FENÓMENO EL NIÑO



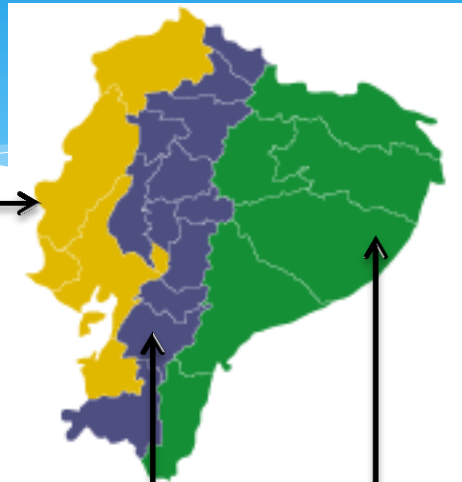
850 hPa WESTERLY BURSTS ALONG COAST



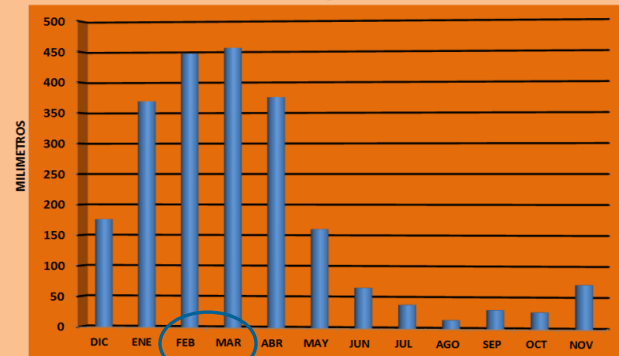
UPPER VENTILATION (SUBTROPICAL RIDGE –
SUBEQUATORIAL RIDGE)



DISTRIBUTION PRECIPITATION IN ECUADOR

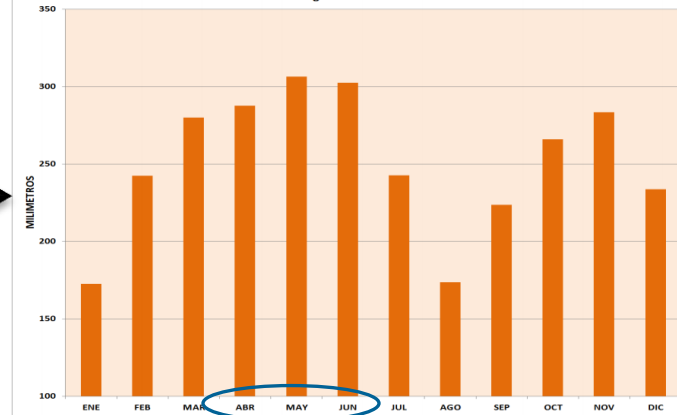


DISTRIBUCION DE LA PRECIPITACION
Región Litoral



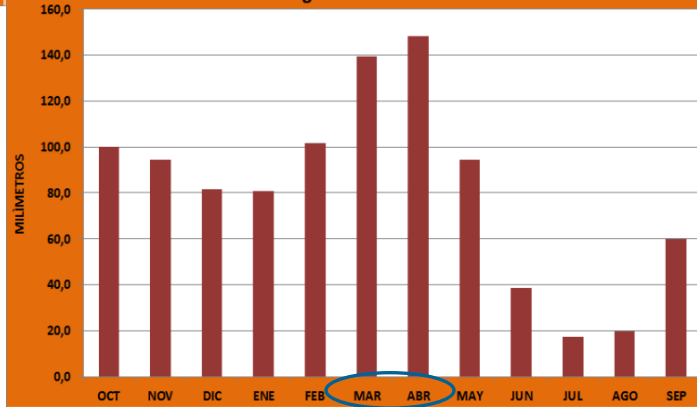
MAXIMUM PEAK
FEB - MAR

DISTRIBUCION MENSUAL DE LA PRECIPITACION
región Amazónica



MAXIMUM PEAK
APR - MAY - JUN

DISTRIBUCION DE LA PRECIPITACION
Región Interandina



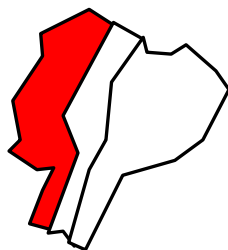
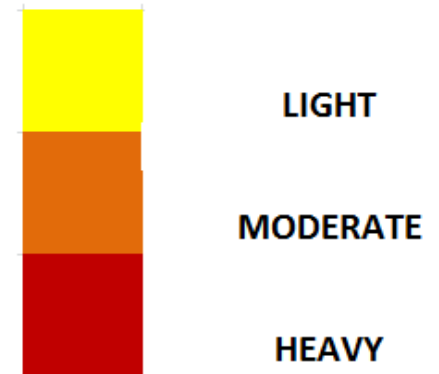
MAXIMUM PEAK
MAR - APR

TIME LINE OF HEAVY RAINFALL EVENT

MARCH 16 – 18 / 2015

RAINFALL TOTALS IN mm /DAY

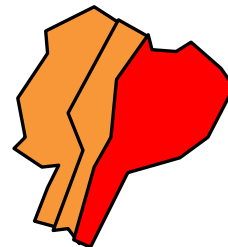
DAY/REGION	16	17	18
COAST	30 - 194	0 - 30	5 - 60
ANDES	0 - 5	15 - 35	5 - 35
AMAZON	0 - 5	10 - 78	10 - 80



D1



D2



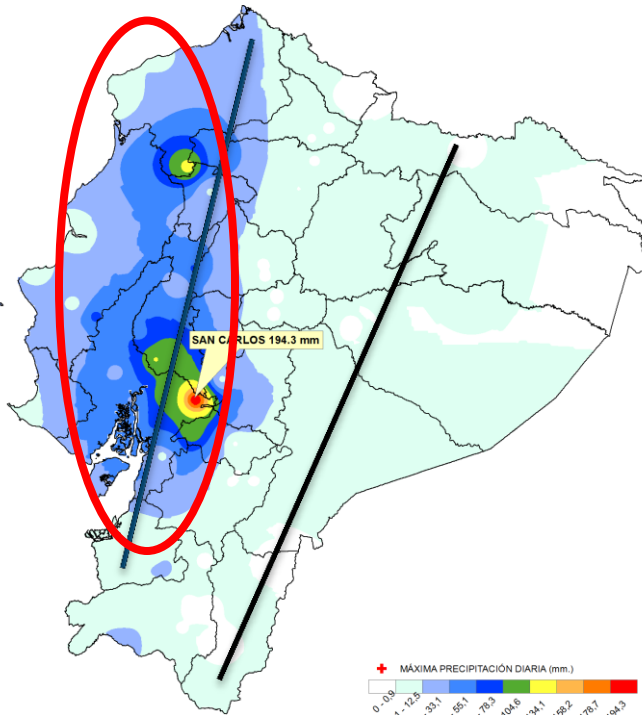
D3

IMAGES OF THE EVENT



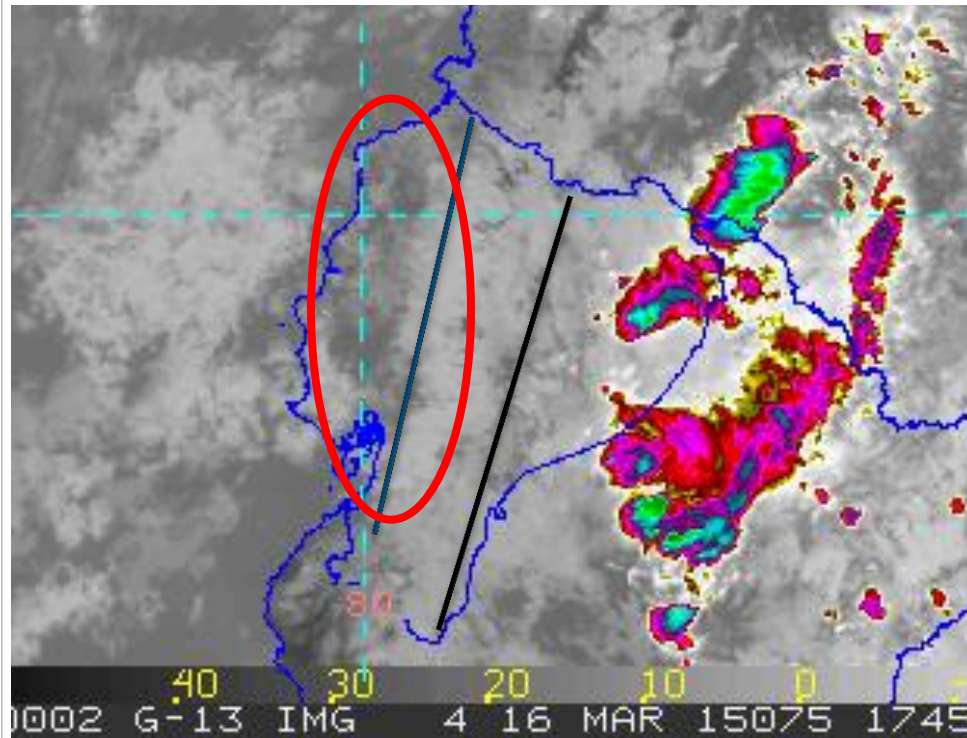
DAY 1: HEAVY RAINS OVER THE COAST

INSTITUTO NACIONAL DE METEOROLOGÍA E HIDROLOGÍA
 MAPA DE PRECIPITACIÓN DIARIA
 DESDE 16/03/2015 (7:00 AM) HASTA 17/03/2015 (7:00 AM)

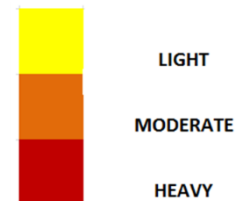


INSTITUTO NACIONAL DE METEOROLOGÍA E HIDROLOGÍA
 SUBPROCESO DE PREDICCIÓN METEOROLÓGICA

ELABORADO POR: P.L.L.L. / M.V.R.

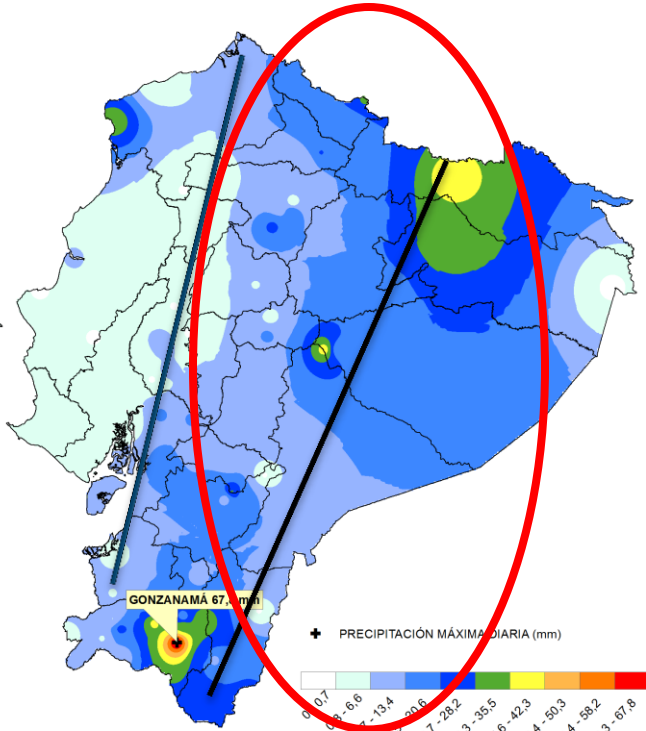


DAY/REGION	16
COAST	30 - 194
ANDES	0 - 5
AMAZON	0 - 5

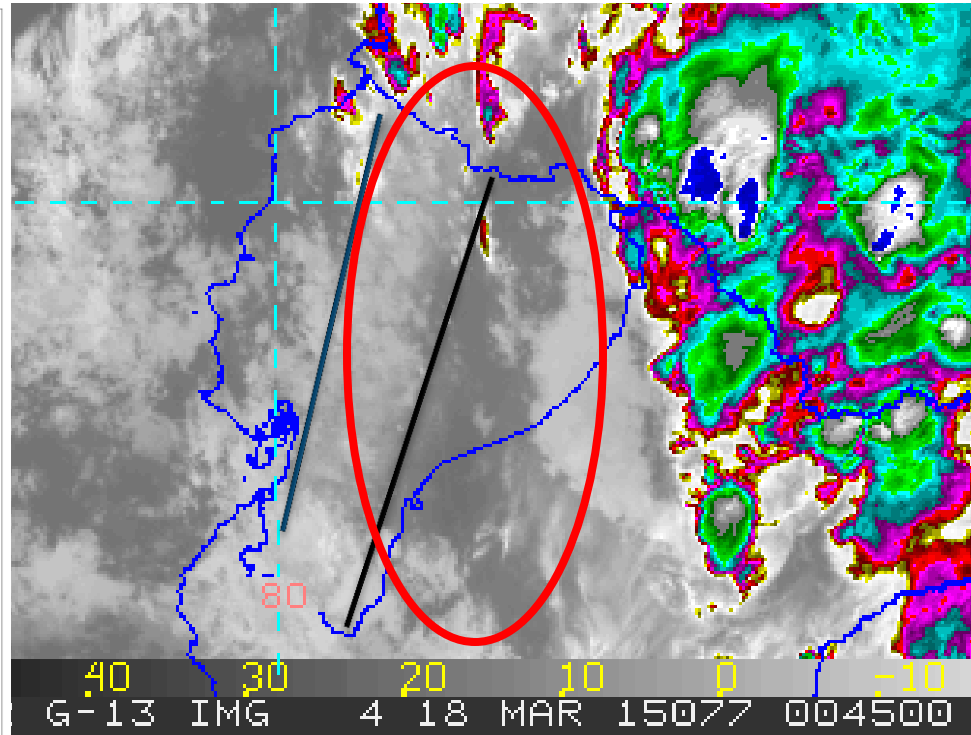


DAY 2: HEAVY RAINS OVER ANDES AND AMAZON

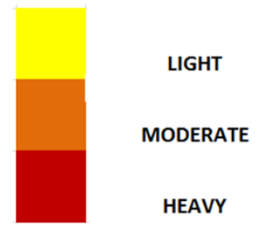
INSTITUTO NACIONAL DE METEOROLOGÍA E HIDROLOGÍA
 MAPA DE PRECIPITACIÓN DIARIA
 DESDE 17/03/2015 (7:00 AM) HASTA 18/03/2015 (7:00 AM)



INSTITUTO NACIONAL DE METEOROLOGÍA E HIDROLOGÍA
 SUBPROCESO DE PREDICCIÓN METEOROLÓGICA
 ELABORADO POR: J.M.J.

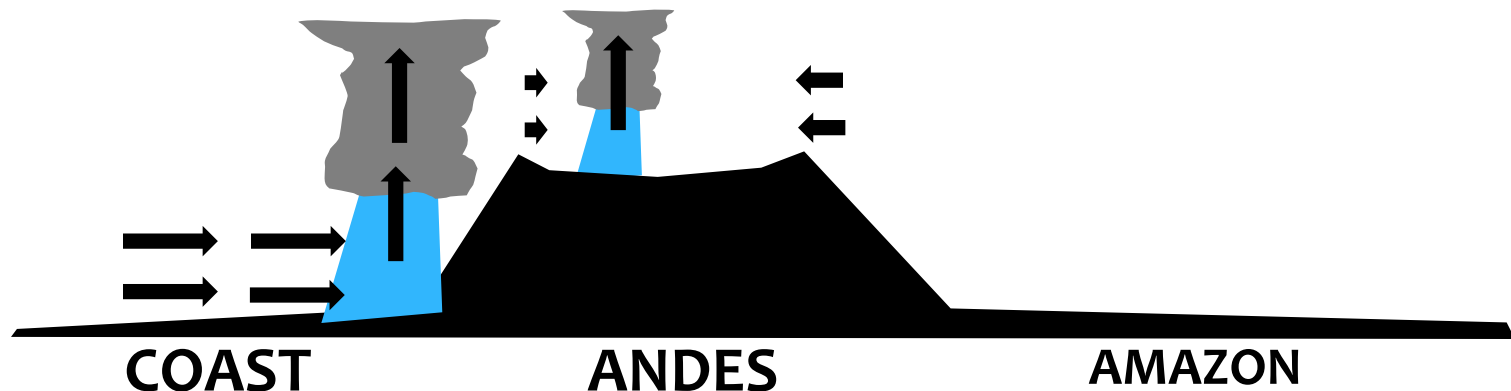


DAY/REGION	17
COAST	0 - 30
ANDES	15 - 35
AMAZON	10 - 78



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

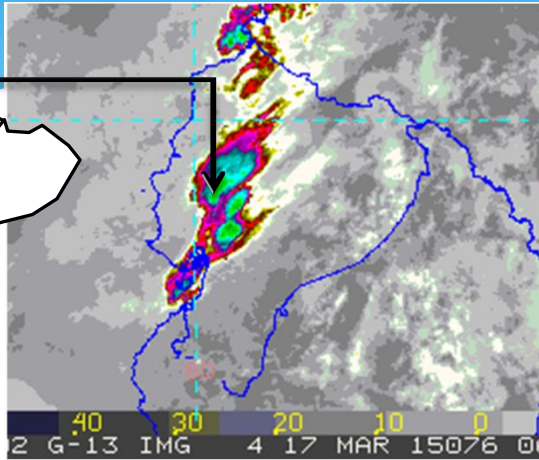


COMPARISON IR₄ SATELLITE IMAGE vs GFS FORECAST

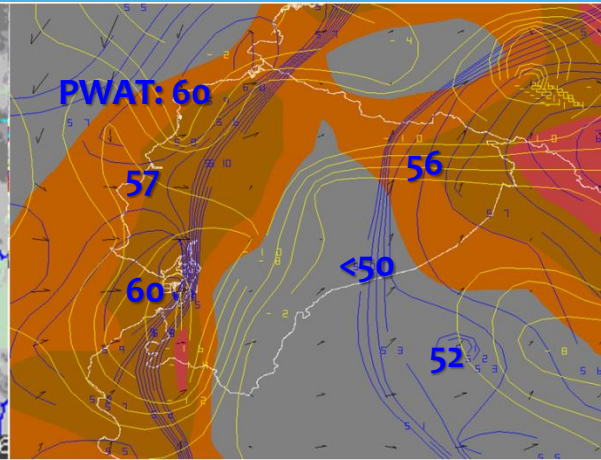
HEAVY RAINS



D1



17 MARCH 06:15 UTC



17 MARCH 06:00 UTC

LEGEND

STABILITY: GDI



UNSTABLE
VERY UNSTABLE



PRECIPITABLE WATER
> 50 mm.

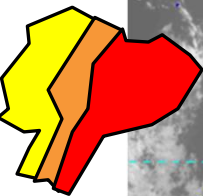


LOW LEVEL
CONVERGENCE
(925 - 850 MB)

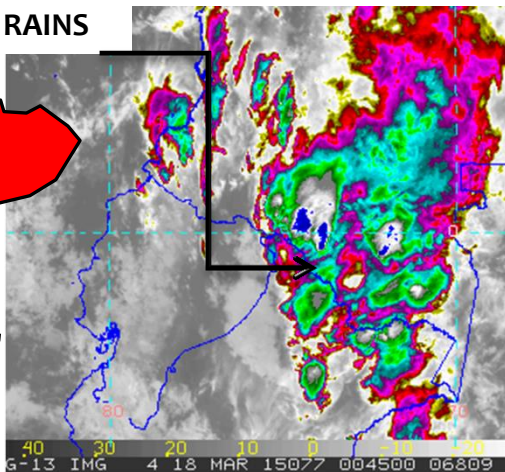


WIND
925 - 850 MB

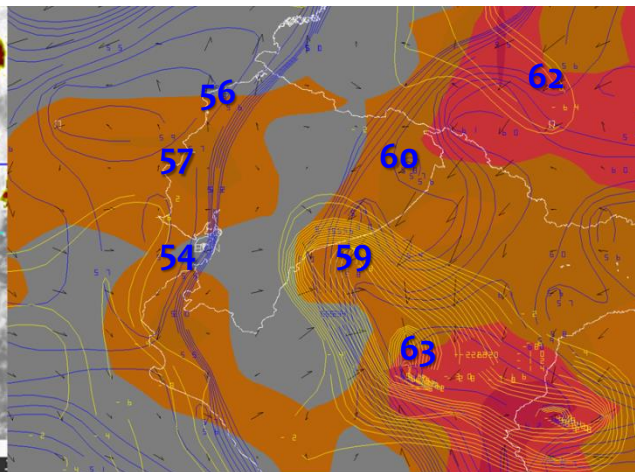
HEAVY RAINS



D2

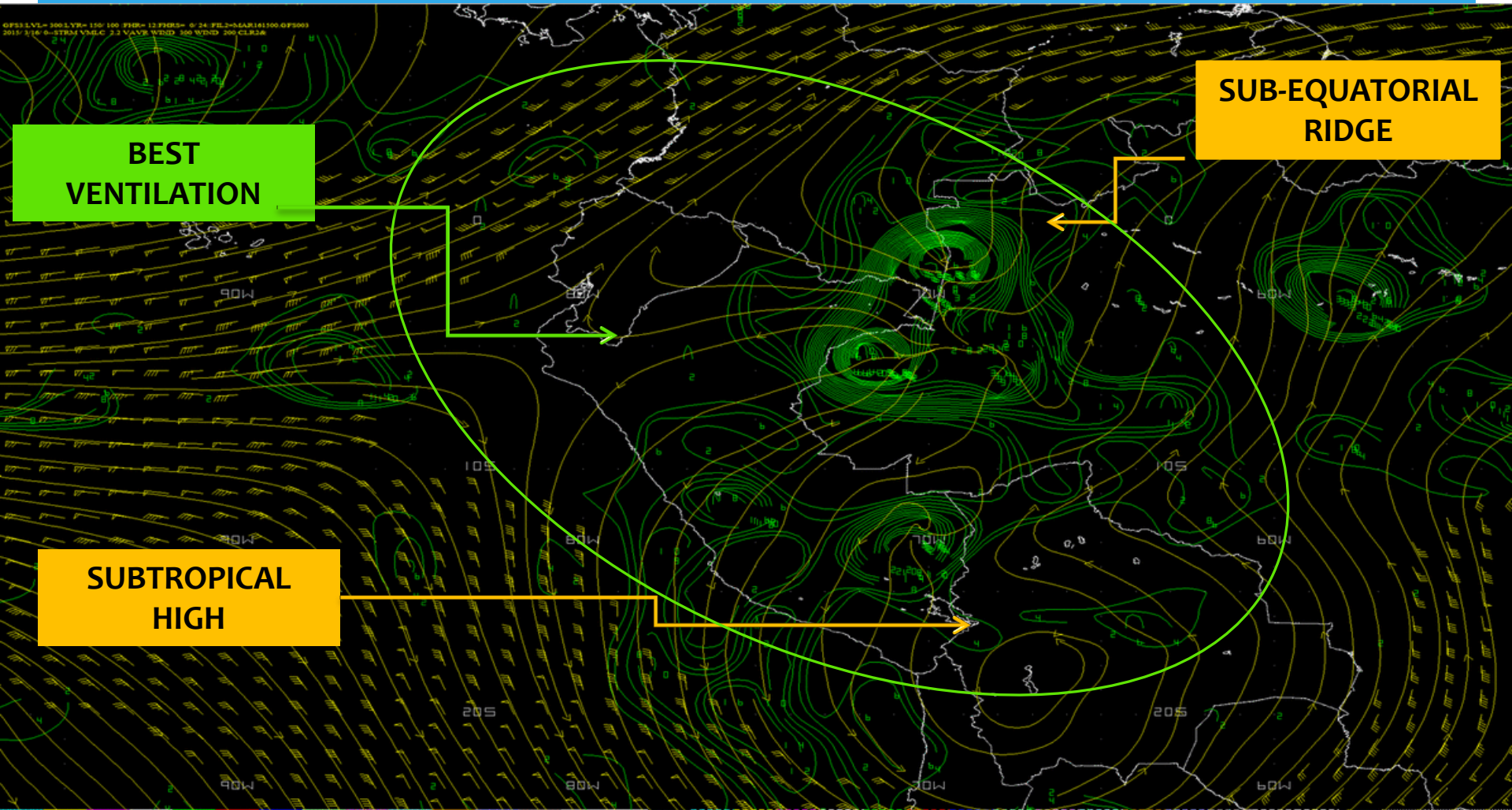


18 MARCH 00:45 UTC



18 MARCH 00:00 UTC

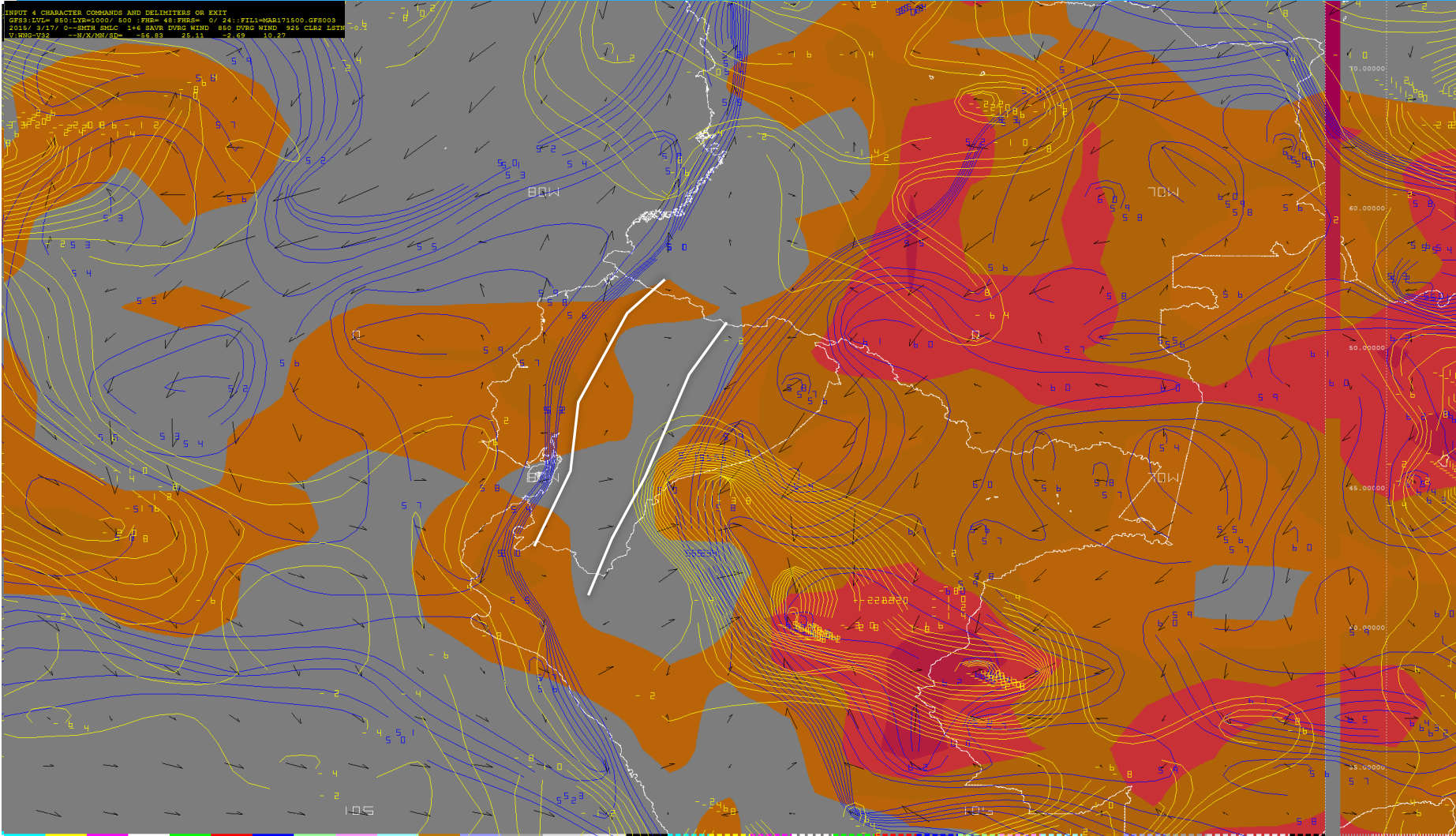
UPPER FLOW AND DIVERGENCE



 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

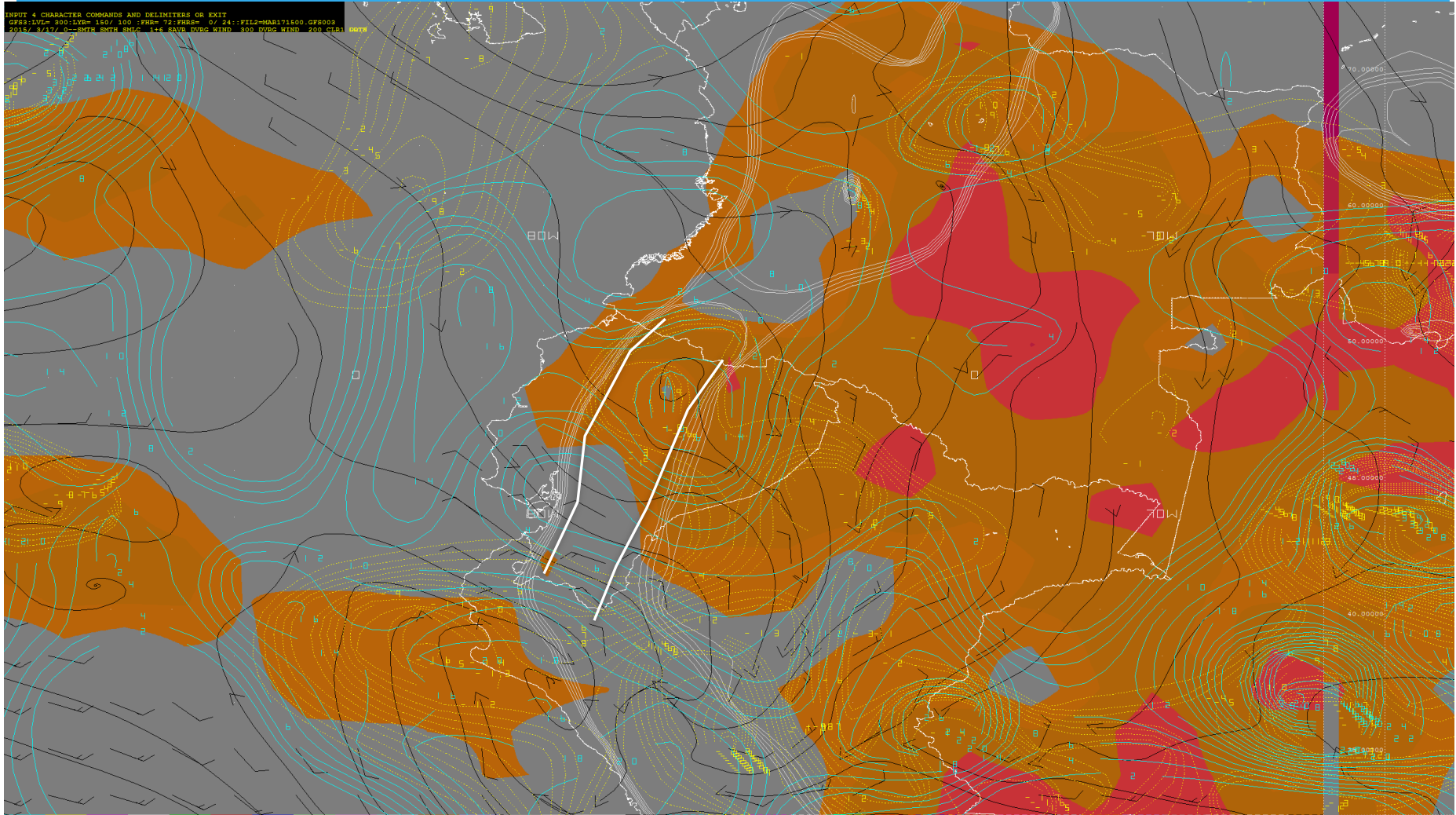
UNSTABLE
VERY UNSTABLE

PRECIPITABLE WATER
> 49 mm.

WIND
925 – 850 MB

LOW LEVEL
CONVERGENCE
(925 – 850 MB)

EVOLUTION OF PREDICTORS FOR HEAVY RAINFALL IN ANDES REGION



INPUT 4 CHARACTER COMMANDS AND DELIMITERS OR EXIT
CFRS-LVL= 900-LVL= 150/100 :FRS= 72:FRS= 0/ 24::FILE=MARI71500.GF8003
2015/ 5/17/ 0--SMTH SMTH SMTC 146 SAVR DURG WIND 300 DURG WIND 200 CTR1 MWTR

STABILITY: GDI



UNSTABLE
VERY UNSTABLE



WIND
600 – 500 MB



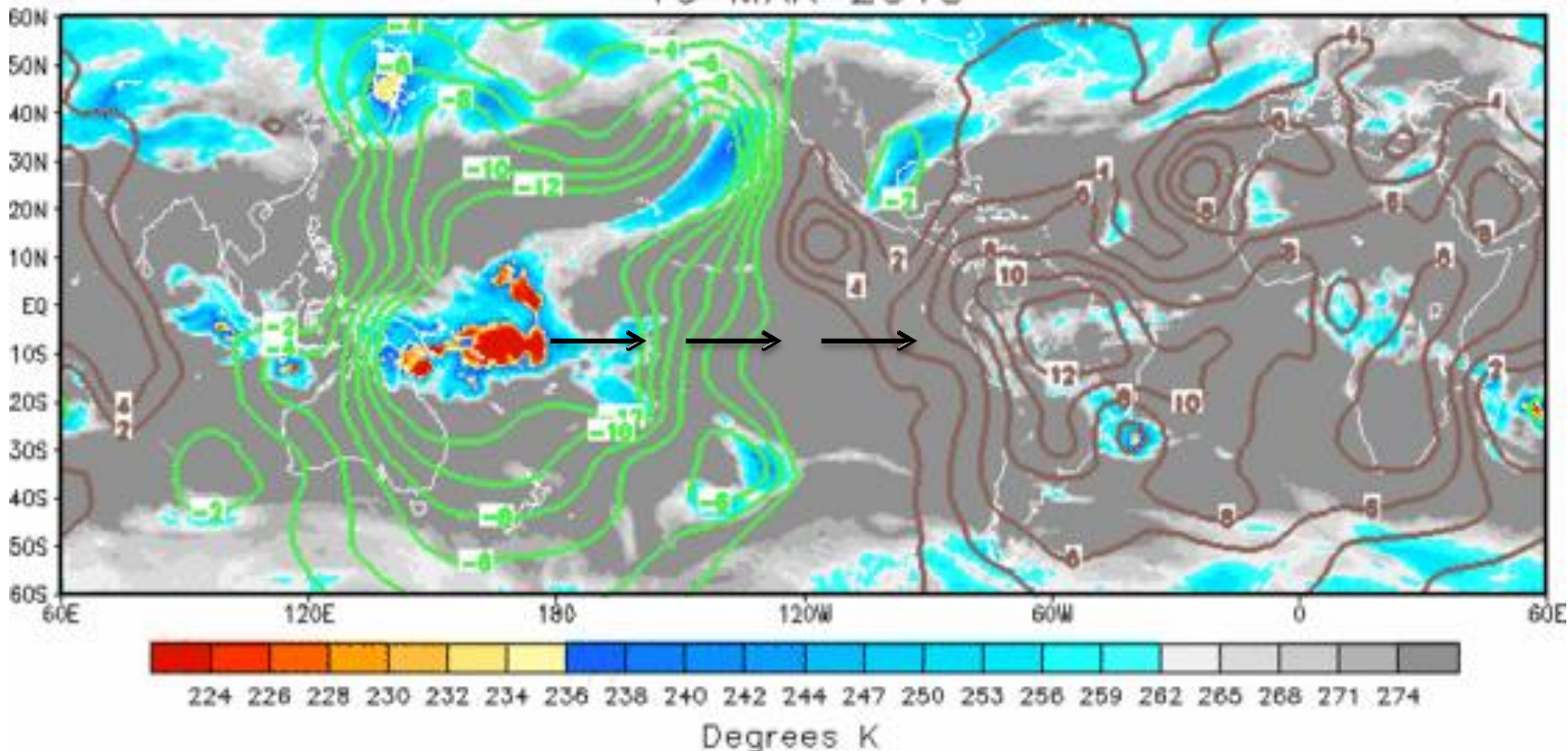
UPPER LEVELS
DIVERGENCE (300 – 200 MB)



LOW LEVEL
CONVERGENCE
(925 – 850 MB)

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

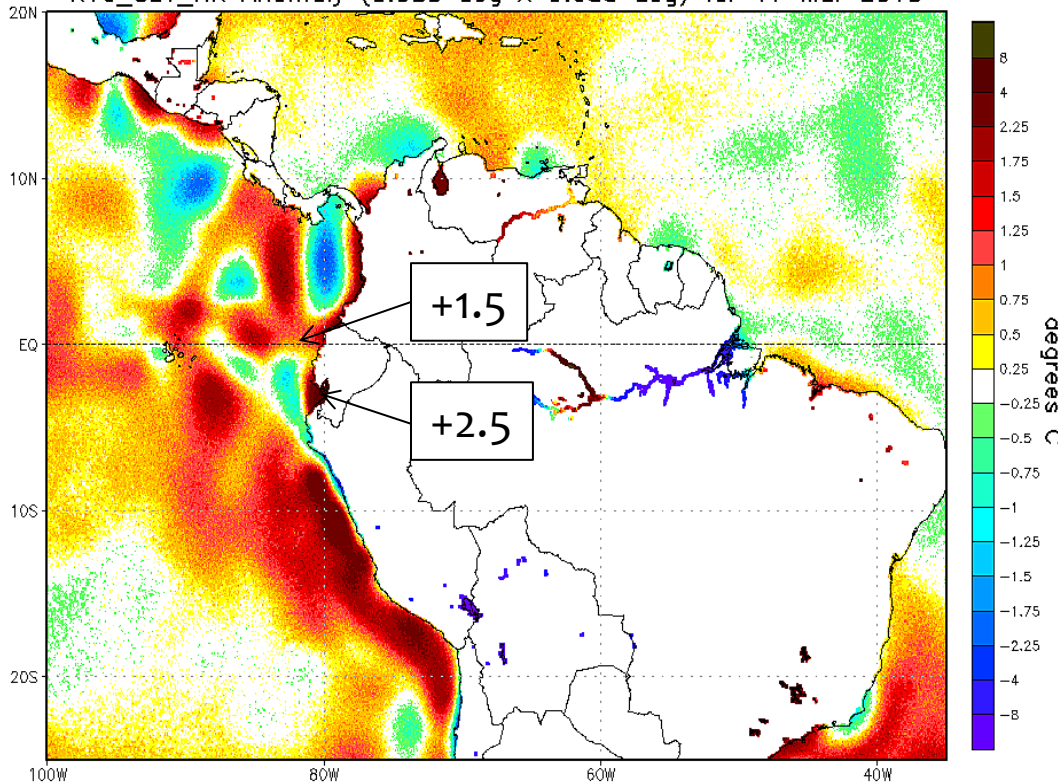
10 MAR 2015



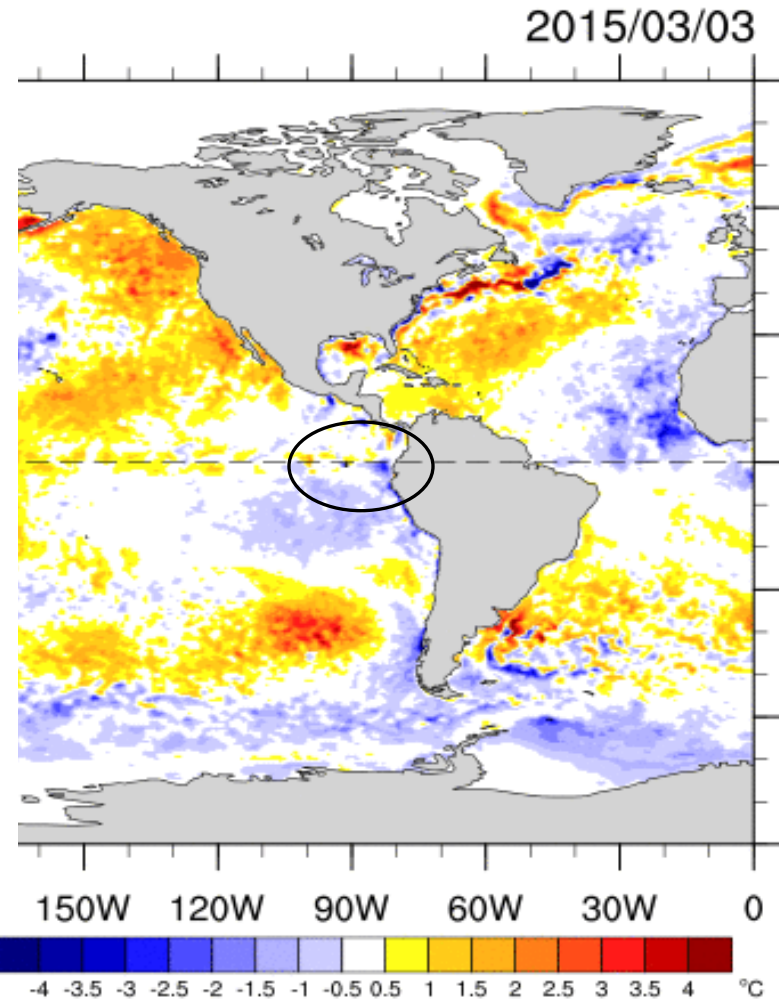
SEA SURFACE TEMPERATURE ANOMALIES AND EVOLUTION

NOAA/NWS/NCEP/EMC Marine Modeling and Analysis Branch Oper H.R.

RTG_SST_HR Anomaly (0.083 deg X 0.083 deg) for 17 Mar 2015



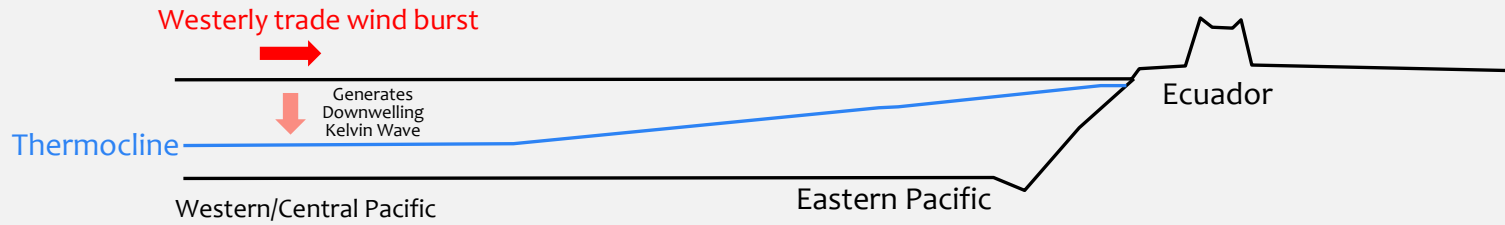
5:19 TUE MAR 17 2015



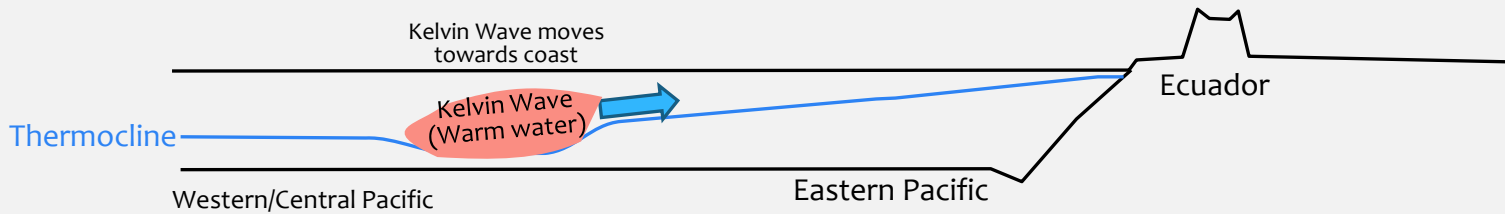
Oceanic Kelvin Wave Mechanism in Equatorial Pacific

1-3 month perspectives

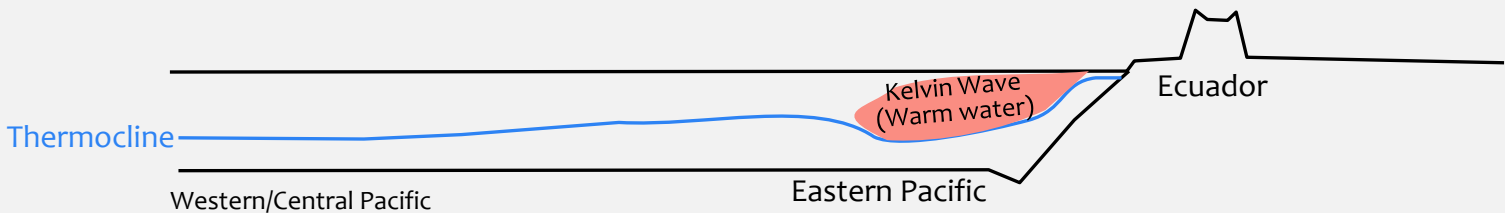
Westerly trade wind burst



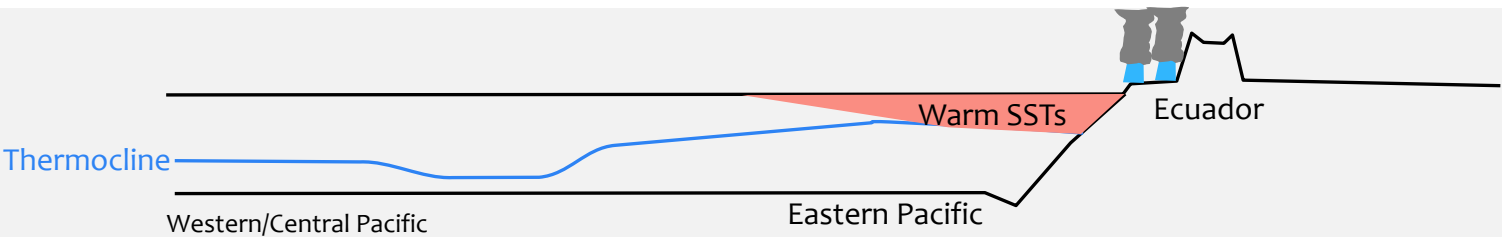
2-4 weeks later



2-3 months later Kelvin arrives

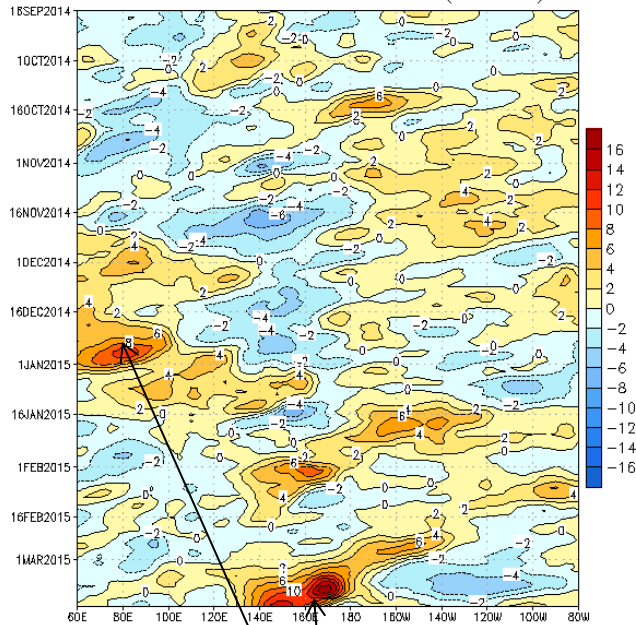


SSTs warm up and rains increase in Ecuador



CURRENT PERSPECTIVES

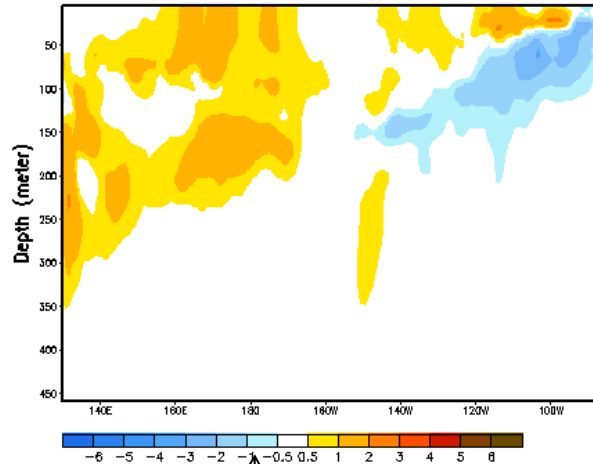
CDAS 850-hPa U Anoms. (5N-5S)



Data updated through 15 MAR 2015

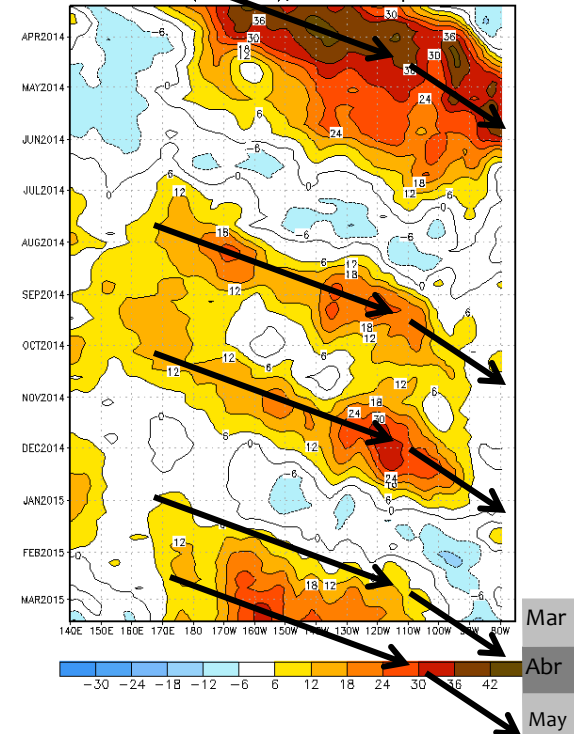
Strong westerly wind bursts occurred in January and esp. March 2015

Equatorial Temperature Anomaly (°C)
Pentad centered on 13 JAN 2015



Current progression of Kelvin Waves (sea temperature anomalies)

Depth 20°C Anom., ending Mar 16 2015
(2S-2°N), 4 times 3pts



Mar
Abr
May

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