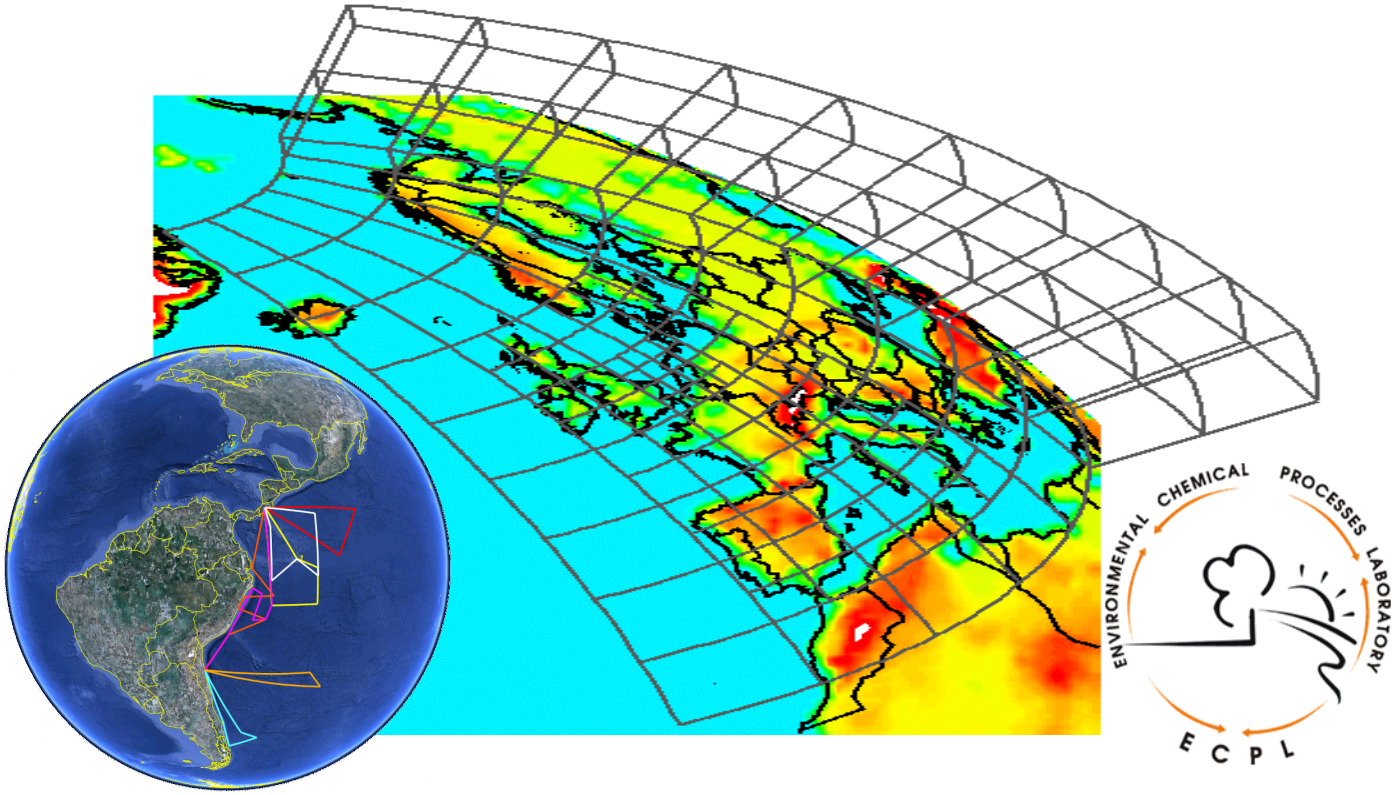
TM4-ECPL model :
Oceanic Sources for Oxygenated VOC and Aerosols



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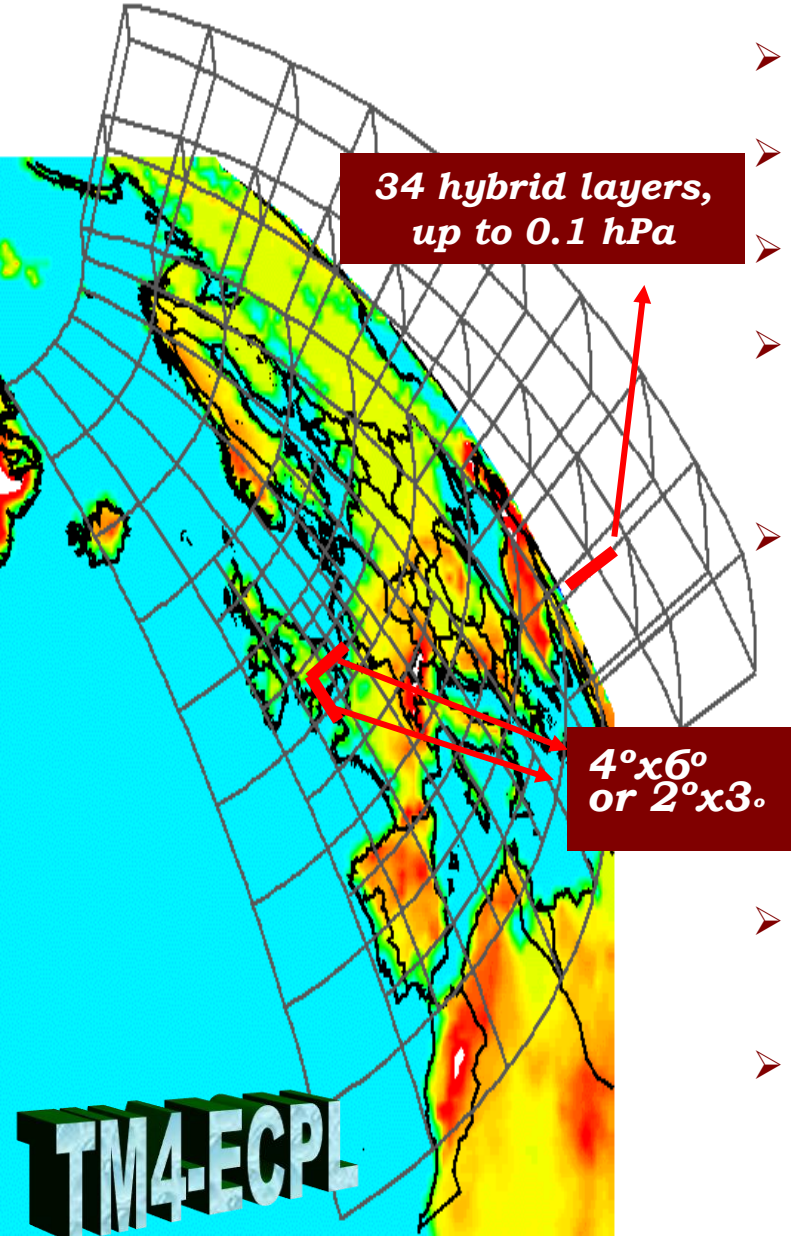
Collaborative Proposal:

TORERO - Tropical Ocean tRoposphere Exchange of Reactive Halogen Species and Oxygenated VOC

TORERO questions that we could investigate

1. How does atmospheric composition in MBL compares to that in FT?
2. How does CHOCHO form in the FT?
3. What is CHOCHO vertical distribution in the MBL and the FT (spatial and temporal variability)?
4. CHOCHO formation from VOC oxidation vs heterogeneous sources.
5. How can we explain the mismatch between global model predictions and satellites? (ocean source?)
6. How relevant are ocean sources of OVOC on global scales?

TM4-ECPL Global 3D Model



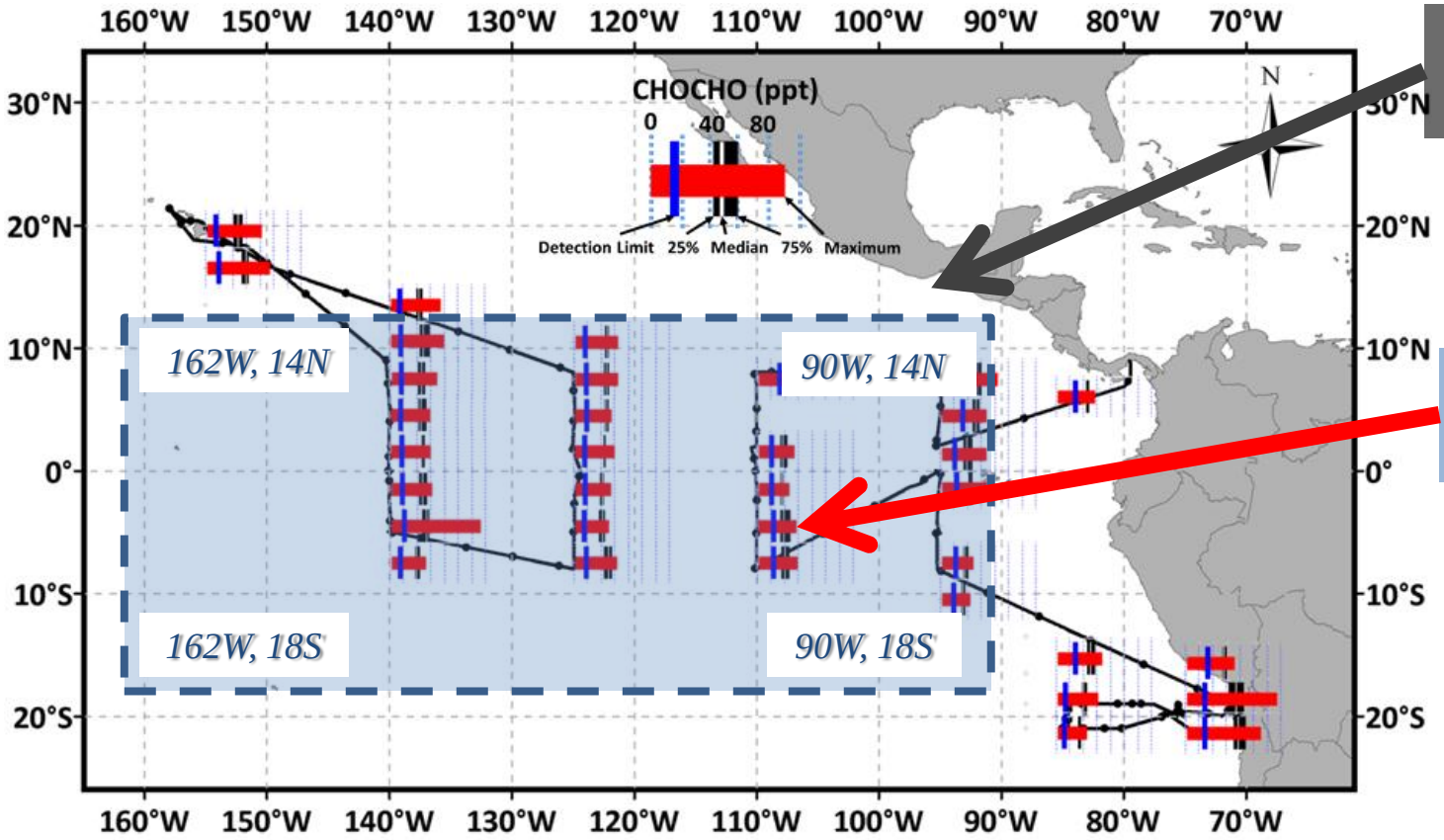
- Meteorology input from ECMWF – ERA-Interim project data-archive: 3 hourly data
- Anthropogenic emissions from CIRCE inventories
- Biogenic Emissions from POET 2000 inventories have been adopted.
- Biomass Burning Emissions from GFED v2
- Marine emissions of POA, hydrocarbons and sea-salt particles and marine SOA are parameterized in the model as outlined in **Myriokefalitakis et al., Advan. Meteo. , 2010**
- The model considers the sulfur and ammonia chemistry and the oxidation of C_1-C_5 Volatile Organic Compounds (VOC) including isoprene as well as a simplified terpenes and aromatic chemistry (**Myriokefalitakis et al., ACP, 2008**)

Multiphase chemistry as outlined in **Myriokefalitakis et al., ACP, 2011**

- Gas-particle partitioning for inorganics is solved using ISORROPIA II (Fountoukis and Nenes, 2007)
- On-line gas-phase chemistry and secondary aerosol formation calculations together with primary carbonaceous, dust & sea-salt particles Tsigaridis et al., ACP, 2006; Tsigaridis& Kanakidou AE, 2007

TM4ECPL - TORERO Simulations

Simulation	Description
S0	Base Run – All CHOCHO Emissions
S1	As for S0 but without oceanic CHOCHO Emissions
S2	As for S1 but without anthropogenic and biomass burning CHOCHO emissions



TORERO Measurements

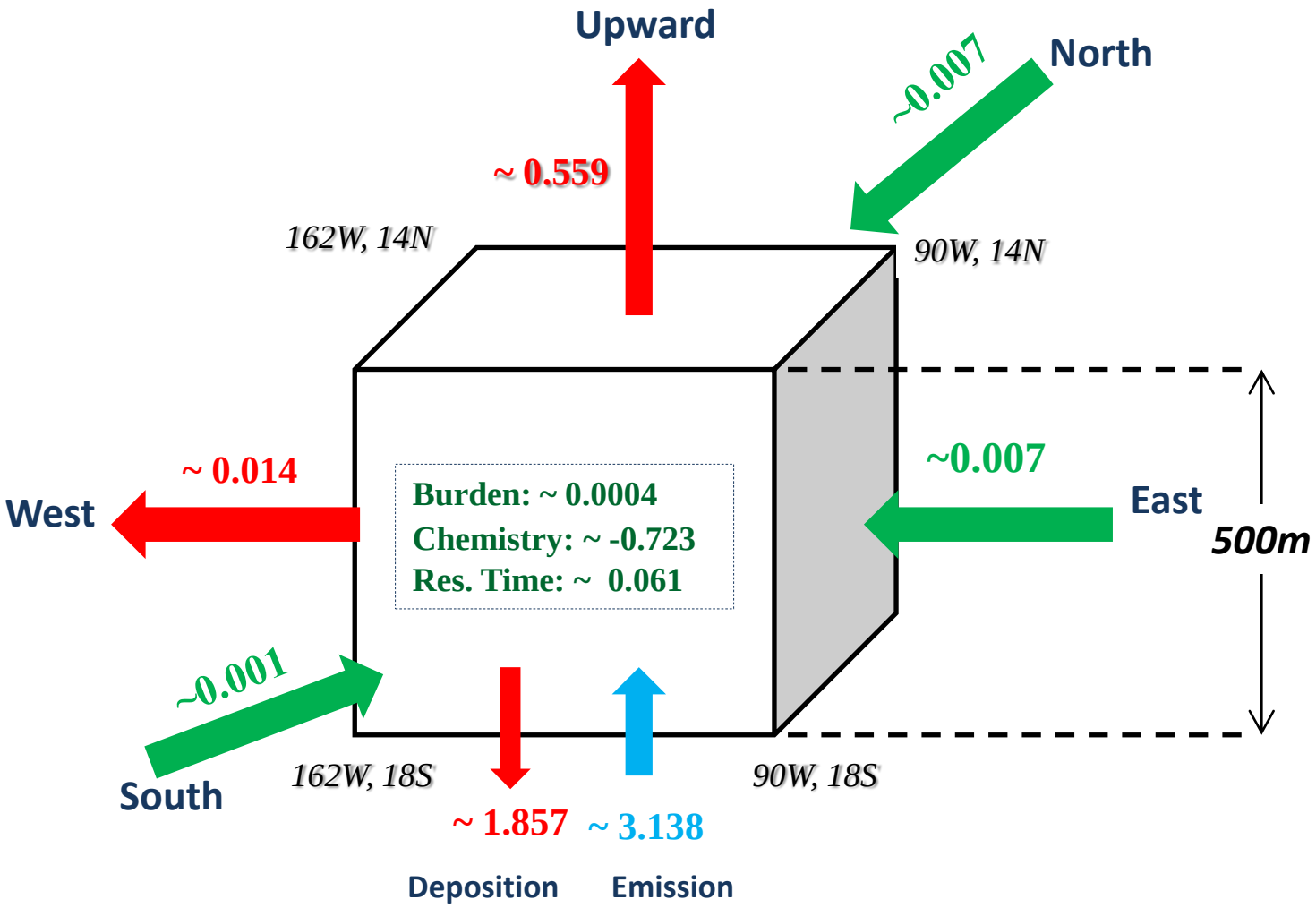
TM4ECPL Budget Analysis

For this presentation, all simulations have been performed in 6°x4° resolution (longitude x latitude) in 34 vertical hybrid layers up to 0.1 hPa

CHOCHO Budget Analysis

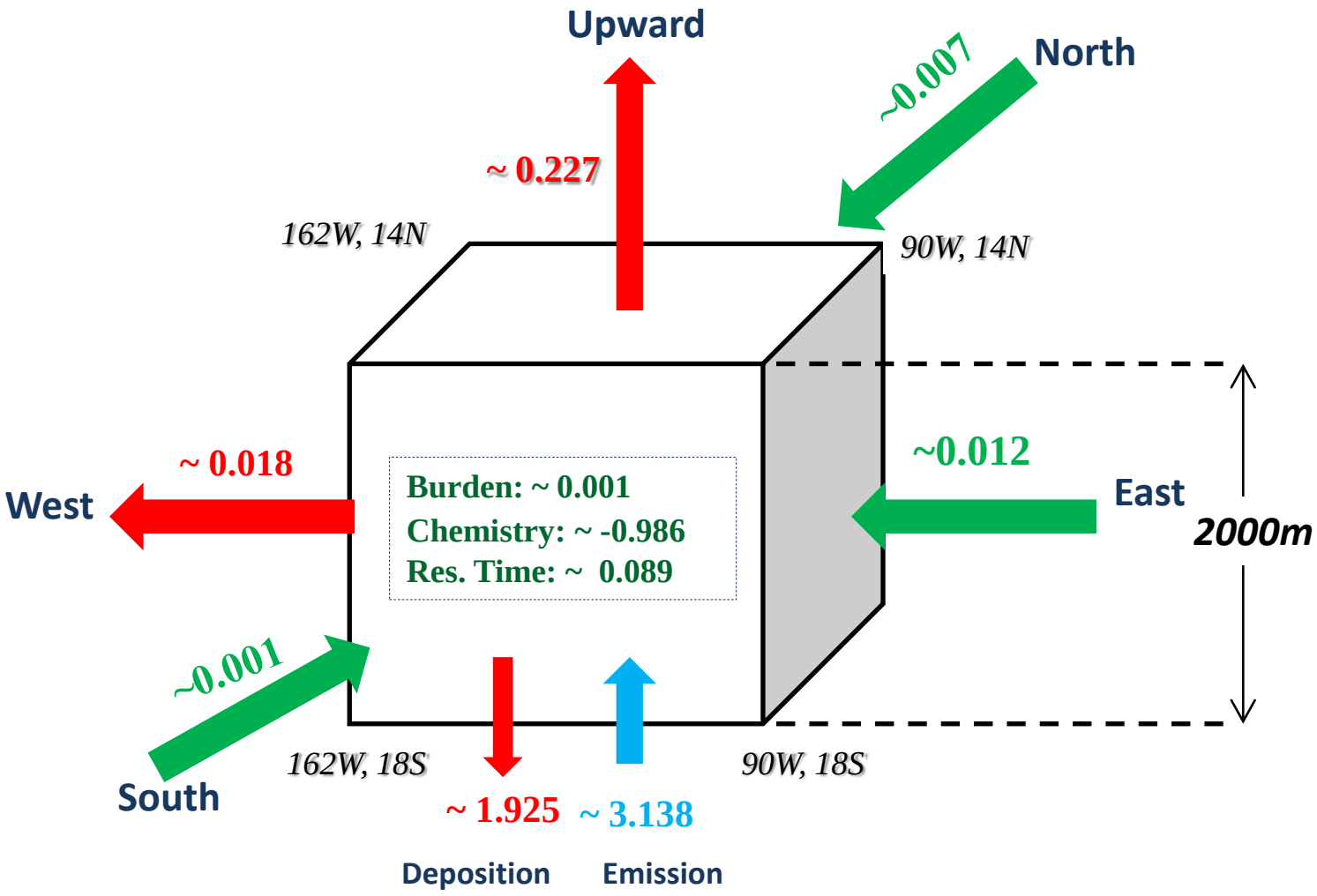
CHOCHO (Tg/yr)	GLOBAL	TORERO – 500m	TORERO – 2000m	TORERO - TA
Burden	0.024	0.0004	0.0005	0.0007
Ocean Emissions	20.0	*3.068*	3.068	3.068
Anthropogenic & Biomass Burning Emissions	11.1	0.070	0.070	0.070
Net Gas Phase Chemistry	*1.0*	*-0.656*	-0.789	-0.908
Net Cloud Chemistry	-3.9	-0.033	-0.153	-0.186
Net Particle Chemistry	-3.3	-0.034	-0.044	-0.090
Dry Deposition	19.0	1.61	1.61	1.61
Wet Deposition	5.9	0.242	0.31	0.35

CHOCHO Schematic Budget
TORERO Ocean Domain @ 0-500m



Burden (Tg) is average of monthly samples; Residence times (days) is burden divided by total sinks; all budget terms and fluxes (Tg yr^{-1}) are annual totals.

CHOCHO Schematic Budget
TORERO Ocean Domain @ 0-2000m



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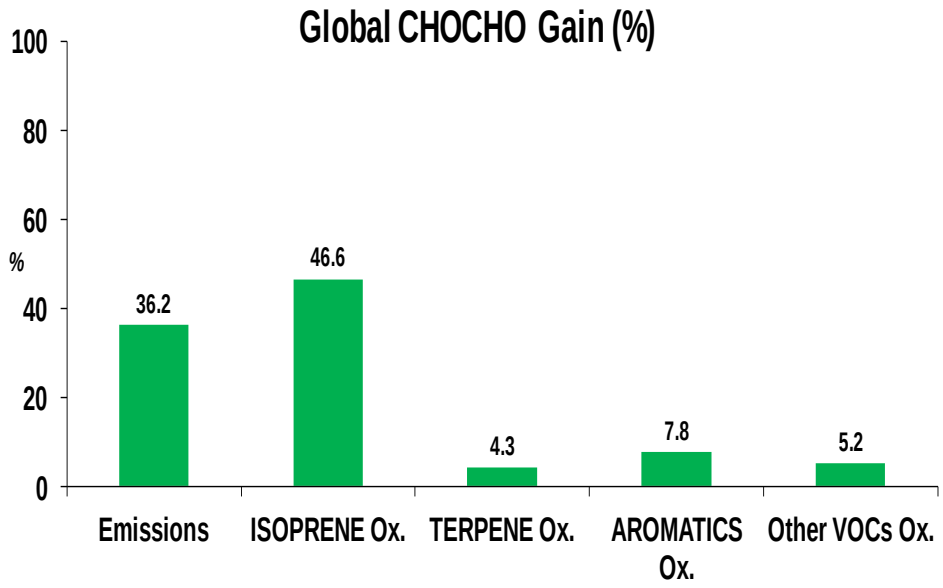
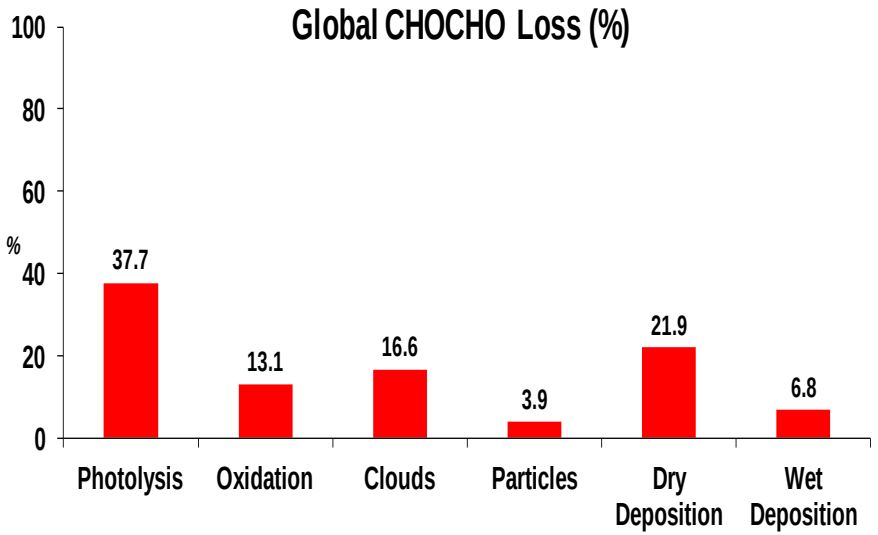
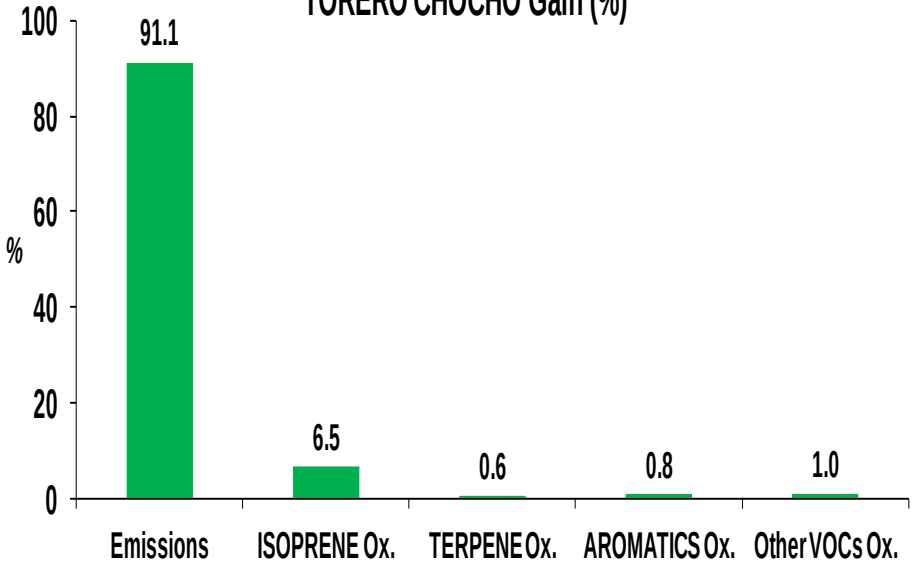
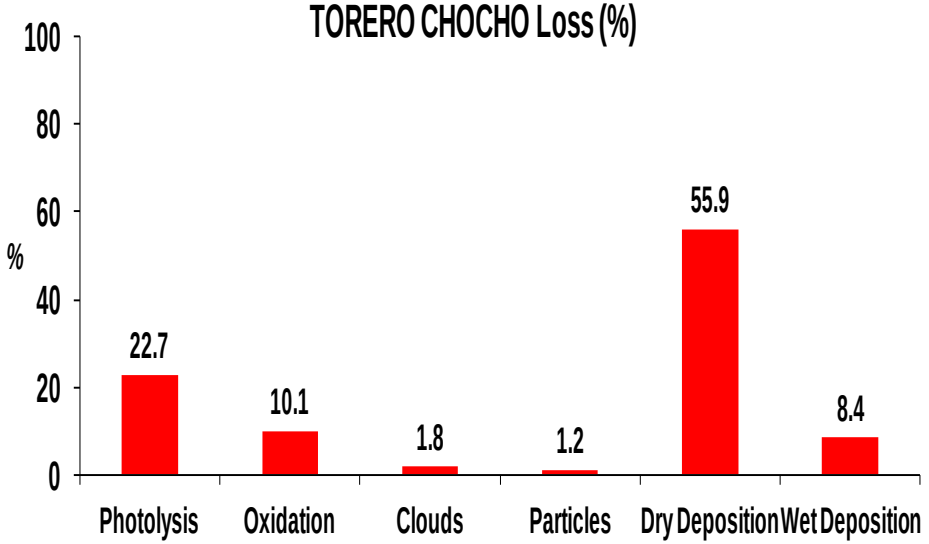
CHOCHO Budget Analysis

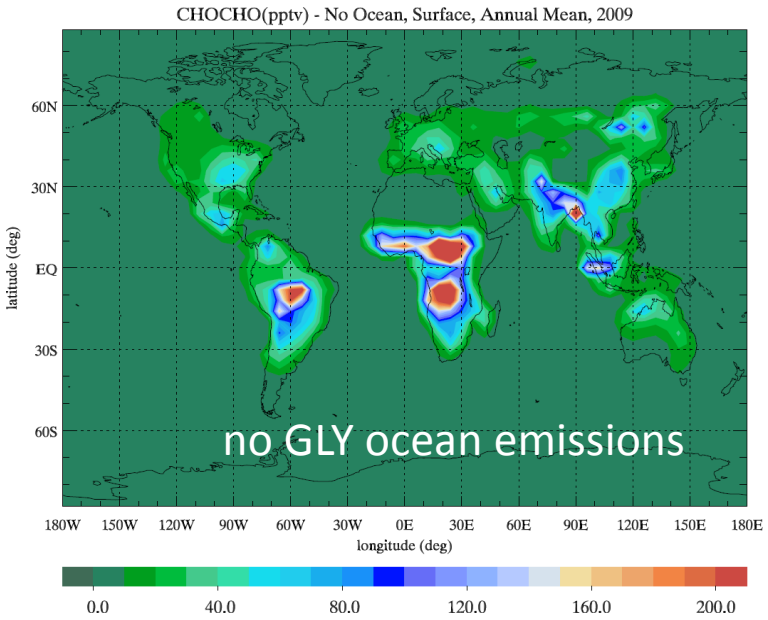


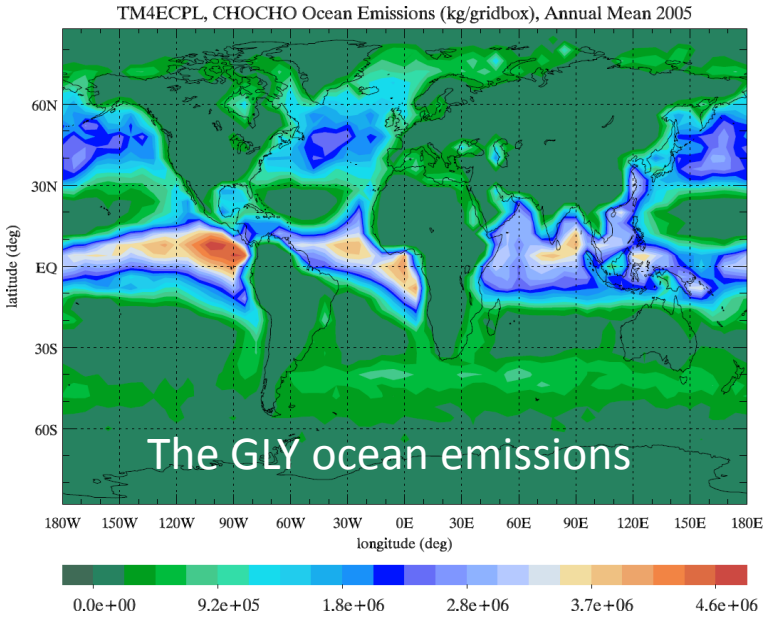


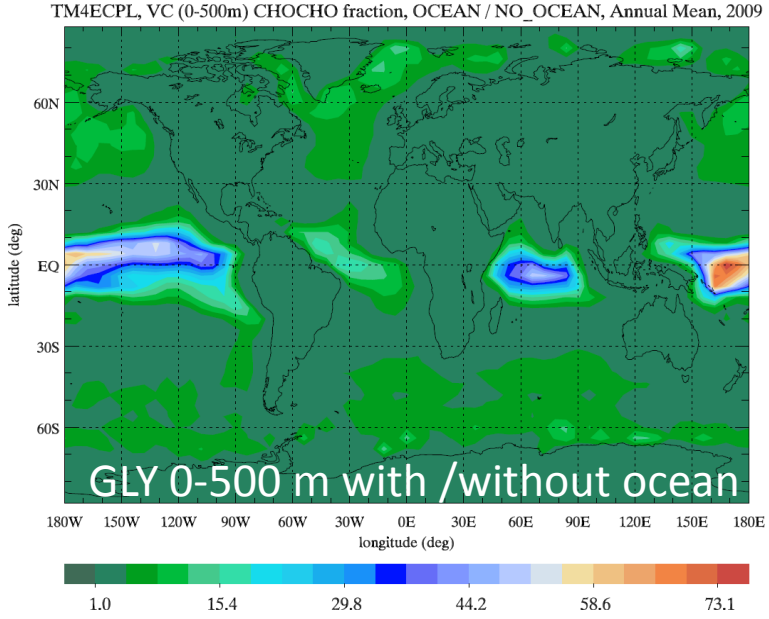


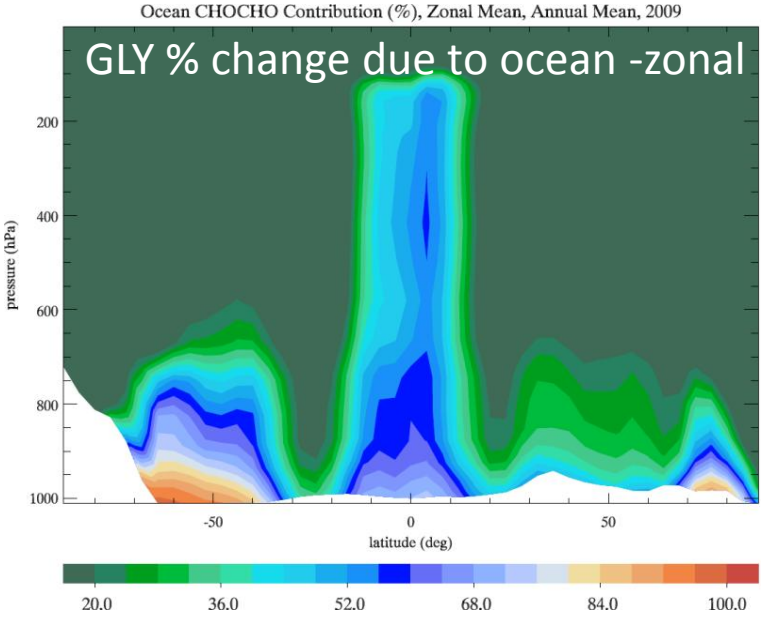


Oceanic Emission Contribution to CHOCHO levels

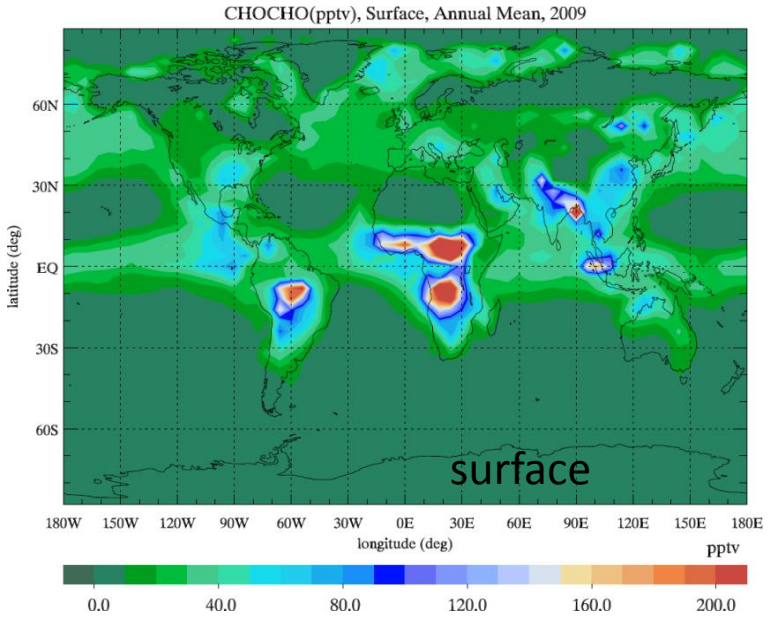


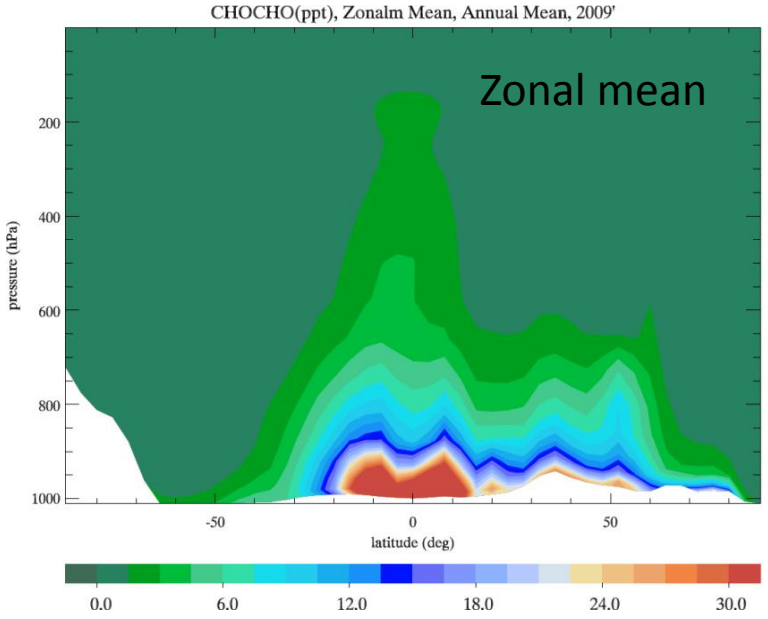


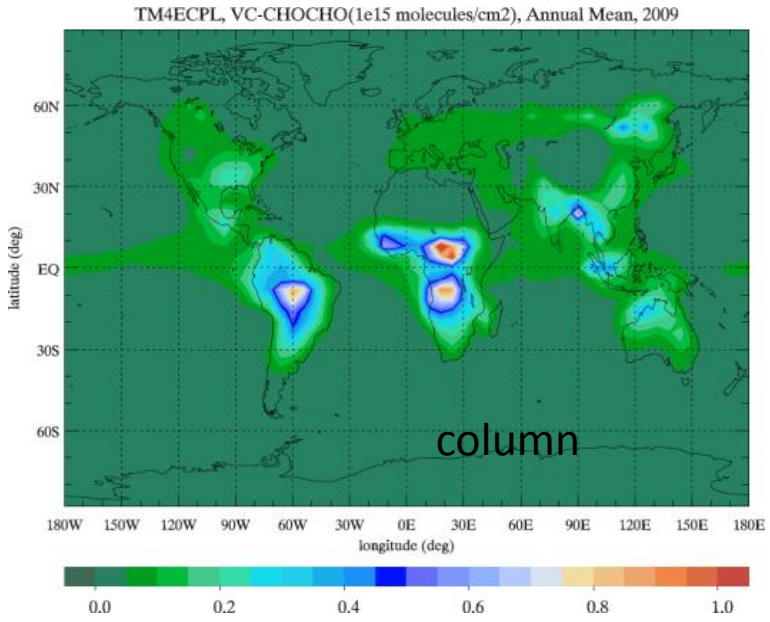


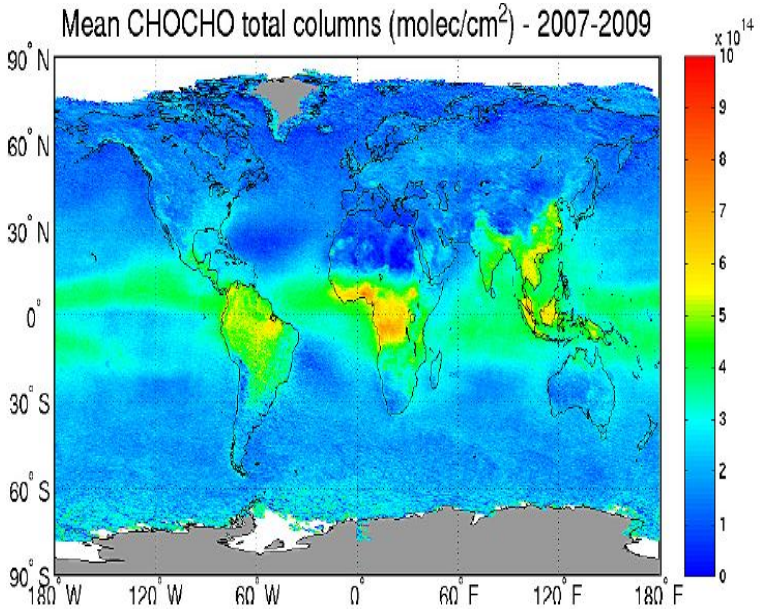


Global CHOCHO Distributions





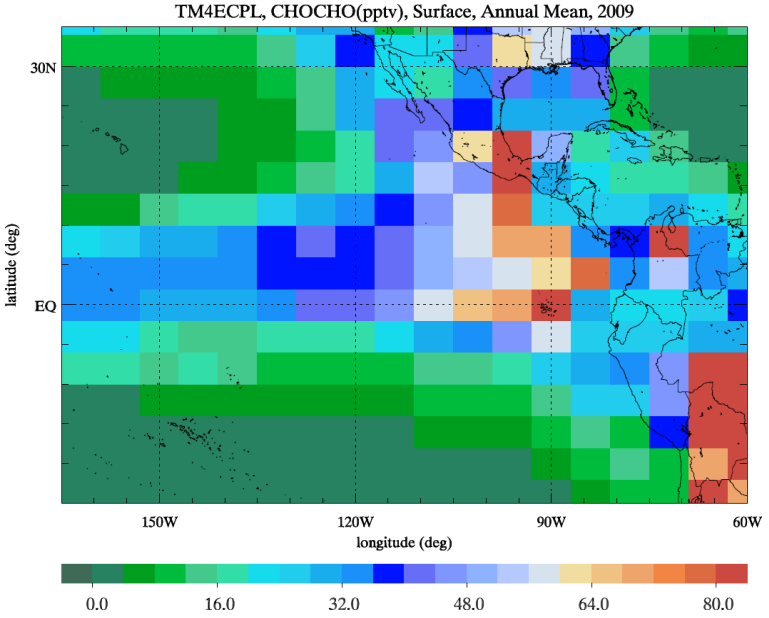


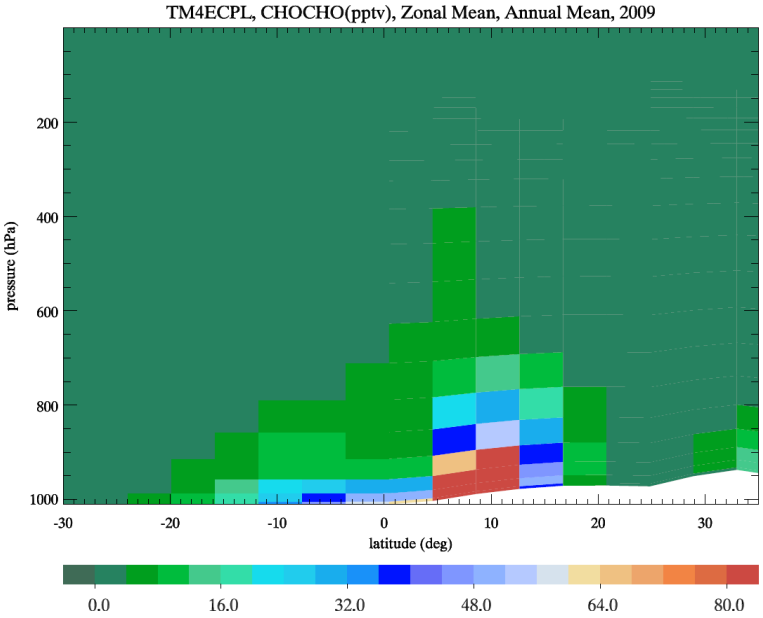


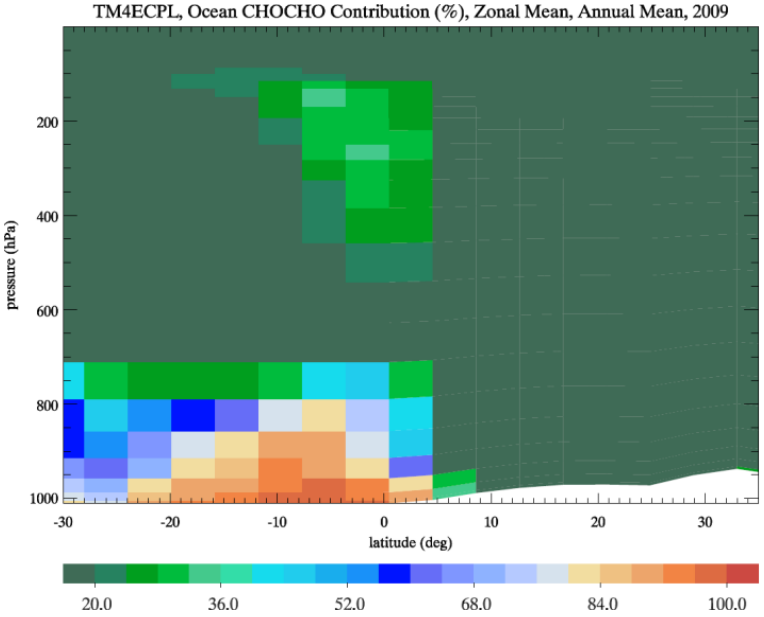
GOME 2- Satellite observations → at low cloud cover (<0.4)

Lerot et al ACP,10,12059, 2010

TORERO CHOCHO Distributions

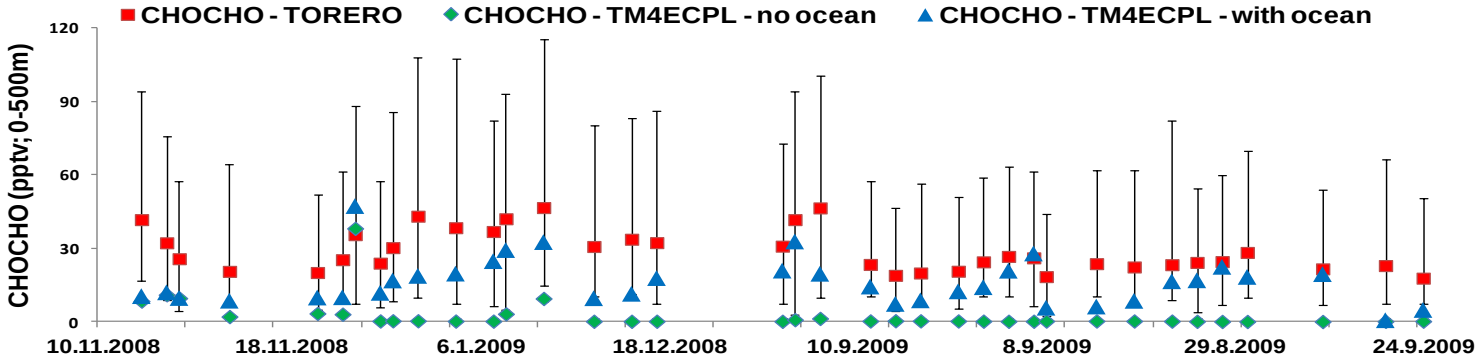


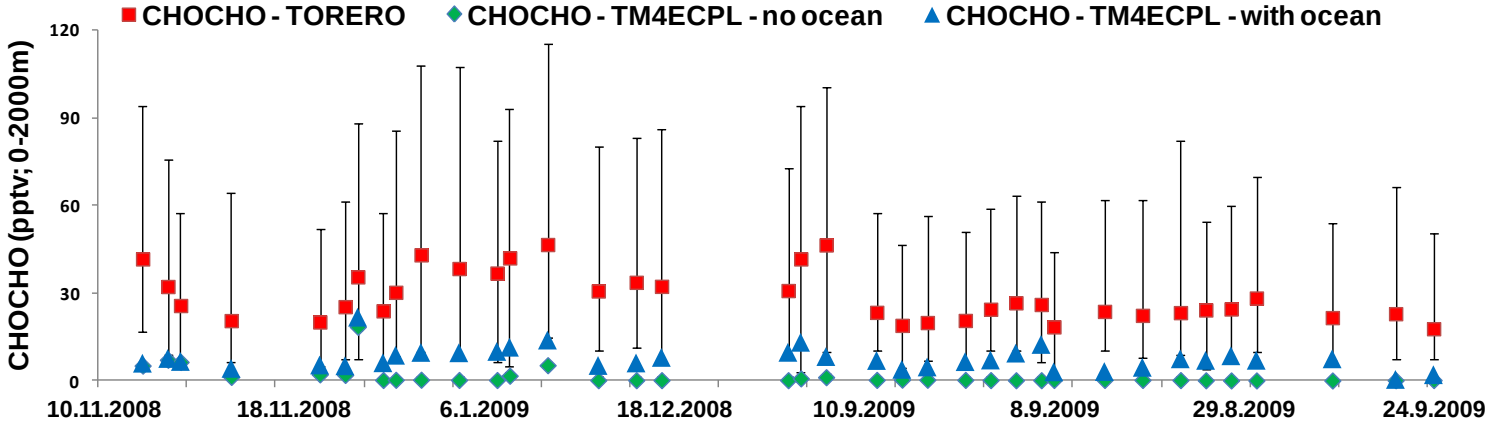


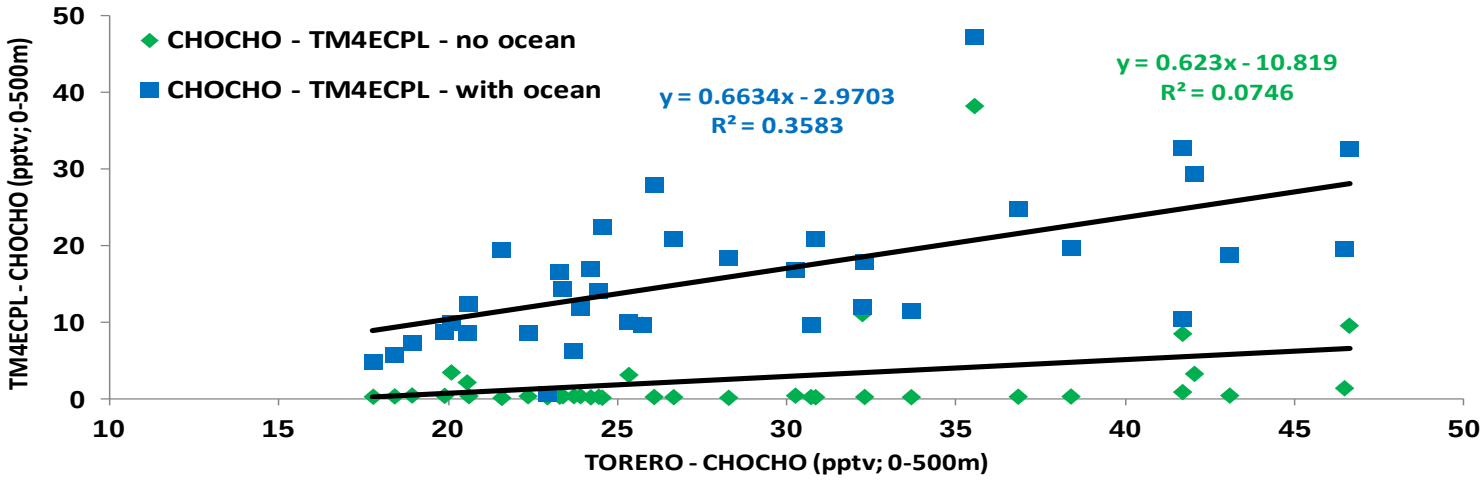


Vertical distribution of ocean contribution –zonal mean

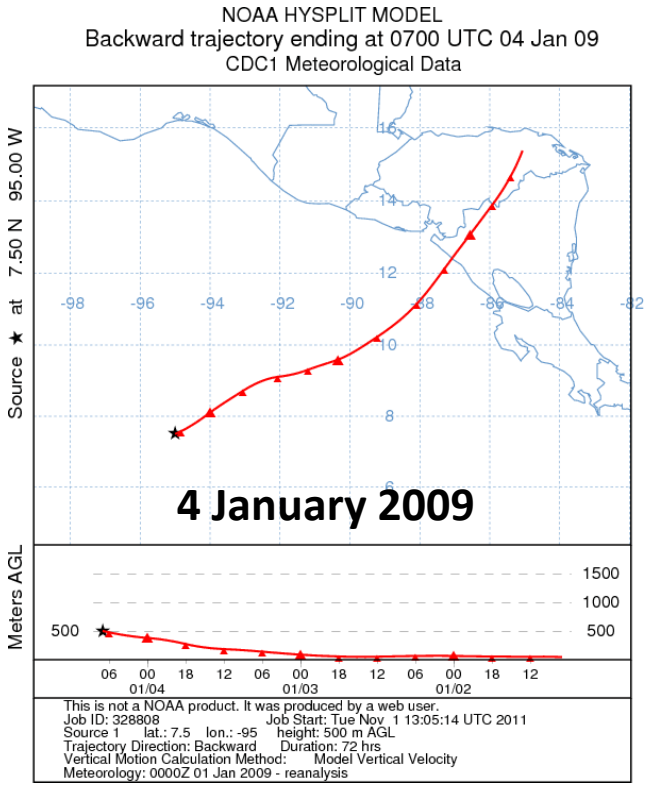
TORERO CHOCHO Validations

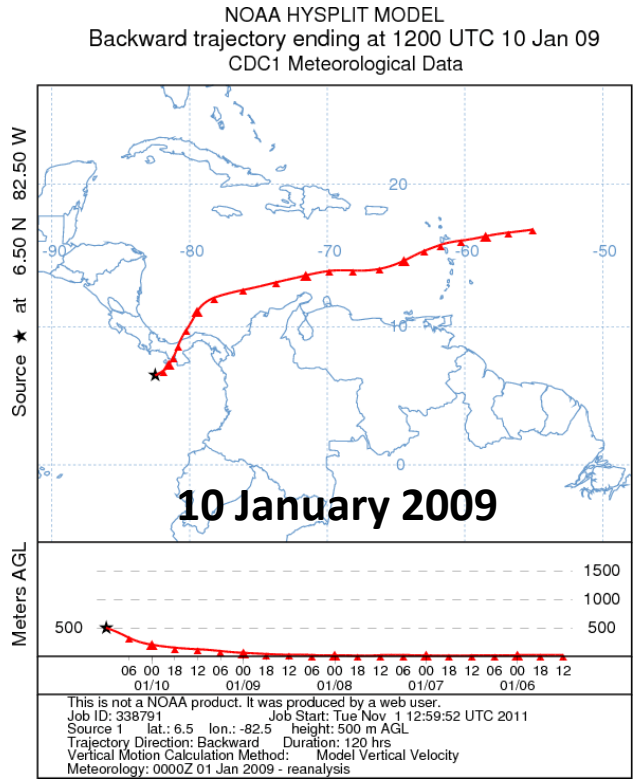






TORERO air mass back trajectories





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