Moisture origin and transport processes in Colombia, Northern South America

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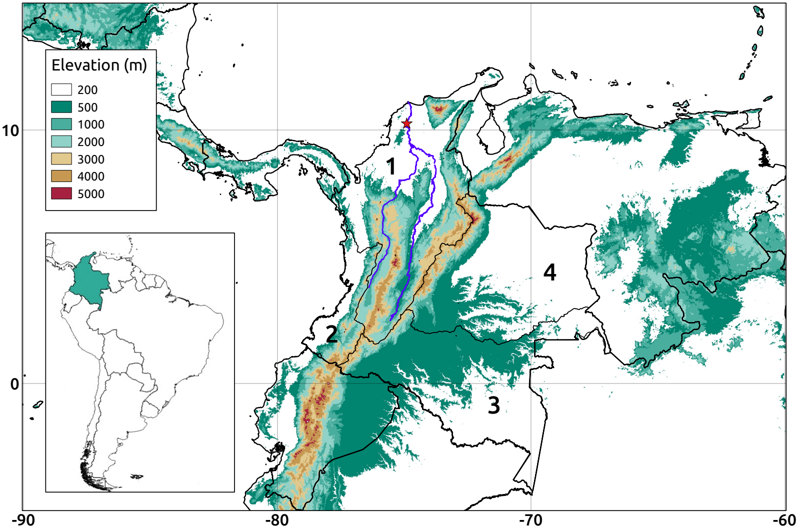
Supported by the USAID-NSF PEER program, project 31 and CODI Universidad de Antioquia.

Outline

Moisture origin and transport processes in Colombia, Northern South America

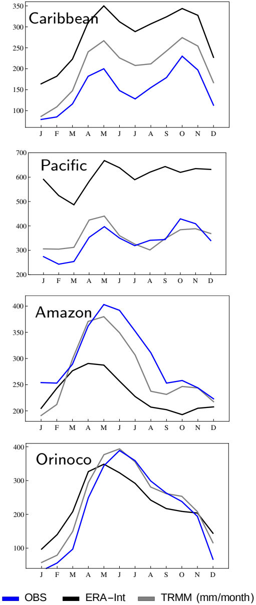
- Spatio-temporal variability of regional moisture fluxes and precipitation regimes
- Identification of regional moisture sources and their intra-annual variability

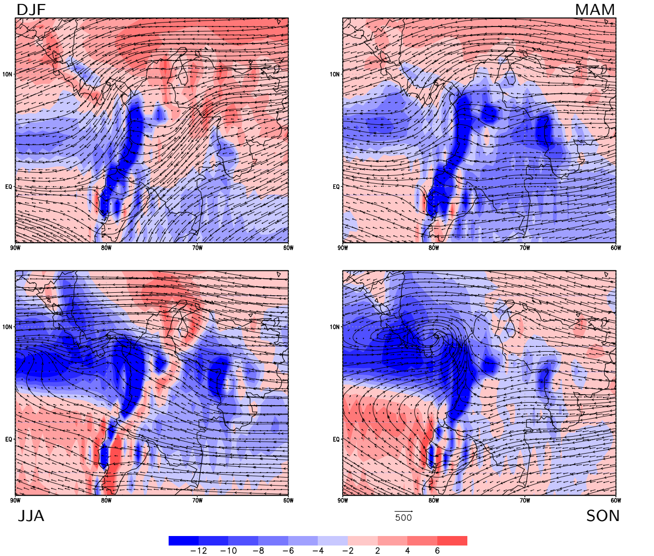
Study area: Northern South America (Colombia)



Outline

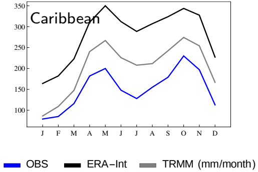
Regional rainfall and atmospheric moisture

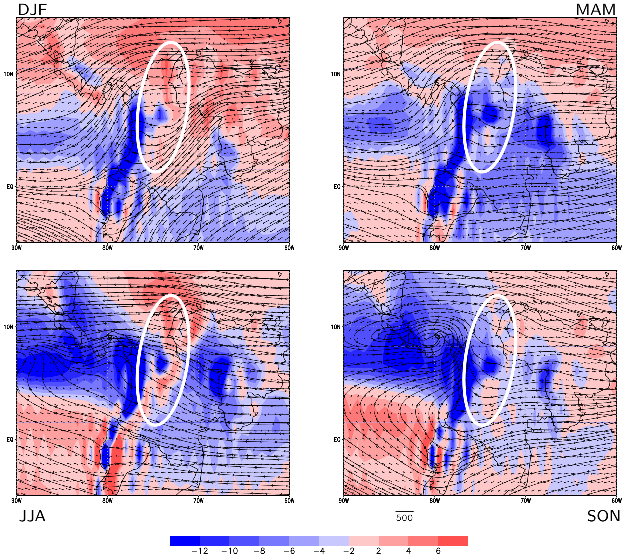




Moisture Flux Divergence (mm/day) in background. Vertical water vapor flux vector (kg/m/s).

Regional rainfall and atmospheric moisture





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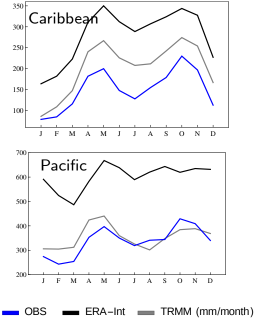
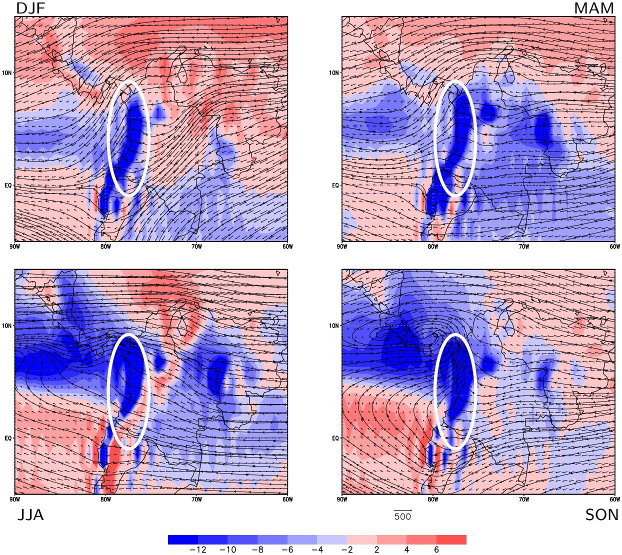
Regional rainfall and atmospheric moisture





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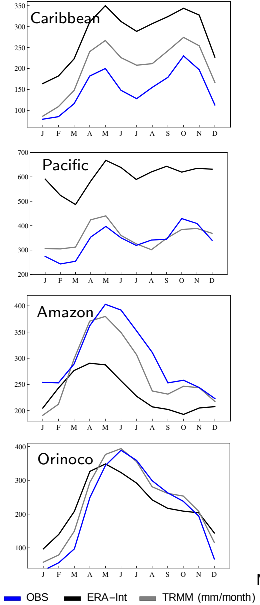
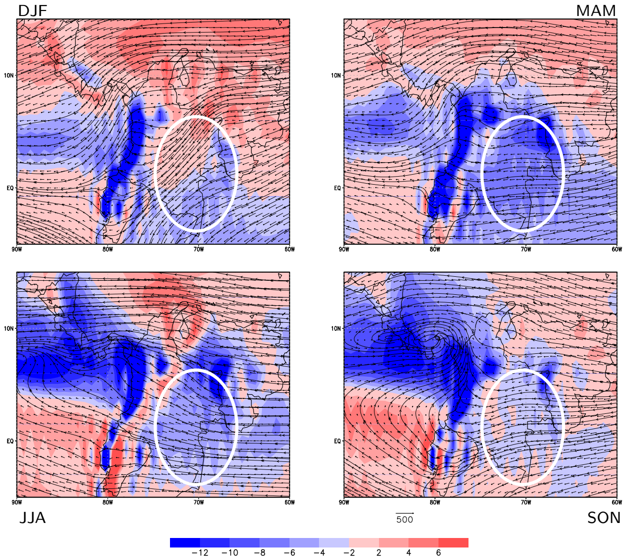




Moisture Flux Divergence (mm/day) in background. Vertical water vapor flux vector (kg/m/s).

Outline

Overview

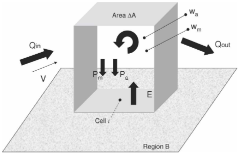
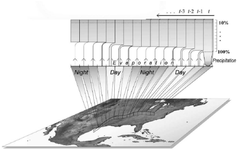
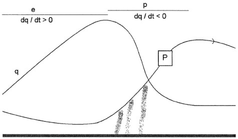
Regional rainfall and atmospheric moisture

Sources of regional moisture

Conclusions

Where does the regional moisture come from?

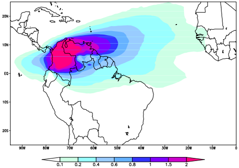
Complementary approaches from different backward trajectory models:

DRM	QIBT	FLEXPART
		
Dynamic Recycling Model	Quasi-isentropic back-trajectory	Particle dispersion model
Dominguez et al. (2006)	Dirmeyer and Brubaker (2007)	Stohl and James (2004)
Semi-lagrangian	Lagrangian	Lagrangian
Water vapor contributions from predefined source regions	Evaporative sources supplying rainfall	Net loss or gain of misture (E-P) along the particle trajectories

Identifying regional moisture sources (1980 - 2005)

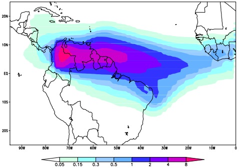
Target region: the Colombian inter-Andean region, the Caribbean low-lands and the Pacific Basin (NOSA)

DRM



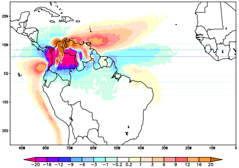
ERA-Interim

QIBT



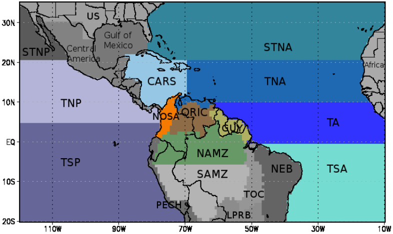
NCEP/DOE

FLEXPART



ERA-Interim

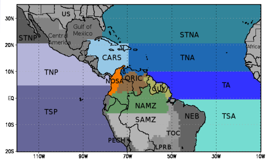
Summary of annual moisture contributions to NOSA

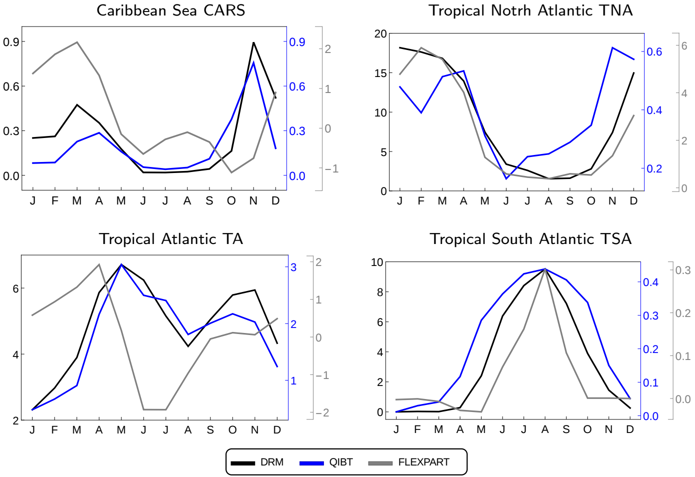


The oceanic regions were delimited using the climatological source map generated by the FLEXPART model. The terrestrial source regions correspond to the main hydrographic units within the continent.

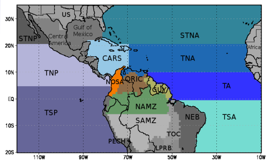
	Source region	FLEXPART E – PP (mm/month)	DRM PW (mm/month)	DRM PW %		QIBT Evaporative Source (mm/month)	QIBT Evaporative Source %	
Atlantic	TNA	2.346	9.029	**23.42**		0.391	**8.86**	
	TA	0.057	4.875	**12.10**		1.784	**36.05**	
	TSA	0.048	3.324	**8.17**	**49.07**	0.221	**5.41**	**52.04**
	STNA	0.001	1.807	4.68		0.002	0.09	
	CARS	0.345	0.267	0.68		0.199	1.60	
	Gulf of Mexico	0.000	0.009	0.02		0.005	0.03	
Pacific	TSP	0.317	0.808	2.00		0.007	0.34	
	TNP	-0.763	0.258	0.64	**2.64**	0.022	0.42	**0.86**
	STNP	0.000	0.001	0.00		0.002	0.10	
Terrestrial	ORIC	-13.940	5.116	12.80	**12.80**	5.779	18.02	**18.02**
	NAMZ	-2.140	3.060	7.50	**8.03**	0.641	5.78	**6.04**
	SAMZ	0.000	0.220	0.53		0.024	0.26	
	NOSA	-12.625	3.803	9.61	**9.61**	5.121	8.08	**8.40**
Others	GUY	-0.841	1.247	3.08		4.135	8.42	
	NEB	0.000	0.283	0.69		0.350	2.53	
	Western Africa	0.000	0.171	0.42		0.072	0.43	
	TOC	0.000	0.133	0.33		0.177	0.52	
	PECH	-0.220	0.093	0.23		0.008	0.02	
	Central America	-0.256	0.034	0.09	17.84	0.023	0.19	14.64
	LPRB	0.000	0.005	0.01		0.002	0.00	
	U S	0.000	0.002	0.01		0.000	0.00	
	Others outside of DRM domain		5.250	12.98		2.900	2.53	

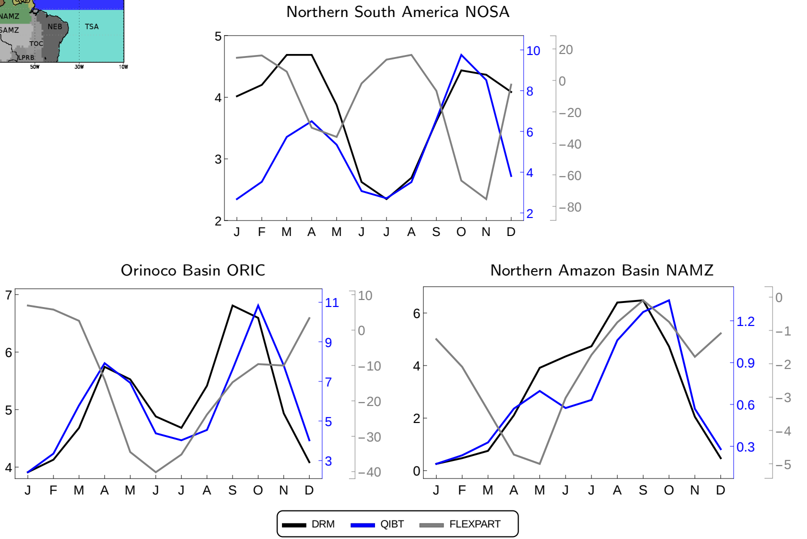
Atlantic sources (mm/month)



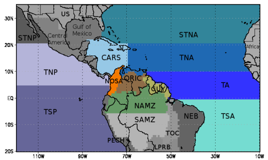


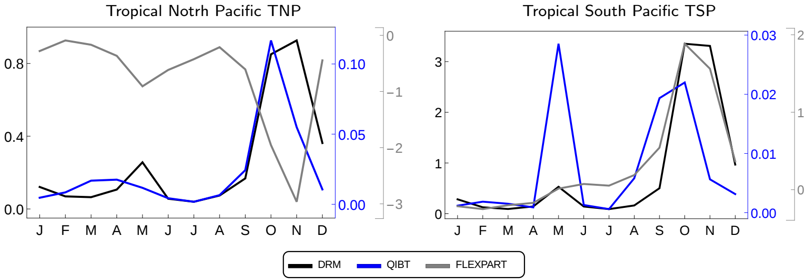
Terrestrial sources (mm/month)





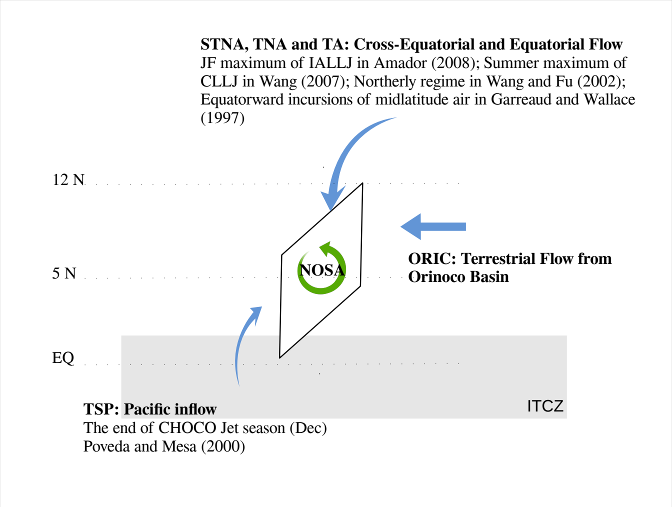
Pacific sources (mm/month)



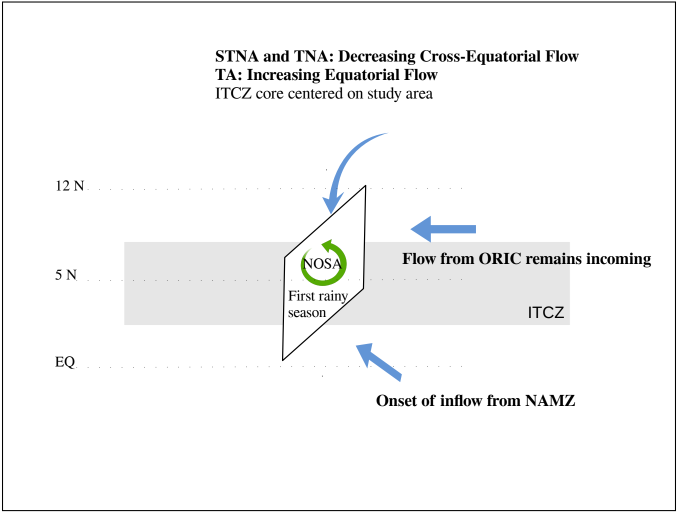


The moisture contribution from the Pacific ocean is significant only during the season of westerly low level jet system, from October to December (CHOCO jet, Poveda and Mesa 2000).

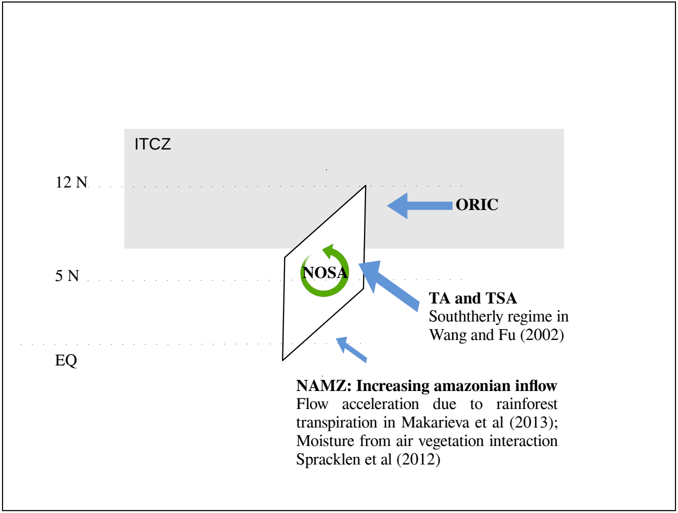
Qualitative summary of the seasonal progression of moisture sources over NOSA: DJF



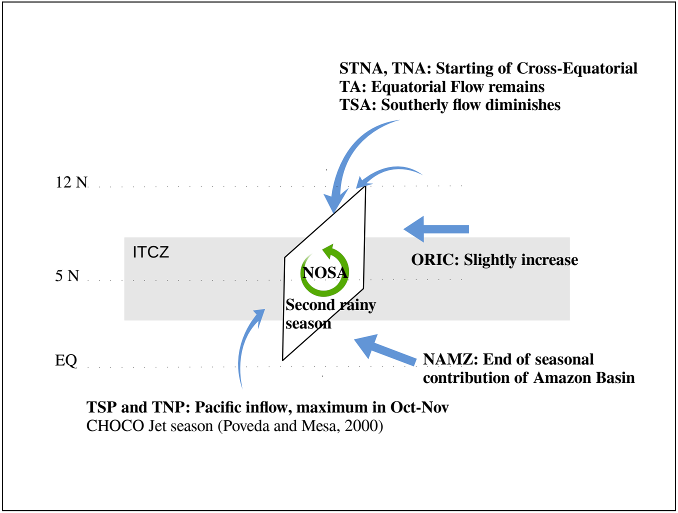
Qualitative summary of the seasonal progression of moisture sources over NOSA: MAM



Qualitative summary of the seasonal progression of moisture sources over NOSA: JJA



Qualitative summary of the seasonal progression of moisture sources over NOSA: SON



Outline

Concluding remarks

- The annual cycle of precipitation in each Colombian basin is driven by the interaction of the ITCZ with topography, and is reflected in the spatial patterns of moisture flux convergence.
- Three different methodologies to evaluate atmospheric moisture sources indicate that marine sources are the most important contributions for Colombia, with a predominance of the Atlantic Ocean and a significant contribution from the Tropical Pacific only during the CHOCO-jet season (SOND).
- Terrestrial sources also play an important role in moisture transference from surrounding areas highlighting the regional sensitivity to surface processes. This could potentially have implications related to changes in vegetation and land cover uses that directly affect transpiration processes and moisture transference.