

# H33A-06

AGU & CGU

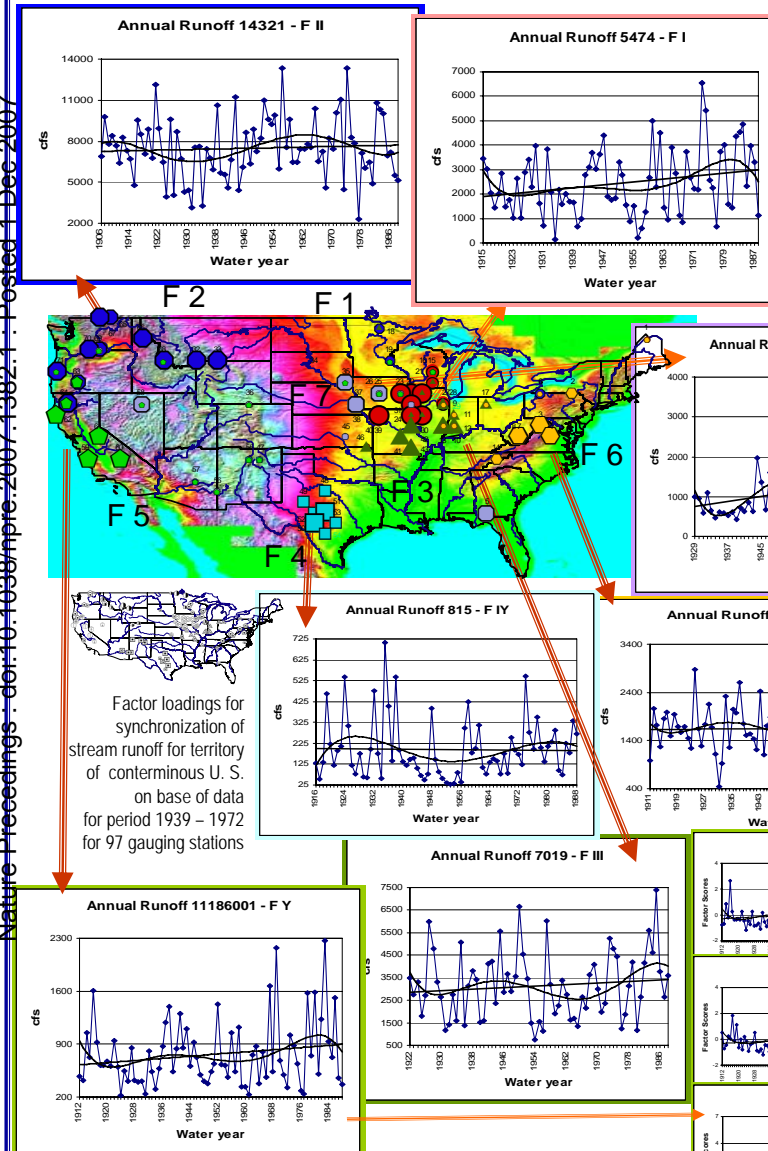
Montreal-2004

# The spatial temporal regime of stream flow of the conterminous U.S. in connection with indices of global atmospheric circulation

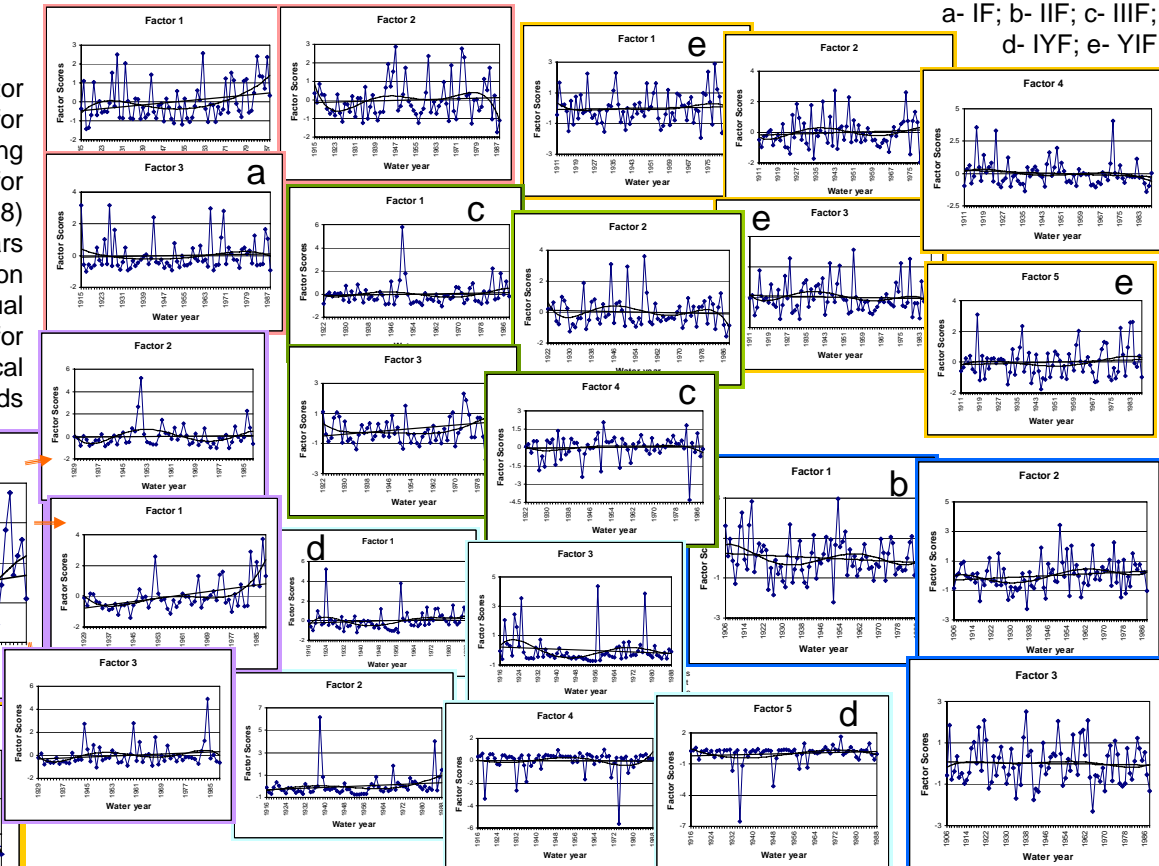
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## Seven Domains of Fluctuation for Conterminous U. S.



Factor loadings for 71 gauging stations for 60 (1929-88) years observation and annual discharge for typical watersheds



Graphs of Seasonal Runoff for Typical Watersheds: a- IF; b- IIF; c- IIIF; d- IYF; e- YIF

Table for Student and Fisher Criteria for Trend of Annual Runoff for Seven Typical Watersheds

Annual Runoff	Mean		t-value	df	p	Valid No		Standard Deviation		F-ratio	p-level
	Group 1	Group 2				Group 1	Group 2	Group 1	Group 2		
IF1 vs. IF2 (5474)	2039.90	2972.00	-2.65	58	0.010	30	30	1172.15	1527.21	1.70	0.160
IIF1 vs. IIF2 (14321)	7353.13	7510.23	-0.25	58	0.802	30	30	2506.36	2325.35	1.16	0.689
IIIF1 vs. IIIF2 (7019)	3030.87	3177.57	-0.38	58	0.707	30	30	1538.78	1463.68	1.11	0.789
IYF1 vs. IYF2 (815)	183.67	199.63	-0.43	58	0.666	30	30	174.46	101.42	2.96	0.005
YF1 vs. YF2 (11186)	731.63	833.67	-0.86	58	0.396	30	30	330.38	563.53	2.91	0.005
YIF1 vs. YIF2 (1668)	1629.07	1630.67	-0.01	58	0.992	30	30	588.22	638.51	1.18	0.662
YIIF1 vs. YIIF2 (68005)	1014.93	1416.03	-2.32	58	0.024	30	30	572.22	753.81	1.74	0.144

Table for Seven Typical Watersheds

Season	Annual	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Expl. Var.
1 (IF- 5474)	0.61	0.69	0.85	0.76	0.43	0.43	0.56	0.44	0.29					3.16
2 (IF- 5474)	0.73				0.50	0.41		0.59	0.77	0.81	0.59			3.05
3 (IF- 5474)	0.27									0.38	0.81	0.80		1.55
1 (IIF- 14321)	0.44							0.39	0.60	0.85	0.80	0.76	0.37	3.05
2 (IIF- 14321)	0.75	0.43	0.72	0.78	0.65	0.32						0.38		2.64
3 (IIF- 14321)	0.45	0.32	0.26		0.54	0.77	0.64	0.51						2.05
1 (IIIF- 7019)	0.74		0.27		0.31	0.64	0.66	0.33	0.69	0.66	0.37			2.79
2 (IIIF- 7019)	0.48	0.72			0.77	0.58					0.73	0.59		2.64
3 (IIIF- 7019)	0.41		0.64	0.71	0.32		0.33		0.83	0.25	-0.44	-0.29	-0.28	1.77
4 (IIIF- 7019)			-0.38		-0.37									1.28
1 (IYF- 815)	0.38	0.84	0.79		0.47	0.73	0.83							3.00
2 (IYF- 815)	-0.52	-0.27										-0.83	-0.62	1.50
3 (IYF- 815)	0.33			0.81	0.61		0.28				0.78			1.88
4 (IYF- 815)	0.26							0.83	0.83					1.47
5 (IYF- 815)	0.64									0.90				1.53
1 (YF- 11186)	0.97				0.72	0.81	0.87	0.91	0.93	0.92	0.90	0.88	0.79	7.61
2 (YF- 11186)		0.88	0.86		0.26					0.39	0.37	0.39		1.69
3 (YF- 11186)				0.91										1.48
1 (YIF- 1668)	0.53				0.75	0.29	0.76		0.29					1.71
2 (YIF- 1668)	0.39	0.68	0.76	0.58	0.27	-0.25						-0.40		1.87
3 (YIF- 1668)	0.30			0.28							0.35	0.79	0.65	1.43
4 (YIF- 1668)	0.43								0.57	0.83	0.74			1.84
5 (YIF- 1668)	0.53			0.55	0.72	0.68	0.43							1.95
1 (YIIF- 68005)	0.49	0.88	0.94	0.92	0.83	0.52	0.49	0.46	0.31					4.29
2 (YIIF- 68005)	0.46					0.45	0.33				0.74	0.89	0.83	2.69
3 (YIIF- 68005)	0.74				0.29	0.30	0.70	0.73	0.89	0.45				2.81

## Seasonal Runoff Structure

- #1 The spatial temporal distribution of stream runoff is multi dimensional process following the topography on continental level
- #2 The inter annual distribution of stream runoff follows the multi year distribution and creates seasonal structures on regional level
- #3 Stream runoff as multi dimensional and multilevel process is in interconnection with process of atmospheric circulation

Hydrological Data for Conterminous US and Central US from source: U.S. Geological Survey Hydro-Climatic Data Network (HCDN): Streamflow Data Set, 1874 - 1988 By J.R. Slack, Alan M. Lumb, and Jurate Macinunas Landwehr. USGS Water-Resources Investigations Report 93-4076 Data for Arctic Oscillation (AO), North Atlantic Oscillation (NAO), Antarctic Oscillation (AAO) & Pacific-North America Index (PO) followed Web sites: Thompson, D. W. J., and J. M. Wallace, 2000. Annual modes in the extratropical circulation. Part I: Month-to-month variability. J. Climate, 13, 1000-1016.

## Table of Regression and Correlation Analysis

for some typical annual and seasonal stream runoff for conterminous USA with monthly teleconnection indices as Arctic Oscillation, North Atlantic Oscillation (°), Antarctic Oscillation (Apr°) and Pacific/ North American (°). Months from previous year indicated with - 1

Dep/Indep	Beta	St. Err. of Beta	B	St. Err. of B	t (f)	p-level
I F			R= .358 R²= .128 Adjusted R²= .105			
Apr°	0.36	0.15	6.19	2.65	2.34	0.02
Aug°	-0.36	0.13	-0.85	0.29	-2.91	0.01
I F2			R= .471 R²= .222 Adjusted R²= .179			
Dec°	0.43	0.14	798.34	260.36	3.07	0.0
Oct°	0.31	0.14	862.51	385.92	2.23	0.03
II F			R= .727 R²= .528 Adjusted R²= .457			
Jan°	0.39	0.13	449.86	148.6	3.03	0.0
Nov°	-0.44	0.14	-722.34	221.27	-3.26	0.0
May°	-0.44	0.14	-1100.6	342.6	-3.21	0.0
Oct°	-0.28	0.14	-592.83	285.94	-2.07	0.05
Apr°	0.25	0.12	4.57	2.27	2.02	0.05
IY F			R= .3583 R²= .1291 Adjusted R²= .1056			
Jul°	0.36	0.15	105.46	45.02	2.34	0.02
Y F			R= .5950 R²= .3541 Adjusted R²= .2987			
Jul°	-0.33	0.14	-437.63	181.01	-2.42	0.02
Oct°	0.37	0.14	249.68	92.74	2.69	0.01
Aug°	-0.29	0.14	-339.33	157.7	-2.15	0.04
YI F			R= .7287 R²= .5311 Adjusted R²= .4759			
Jun°	-0.52	0.12	-576.03	132.78	-4.34	0.0
Jan°	0.38	0.12	166.14	53.28	3.12	0.0
Nov°	-0.37	0.13	-225.23	76.34	-2.95	0.01
May°	0.29	0.12	295.55	120.45	2.45	0.02
YII F			R= .3244 R²= .1052 Adjusted R²= .0811			
Apr°	0.32	0.16	284.8	136.49	2.09	0.04
Aug	-0.27	0.14	-0.44	0.22	-2.01	0.05
I F2			R= .61522837 R²= .37850594 Adjusted R²= .32366823			
Sep°	-0.51	0.15	-1182.8	340.27	-3.48	0.00
May°	-0.38	0.15	-833.7	325.89	-2.56	0.02
Apr°	0.32	0.14	5.59	2.43	2.30	0.03
II F3			R= .98614611 R²= .97248415 Adjusted R²= .95372335			
Jun°	-0.39	0.04	-1486.1	169.90	-8.80	0.00
Jan°	-0.60	0.04	-1434.8	103.78	-13.83	0.00
Sep°	0.69	0.05	2721.2	190.46	14.29	0.00
Sep°	-0.30	0.05	-1308.9	212.83	-6.15	0.00
Jul°	0.47	0.04	2562.6	217.49	11.78	0.00
Oct°	0.45	0.05	1248.1	130.88	9.54	0.00
Aug°	0.26	0.04	1019.8	154.55	6.60	0.00
May°	0.37	0.04	1750.0	198.53	8.82	0.00
Apr°	-0.28	0.04	-7.66	1.08	-7.08	0.00
Jun°	0.25	0.04	1077.2	177.64	6.06	0.00
Jan°	0.19	0.05	326.14	82.19	3.97	0.00
Mar°	-0.20	0.04	-365.6	80.45	-4.55	0.00
Oct°	0.15	0.05	459.23	182.69	3.01	0.01
Mar°	-0.21	0.04	-389.92	72.54	-5.38	0.00
Nov°	0.13	0.04	324.93	106.70	2.96	0.01
III F			R= .7257 R²= .526 Adjusted R²= .469			
Apr°	0.58	0.14	10.09	2.39	4.22	0.00
Sep°	-0.52	0.13	-1518.0	387.63	-3.92	0.00
Jan°	0.43	0.13	481.24	144.79	3.32	0.00
Dec°	-0.27	0.14	-251.60	124.81	-2.02	0.05
IY F2			R= .607 R²= .368 Adjusted R²= .312			
Jul°	0.46	0.14	134.82	40.95	3.29	0.00
Apr°	0.41	0.14	57.01	19.85	2.87	0.01
Apr°	0.38	0.14	0.49	0.18	2.71	0.01
Y F			R= .837 R²= .700 Adjusted R²= .618			
Jul°	-0.42	0.11	-548.38	149.80	-3.66	0.00
Apr°	-0.70	0.12	-432.18	73.83	-5.85	0.00
Jun°	-0.29	0.11	-234.99	89.32	-2.63	0.01
Oct°	-0.37	0.12	-250.24	79.81	-3.14	0.00
Oct°	0.34	0.11	203.09	67.40	3.01	0.01
Mar°	0.31	0.11	136.30	49.32	2.76	0.01
May°	-0.27	0.11	-212.52	87.17	-2.44	0.02
Sep°	-0.23	0.11	-229.33	106.50	-2.15	0.04
YII F2			R= .927 R²= .860 Adjusted R²= .801			
Jan°	0.76	0.10	481.50	60.98	7.90	0.00
Oct°	-0.49	0.10	-611.03	119.16	-5.13	0.00
May°	-0.75	0.10	-724.27	94.29	-7.68	0.00
Mar°	-0.63	0.10	-5.36	0.82	-6.55	0.00
May°	-0.54	0.10	-475.26	127.80	-3.73	0.00
May°	-0.52	0.10	-595.35	116.53	-5.11	0.00
Mar°	0.57	0.09	321.96	50.71	6.35	0.00
Jun°	-0.29	0.10	-385.31	129.13	-2.98	0.01
Dec°	-0.22	0.08	-126.69	44.35	-2.86	0.01
Apr°	-0.23	0.08	-267.76	98.60	-2.72	0.01
Apr°	-0.25	0.10	-230.45	90.74	-2.54	0.02
I F3			R= .663 R²= .440 Adjusted R²= .409			
Apr°	0.52	0.13	0.01	0	4.11	0.00
Aug°	-0.36	0.13	-0.85	0.29	-2.91	0.01
I F2			R= .471 R²= .222 Adjusted R²= .179			
Dec°	0.35	0.15	0.3	0.13	2.39	0.02
Sep°	0.36	0.15	0.59	0.24	2.43	0.02
I F3			R= .56			