

7. Gander Airport CS

This station was updated in CRA (2015). The updated IDF curve from CRA (2015) is reproduced below, with the addition of the 20-year return period.

This IDF curve was updated using 5-min, 15-min, and 1-hr data from Gander Airport CS. The IDF curve increased during the update (Table 7.1).

Table 7.1 Differences Between IDF Curves for Gander Airport CS

Percent Difference in Precipitation Amount (%) (Difference in Precipitation Amount (mm))						
Duration	Return Period (years)					
	2	5	10	25	50	100
5-min	0.7 (0.0)	0.5 (0.0)	0.4 (0.0)	0.3 (0.0)	0.3 (0.0)	0.3 (0.0)
10-min	1.3 (0.1)	1.6 (0.1)	1.7 (0.2)	1.8 (0.2)	1.9 (0.3)	1.9 (0.3)
15-min	1.9 (0.1)	2.3 (0.3)	2.4 (0.3)	2.5 (0.4)	2.6 (0.5)	2.7 (0.5)
30-min	1.6 (0.2)	1.3 (0.2)	1.2 (0.2)	1.1 (0.2)	1.0 (0.3)	1.0 (0.3)
1-hr	2.5 (0.3)	2.6 (0.5)	2.7 (0.6)	2.7 (0.7)	2.7 (0.8)	2.8 (0.9)
2-hr	2.7 (0.5)	4.1 (1.0)	4.8 (1.3)	5.4 (1.7)	5.7 (2.0)	6.0 (2.4)
6-hr	3.2 (0.9)	6.2 (2.4)	7.6 (3.3)	8.9 (4.5)	9.7 (5.4)	10.4 (6.2)
12-hr	3.6 (1.4)	8.8 (4.3)	11.2 (6.2)	13.6 (8.6)	14.9 (10.4)	16.1 (12.2)
24-hr	4.7 (2.2)	12.3 (7.4)	15.7 (10.9)	18.9 (15.3)	20.7 (18.5)	22.2 (21.7)
Notes: Red numbers indicate that the updated IDF curve is lower than the EC-IDF V2.3 IDF curve for that duration and return period. Bold numbers indicate changes greater than 5 percent.						

Office of Climate Change and Energy Efficiency

Short Duration Rainfall Intensity-Duration-Frequency Data
Données sur l'intensité, la durée et la fréquence des chutes
de pluie de courte durée

Gumbel - Method of moments/Méthode des moments

2015/10/30

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GANDER AIRPORT CS NL 8401705
Updated with 5-min, 15-min, and 1-hr data measured at Gander Airport CS
(8401705): 2010-2013
Latitude: 48 57'N Longitude: 54 34'W Elevation/Altitude: 151 m
Years/Années : 1939 - 2013 # Years/Années : 68

Table 1 : Annual Maximum (mm)/Maximum annuel (mm)

	Year Année	5 min	10 min	15 min	30 min	1 h	2 h	6 h	12 h	24 h
EC-IDF	1939	6.1	7.6	11.4	11.4	13.0	16.0	26.7	32.0	35.1
EC-IDF	1941	3.6	5.1	6.6	8.1	13.5	19.6	35.1	39.1	58.7
EC-IDF	1942	3.0	5.6	7.6	9.4	13.0	25.1	61.5	81.5	103.4
EC-IDF	1945	4.1	4.3	4.6	4.6	7.4	14.0	24.1	25.7	30.0
EC-IDF	1946	2.5	3.8	4.6	6.9	9.9	13.5	20.8	24.4	40.9
EC-IDF	1947	4.1	6.6	8.6	13.2	14.0	14.2	32.3	32.3	32.3
EC-IDF	1948	7.1	11.4	13.5	14.7	19.3	22.1	33.8	46.7	53.3
EC-IDF	1949	15.2	22.9	27.9	40.6	46.2	46.5	51.1	51.6	52.3
EC-IDF	1950	4.6	8.9	10.9	12.2	14.5	16.0	21.3	42.7	50.0
EC-IDF	1951	4.6	7.6	9.7	12.7	20.8	-99.9	-99.9	-99.9	98.3
EC-IDF	1952	7.6	8.6	11.2	15.7	17.5	18.0	23.6	27.7	29.5
EC-IDF	1953	4.6	9.1	12.2	16.8	18.3	22.1	29.2	41.9	47.2
EC-IDF	1954	4.3	7.1	7.9	9.9	11.2	18.0	27.2	37.3	41.4
EC-IDF	1955	4.6	7.6	9.7	10.4	11.7	18.3	24.1	31.0	35.1
EC-IDF	1956	2.0	3.3	4.8	7.4	14.5	16.3	21.3	26.9	31.0
EC-IDF	1958	2.5	4.8	5.1	9.4	12.4	19.3	40.4	44.7	49.5
EC-IDF	1959	2.8	5.1	5.3	5.8	7.6	10.9	25.9	32.3	38.1
EC-IDF	1960	5.6	6.3	6.3	8.1	9.4	14.7	31.5	33.0	33.0
EC-IDF	1961	3.6	5.3	7.6	13.7	18.8	31.2	33.3	33.5	38.9
EC-IDF	1962	6.3	12.7	15.2	25.1	27.2	31.2	31.2	32.8	36.6
EC-IDF	1963	8.4	10.7	12.4	15.2	15.5	23.1	46.7	49.5	49.5
EC-IDF	1964	4.1	5.8	6.3	8.4	10.9	19.6	35.3	38.4	38.9
EC-IDF	1965	2.5	2.8	3.3	5.8	8.4	13.2	24.9	39.1	39.9
EC-IDF	1966	9.1	12.7	14.7	17.8	17.8	20.1	26.9	37.3	38.9
EC-IDF	1967	4.3	6.1	7.6	9.9	10.9	13.0	29.5	35.6	39.1
EC-IDF	1968	8.6	9.1	9.1	9.7	10.4	12.4	21.6	37.8	45.0
EC-IDF	1969	3.6	6.6	6.6	6.6	9.1	14.2	23.4	36.3	45.0
EC-IDF	1970	2.8	5.1	6.1	9.1	13.2	15.7	21.6	27.4	45.0
EC-IDF	1971	3.0	3.3	3.6	5.1	7.6	12.4	26.7	43.4	55.9
EC-IDF	1972	2.0	2.8	3.0	4.1	6.3	9.7	16.3	20.6	30.2
EC-IDF	1973	4.3	6.9	8.9	14.7	18.5	22.1	29.7	40.6	46.0
EC-IDF	1974	2.5	3.6	4.6	7.6	11.9	17.0	21.1	27.9	36.8
EC-IDF	1975	5.1	6.3	7.1	10.2	12.4	14.5	26.7	37.6	41.7
EC-IDF	1976	4.3	6.1	6.1	8.4	11.9	17.8	24.4	33.8	38.6
EC-IDF	1977	5.1	5.6	6.6	8.4	10.7	16.5	29.7	37.6	38.9
EC-IDF	1978	5.3	5.9	6.9	7.3	9.2	12.9	20.8	21.2	21.2
EC-IDF	1979	6.1	8.7	9.3	10.3	13.1	19.1	26.0	31.1	40.8
EC-IDF	1980	5.8	8.3	8.7	11.4	15.4	23.9	30.3	47.0	59.3
EC-IDF	1981	2.8	4.4	5.9	7.9	12.9	16.6	29.8	38.1	70.1
EC-IDF	1982	2.9	3.9	4.3	6.2	9.3	12.3	23.8	33.0	42.0
EC-IDF	1983	4.6	6.9	8.4	13.4	15.2	15.6	26.0	33.8	40.8
EC-IDF	1984	5.2	6.3	7.5	8.4	10.0	19.2	36.8	37.4	46.6
EC-IDF	1985	4.1	4.8	5.2	6.4	10.3	16.5	24.4	36.0	38.2
EC-IDF	1986	5.4	7.9	8.3	10.9	15.1	24.2	46.7	64.6	68.9
EC-IDF	1987	2.1	3.1	3.7	6.2	10.7	16.9	29.1	35.9	45.4
EC-IDF	1988	4.2	6.0	8.9	14.7	18.3	28.5	45.8	46.0	52.8
EC-IDF	1989	3.9	7.7	10.7	15.8	20.2	21.3	30.7	43.9	55.4
EC-IDF	1990	5.6	7.5	8.1	10.1	11.0	12.3	23.3	43.3	75.4
EC-IDF	1991	4.7	6.6	6.6	7.7	11.9	17.8	31.4	33.8	45.9
EC-IDF	1992	4.4	7.4	11.1	12.5	12.5	17.5	42.6	61.2	64.2
EC-IDF	1993	3.2	5.3	7.8	10.8	17.0	27.7	48.9	53.7	60.6
EC-IDF	1994	3.3	6.6	7.2	7.6	11.4	16.5	20.1	26.6	32.8
EC-IDF	1995	7.9	8.1	8.3	9.2	10.6	15.8	39.6	65.6	71.5
EC-IDF	1996	6.3	9.3	10.5	11.2	14.6	19.6	34.2	50.3	67.5
EC-IDF	1997	3.8	5.8	6.2	8.8	12.0	16.7	31.6	54.8	57.6
EC-IDF	1998	8.0	10.7	12.3	18.5	18.5	18.7	33.1	40.7	59.1
EC-IDF	1999	3.2	4.3	5.6	8.6	12.8	18.2	25.8	44.1	57.0
EC-IDF	2000	6.8	12.2	13.2	19.8	24.5	28.4	32.0	33.4	41.0
EC-IDF	2001	3.0	4.0	4.9	9.6	10.6	14.6	24.3	-99.9	33.8
EC-IDF	2002	8.0	10.8	13.9	18.4	21.1	32.9	37.6	37.6	45.2
EC-IDF	2003	3.9	4.5	6.0	9.4	14.0	20.9	44.3	61.8	89.1
EC-IDF	2004	3.5	5.4	7.9	11.0	14.0	19.7	34.4	44.6	68.4
EC-IDF	2005	7.8	7.8	11.2	16.0	19.4	32.6	37.8	38.2	43.2

EC-IDF	2006	4.0	5.4	5.4	7.6	12.2	20.8	35.0	44.0	52.0
EC-IDF	2007	3.6	5.2	7.0	8.0	11.6	18.0	41.2	48.8	51.4
EC-IDF	2008	6.4	11.6	14.4	15.6	18.4	20.0	37.4	49.8	54.2
EC-IDF	2009	3.0	4.8	6.4	11.2	18.2	29.8	53.2	58.6	59.0
UPDATE	2010	7.0	13.4	18.0	20.0	25.7	25.7	52.5	84.7	138.2
UPDATE	2012	NM	NM	NM	NM	18.5	30.9	55.0	65.9	103.6
UPDATE	2013	NM	NM	10.0	14.0	23.9	41.3	70.3	101.0	124.5

# Yrs.	68	68	69	69	70	69	69	68	70
Années									
Mean	4.8	7.0	8.5	11.3	14.6	19.9	32.7	42.2	52.0
Moyenne									
Std. Dev.	2.2	3.2	4.0	5.5	5.9	6.9	10.7	14.6	21.6
Écart-type									
Skew.	1.86	2.08	2.03	2.58	2.49	1.54	1.26	1.70	1.98
Dissymétrie									
Kurtosis	9.15	10.66	10.35	14.01	13.71	6.03	4.71	7.02	7.65

*-99.9 Indicates Missing Data/Données manquantes

* NM Indicates No Measurements/Aucunes mesures

Warning: annual maximum amount greater than 100-yr return period amount
Avertissement : la quantité maximale annuelle excède la quantité pour une période de retour de 100 ans

Year/Année	Duration/Durée	Data/Données	100-yr/ans
1949	5 min	15.2	11.7
1949	10 min	22.9	17.1
1949	15 min	27.9	21.0
1949	30 min	40.6	28.5
1949	1 h	46.2	33.2
1949	2 h	46.5	41.7
2010	12 h	101.0	88.0
2010	24 h	138.2	119.8
2012	6 h	70.3	66.2
2013	24 h	124.5	119.8

Table 2a : Return Period Rainfall Amounts (mm)
Quantité de pluie (mm) par période de retour

Duration/Durée	2	5	10	20	25	50	100	#Years
	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	Années
UPDATE 5 min	4.5	6.4	7.7	8.9	9.3	10.5	11.7	68
UPDATE 10 min	6.5	9.3	11.2	13.0	13.6	15.4	17.1	68
UPDATE 15 min	7.8	11.4	13.7	15.9	16.6	18.8	21.0	69
UPDATE 30 min	10.4	15.3	18.5	21.6	22.5	25.6	28.5	69
UPDATE 1 h	13.6	18.8	22.3	25.6	26.7	29.9	33.2	70
UPDATE 2 h	18.7	24.9	28.9	32.8	34.1	37.9	41.7	69
UPDATE 6 h	30.9	40.4	46.6	52.6	54.5	60.4	66.2	69
UPDATE 12 h	39.8	52.7	61.3	69.4	72.0	80.1	88.0	68
UPDATE 24 h	48.5	67.6	80.2	92.3	96.2	108.1	119.8	70

* 5-min, 15-min, 1-hr data were used for the update: all durations were updated

Table 2b :

Return Period Rainfall Rates (mm/h) - 95% Confidence limits
Intensité de la pluie (mm/h) par période de retour - Limites de confiance de 95%

Duration/Durée	2	5	10	20	25	50	100	#Years
	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	Années
UPDATE 5 min	53.6	76.9	92.3	107.1	111.8	126.3	140.6	68
	+/- 5.7	+/- 9.7	+/- 13.1	+/- 16.5	+/- 17.6	+/- 21.1	+/- 24.6	68
UPDATE 10 min	39.0	56.1	67.4	78.2	81.7	92.3	102.8	68
	+/- 4.2	+/- 7.1	+/- 9.6	+/- 12.1	+/- 12.9	+/- 15.5	+/- 18.0	68
UPDATE 15 min	31.4	45.4	54.7	63.6	66.5	75.2	83.8	69
	+/- 3.4	+/- 5.8	+/- 7.8	+/- 9.9	+/- 10.5	+/- 12.6	+/- 14.7	69
UPDATE 30 min	20.9	30.6	37.0	43.1	45.1	51.1	57.1	69

		+/-	2.4 +/-	4.0 +/-	5.4 +/-	6.8 +/-	7.3 +/-	8.7 +/-	10.2	69
UPDATE	1 h		13.6	18.8	22.3	25.6	26.7	29.9	33.2	70
		+/-	1.3 +/-	2.1 +/-	2.9 +/-	3.7 +/-	3.9 +/-	4.7 +/-	5.5	70
UPDATE	2 h		9.4	12.4	14.5	16.4	17.0	18.9	20.8	69
		+/-	0.8 +/-	1.3 +/-	1.7 +/-	2.2 +/-	2.3 +/-	2.8 +/-	3.2	69
UPDATE	6 h		5.2	6.7	7.8	8.8	9.1	10.1	11.0	69
		+/-	0.4 +/-	0.7 +/-	0.9 +/-	1.1 +/-	1.2 +/-	1.4 +/-	1.7	69
UPDATE	12 h		3.3	4.4	5.1	5.8	6.0	6.7	7.3	68
		+/-	0.3 +/-	0.4 +/-	0.6 +/-	0.8 +/-	0.8 +/-	1.0 +/-	1.1	68
UPDATE	24 h		2.0	2.8	3.3	3.8	4.0	4.5	5.0	70
		+/-	0.2 +/-	0.3 +/-	0.4 +/-	0.6 +/-	0.6 +/-	0.7 +/-	0.8	70
* 5-min, 15-min, 1-hr data were used for the update: all durations were updated										

Table 3 : Interpolation Equation / Équation d'interpolation: $R = A \cdot T^B$

R = Interpolated Rainfall rate (mm/h)/Intensité interpolée de la pluie (mm/h)

RR = Rainfall rate (mm/h) / Intensité de la pluie (mm/h)

T = Rainfall duration (h) / Durée de la pluie (h)

Statistics/Statistiques	2	5	10	20	25	50	100
	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans
Mean of RR/Moyenne de RR	19.8	28.2	33.8	39.2	40.9	46.1	51.3
Std. Dev. /Écart-type (RR)	18.0	26.1	31.5	36.6	38.3	43.3	48.3
Std. Error/Erreur-type	1.5	2.6	3.4	4.2	4.4	5.1	5.9
Coefficient (A)	13.7	19.1	22.7	26.1	27.2	30.5	33.8
Exponent/Exposant (B)	-0.577	-0.593	-0.599	-0.603	-0.605	-0.608	-0.610
Mean % Error/% erreur moyenne	3.5	3.2	3.2	3.6	3.8	4.3	4.6

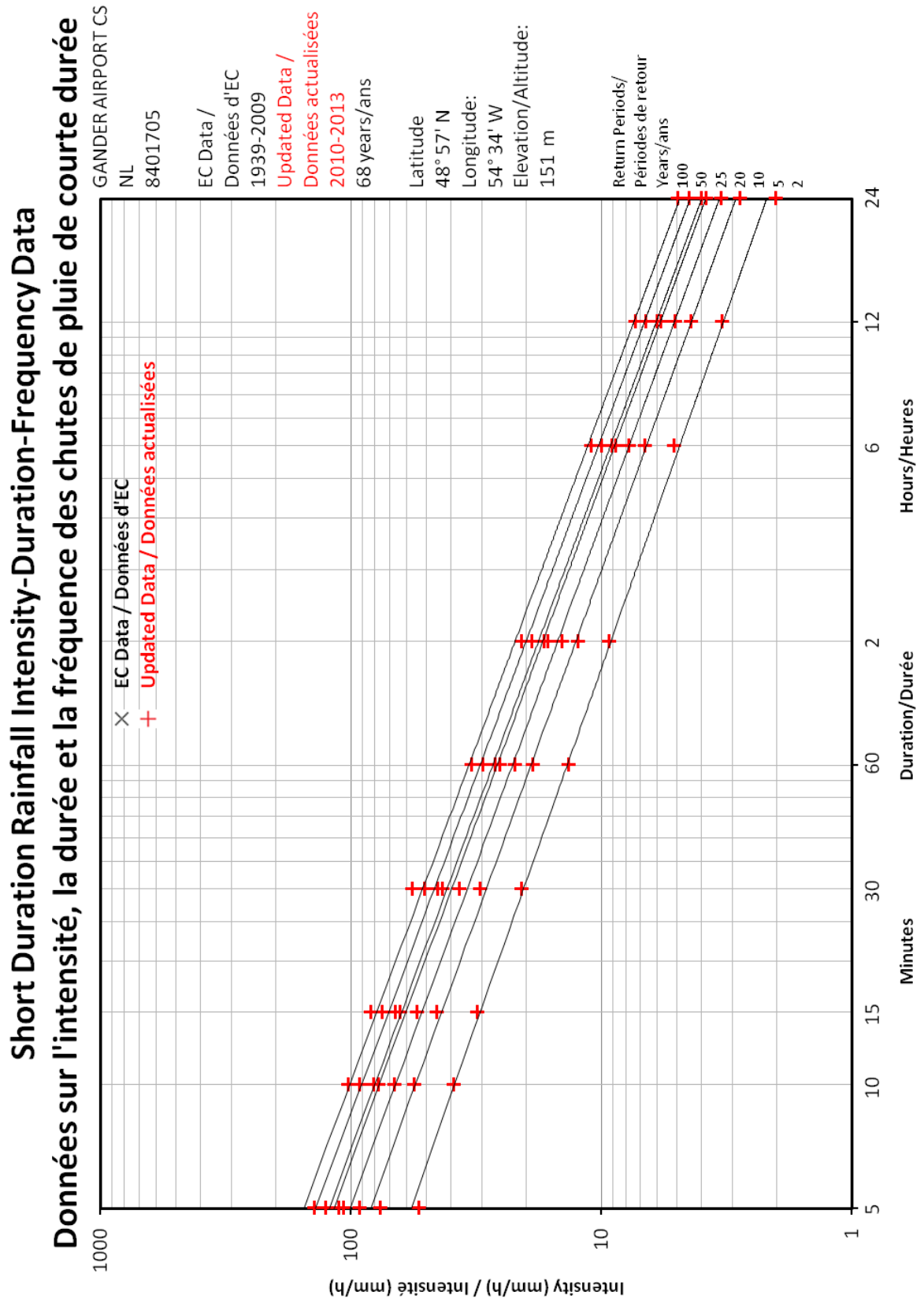


Figure 7.1 Gander Airport CS IDF Curve – Updated

Quantile-Quantile : GANDER AIRPORT CS, NL 8401705

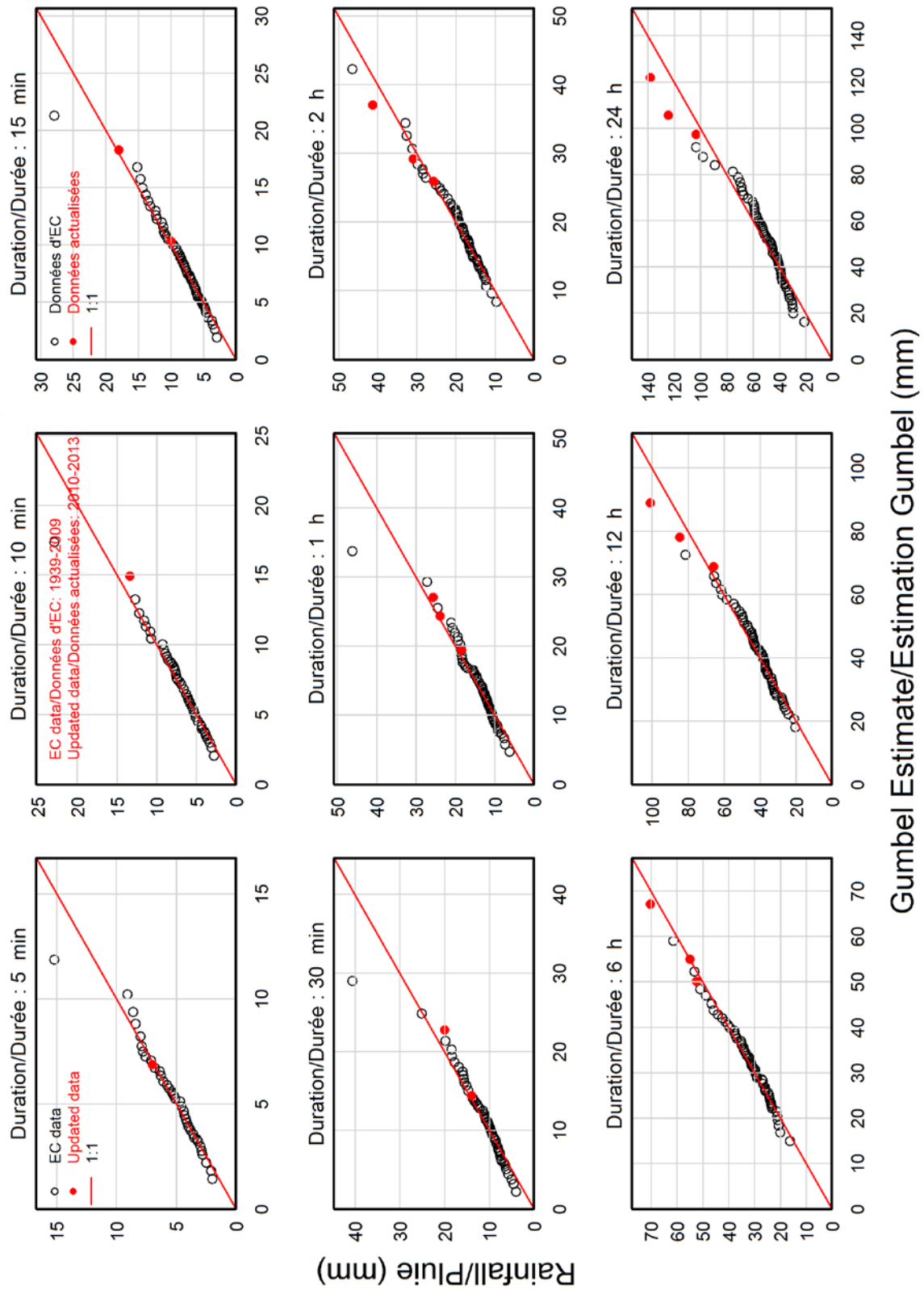
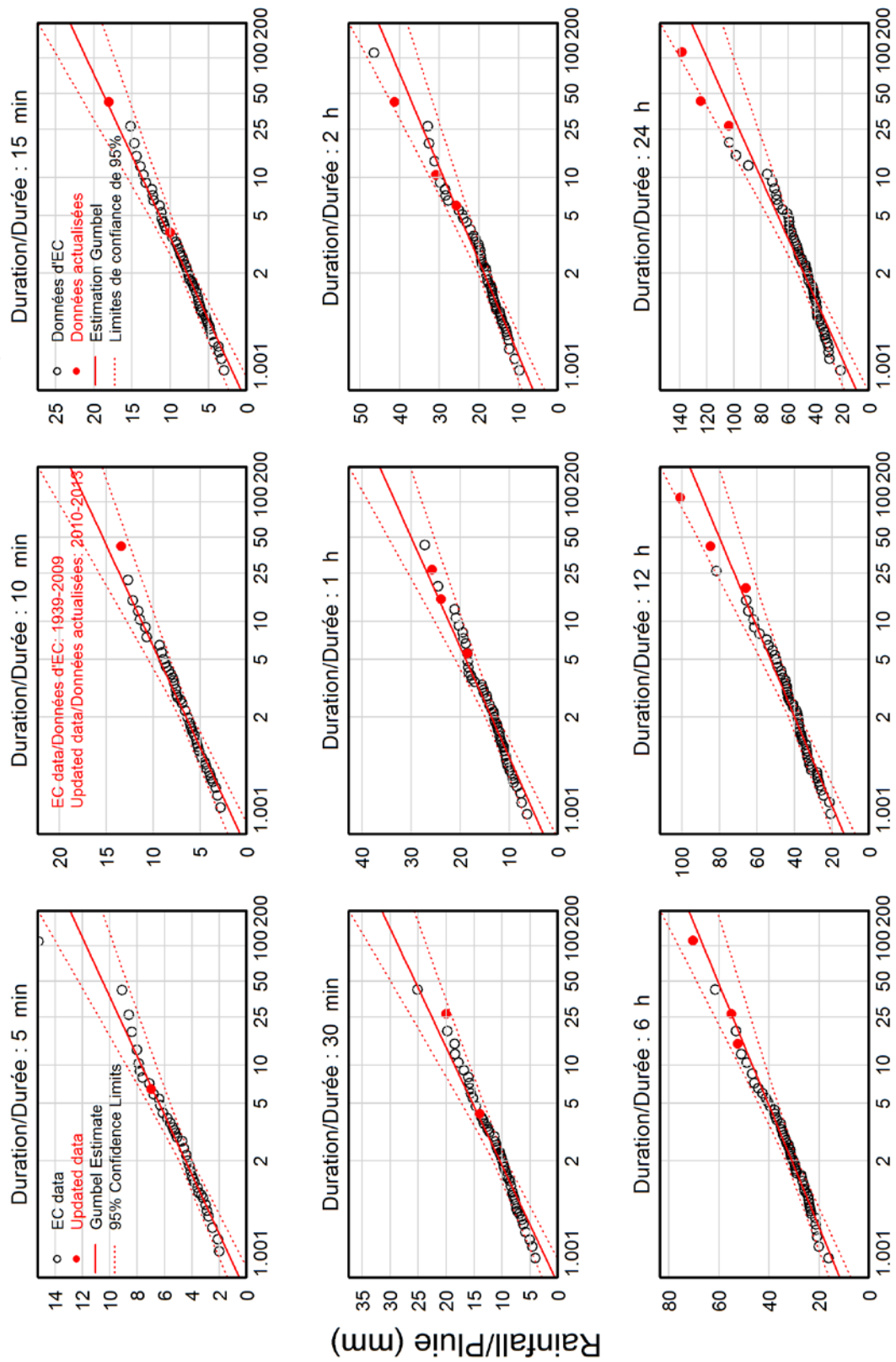


Figure 7.2 Gander Airport CS Quantile-Quantile Plot – Updated

Return Level/Niveau de retour : GANDER AIRPORT CS, NL 8401705



Return Period/Période de retour (years/années)

Figure 7.3 Gander Airport CS Return Level Plot - Updated

Trend/Tendance : GANDER AIRPORT CS, NL 8401705

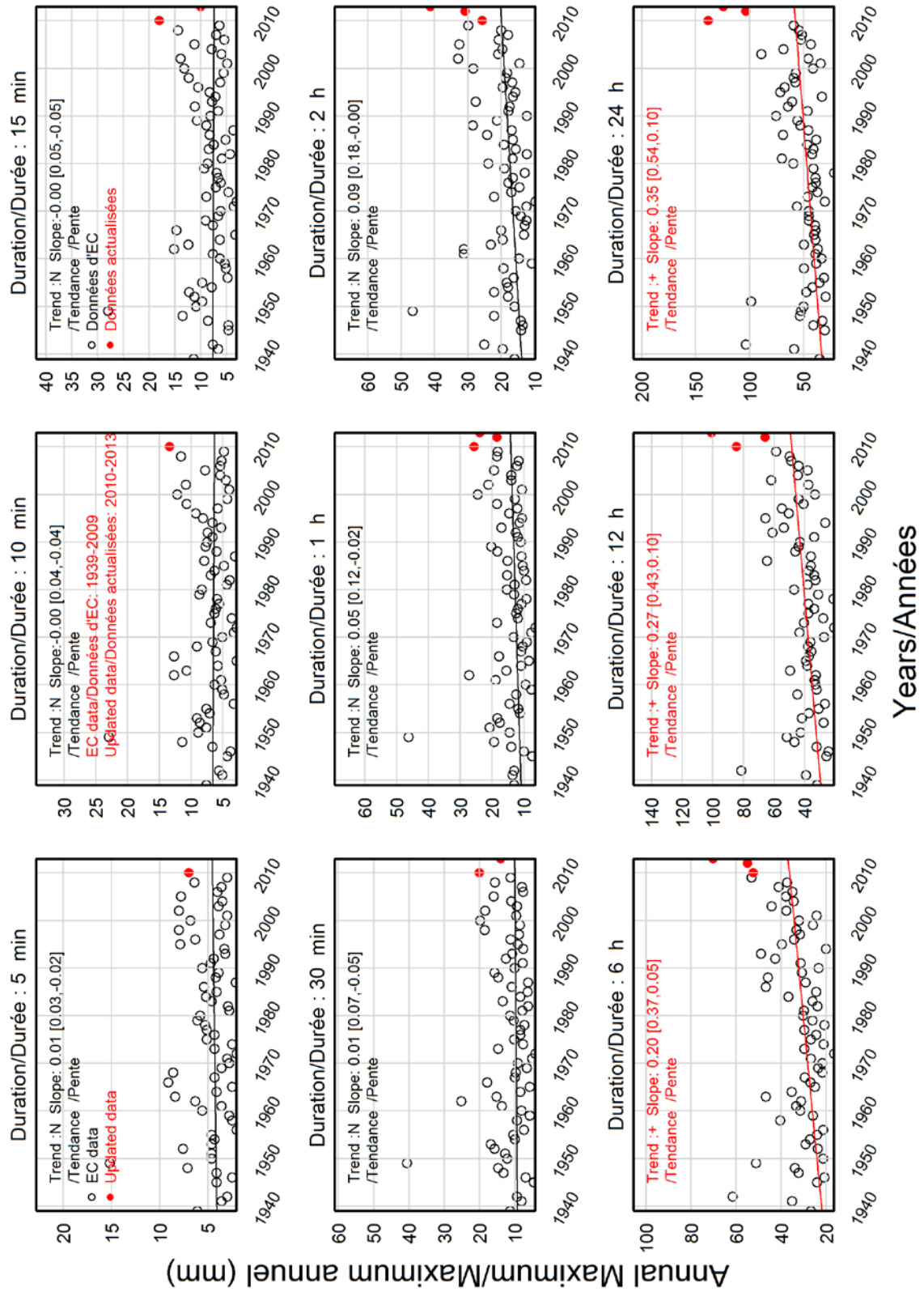


Figure 7.4 Gander Airport CS Trend Plot – Updated