## APENDICE 7.10.

**APLICACIÓN DE TÉCNICAS REGIONALES**

###### Técnica de las estaciones-años

En la Tabla 7.3.1.25 y Tabla 7.3.1.26 se presentan los datos en m3/s y en la Tabla 7.3.1.27 y Tabla 7.3.1.28 modulados para cada región.

Tabla 7.3.1.25. QMI (m3/s) de las estaciones de la región homogénea uno.

| AÑO | ESTACIÓN | | |
| --- | --- | --- | --- |
| 27001 | 27005 | 27006 |
| 1951 |  |  |  |
| 1952 | 294.38 |  |  |
| 1953 | 136.45 |  |  |
| 1954 | 122.78 |  |  |
| 1955 | 85.11 |  |  |
| 1956 | 160.95 |  |  |
| 1957 | 144.31 |  |  |
| 1958 | 122.24 |  |  |
| 1959 | 185.06 | 19.11 |  |
| 1960 | 210.71 | 18.72 |  |
| 1961 | 126.24 | 10.11 | 11.40 |
| 1962 | 152.47 | 15.21 | 23.20 |
| 1963 | 117.10 | 9.62 | 21.35 |
| 1964 | 136.58 | 16.76 | 11.08 |
| 1965 | 125.64 | 23.63 | 11.47 |
| 1966 | 161.25 | 10.23 | 24.05 |
| 1967 | 108.04 | 11.38 | 20.14 |
| 1968 | 101.47 | 15.34 | 32.82 |
| 1969 | 127.84 | 11.20 | 19.38 |
| 1970 | 134.22 | 10.91 | 18.94 |
| 1971 | 127.16 | 7.99 | 21.34 |
| 1972 | 136.21 | 17.71 | 20.04 |
| 1973 | 163.84 | 20.69 | 28.65 |
| 1974 | 123.90 | 10.01 | 19.85 |
| 1975 | 127.76 | 14.97 | 20.98 |
| 1976 | 127.02 | 16.44 | 35.55 |
| 1977 | 120.27 | 10.05 | 14.65 |
| 1978 | 121.73 | 7.34 | 20.59 |
| 1979 | 160.30 | 20.75 | 36.91 |
| 1980 | 136.61 | 13.18 | 22.20 |
| 1981 | 135.22 | 18.24 | 24.84 |
| 1982 | 131.00 | 11.40 | 22.75 |
| 1983 | 105.85 | 4.92 | 19.42 |
| 1984 | 138.72 | 11.13 | 25.60 |
| 1985 | 118.79 | 13.83 | 40.73 |
| 1986 | 122.94 | 13.49 | 21.09 |
| 1987 | 126.77 | 18.52 | 22.65 |
| 1988 | 114.01 | 18.53 | 24.89 |
| 1989 | 89.71 | 10.49 | 23.20 |
| 1990 | 133.92 | 19.75 | 32.60 |
| 1991 | 120.23 | 12.66 | 18.08 |
| 1992 | 150.53 | 7.67 | 16.69 |
| 1993 | 131.43 | 12.43 | 20.69 |
| 1994 | 128.66 | 9.53 | 18.29 |
| 1995 | 109.64 | 7.94 | 14.77 |
| 1996 | 150.07 | 11.41 | 51.24 |
| 1997 | 98.62 | 12.99 | 43.25 |
| 1998 | 194.43 | 8.96 | 48.87 |
| 1999 | 130.93 | 8.91 | 43.84 |
| 2000 | 141.87 | 13.28 | 64.42 |
| 2001 | 152.99 | 13.40 | 60.85 |
| 2002 | 172.08 | 8.18 | 24.92 |
| 2003 | 78.29 | 9.09 | 38.84 |
| 2004 | 112.11 |  |  |
| 2005 | 74.68 |  |  |
| 2006 | 137.90 |  |  |
| 2007 | 148.61 |  |  |
| 2008 | 183.62 |  |  |
| 2009 | 189.11 |  |  |
| 2010 | 190.71 |  |  |
| 2011 | 163.86 |  |  |

Tabla 7.3.1.26. QMI (m3/s) de las estaciones de la región homogénea dos.

|  | ESTACIÓN | | | |
| --- | --- | --- | --- | --- |
| AÑO | 28003 | 28108 | 28111 | 28125 |
| 1951 | 67.49 |  |  |  |
| 1952 | 75.25 |  |  |  |
| 1953 | 99.37 |  |  |  |
| 1954 | 35.77 |  |  |  |
| 1955 | 32.86 |  |  |  |
| 1956 | 53.04 |  |  |  |
| 1957 | 30.09 |  |  |  |
| 1958 | 19.27 |  |  |  |
| 1959 | 48.77 |  |  |  |
| 1960 | 27.67 |  |  |  |
| 1961 | 9.8 | 12.22 |  |  |
| 1962 | 19.34 | 9.22 |  |  |
| 1963 | 7.65 | 7.36 | 1.35 |  |
| 1964 | 6.8 | 7.18 | 1.58 |  |
| 1965 | 13.17 | 5.47 | 1.82 |  |
| 1966 | 79.25 | 8.7 | 4.21 | 42.02 |
| 1967 | 19.06 | 7.37 | 2.08 | 98.69 |
| 1968 | 49.12 | 8.55 | 2.33 | 98.65 |
| 1969 | 75.83 | 8.66 | 1.82 | 95.68 |
| 1970 | 31.46 | 13.65 | 2.4 | 89.86 |
| 1971 | 34.88 | 10.72 | 1.45 | 84.51 |
| 1972 | 56.41 | 9.51 | 1.76 | 104.39 |
| 1973 | 58.34 | 16.91 | 1.88 | 106.35 |
| 1974 | 41.45 | 11.03 | 4.18 | 99.91 |
| 1975 | 17.05 | 11.52 | 1.96 | 84.61 |
| 1976 | 28.11 | 10.77 | 2.2 | 85.51 |
| 1977 | 46.34 | 8.78 | 2.91 | 72.29 |
| 1978 | 7.44 | 7.41 | 1.96 | 51.13 |
| 1979 | 13.91 | 16.49 | 4.49 | 138.99 |
| 1980 | 14.42 | 14.66 | 3.39 | 121.32 |
| 1981 | 49.79 | 14.95 | 5.6 | 120.6 |
| 1982 | 35.34 | 16.1 | 4.89 | 119.1 |
| 1983 | 4.03 | 11.03 | 2.24 | 91.72 |
| 1984 | 16.75 | 6.54 | 2.25 | 103.55 |
| 1985 | 47.07 | 11.33 | 4.68 | 120.04 |
| 1986 | 38.73 | 11.37 | 2.82 | 115.82 |
| 1987 | 55.75 | 12.97 | 5.28 | 121.11 |
| 1988 | 45.16 | 8.68 | 4.43 | 119.9 |
| 1989 | 29.83 | 6.75 | 1.98 | 108.27 |
| 1990 | 28.33 | 8.27 | 3.27 | 118.87 |
| 1991 | 32.25 | 6.3 | 3.14 | 106.22 |
| 1992 | 135.43 | 38.74 | 11.09 | 118.08 |
| 1993 | 45.33 | 15.17 | 5.37 | 89.12 |
| 1994 | 41.69 | 18.44 | 5.6 | 97.81 |
| 1995 | 2.41 | 10 | 3.11 | 81.38 |
| 1996 | 11.27 | 11.65 | 5.39 | 87.24 |
| 1997 | 29.54 | 10.56 | 5.15 | 99.74 |
| 1998 | 3.54 | 10.67 | 2.69 | 91.68 |
| 1999 | 5.91 | 17.55 | 3.55 | 101.91 |
| 2000 | 15.44 | 18.16 | 4.16 | 107.24 |
| 2001 | 13.18 | 23.96 | 6.25 | 115.61 |
| 2002 | 6.61 | 7.02 | 3.88 | 100.43 |
| 2003 | 5.48 | 1.39 | 3.93 | 106.85 |
| 2004 | 65.99 | 16.58 | 6.67 | 123.12 |
| 2005 | 5.03 | 18.06 | 4.58 | 100.56 |
| 2006 | 29.68 | 10.62 | 2.78 | 101.47 |
| 2007 | 108.57 | 7.69 | 4.97 | 158.1 |
| 2008 | 12.88 | 11.26 | 2 | 114.82 |
| 2009 | 21.74 | 17.15 | 4.39 | 118.97 |
| 2010 | 19 | 14.36 | 9.16 | 139.31 |
| 2011 | 33.38 | 64.62 | 3.66 | 153.39 |

Tabla 7.3.1.27. QMI modulados de las estaciones de la región homogénea uno.

|  | ESTACIÓN | | | |
| --- | --- | --- | --- | --- |
| AÑO | 28003 | 28108 | 28111 | 28125 |
| 1951 | 67.49 |  |  |  |
| 1952 | 75.25 |  |  |  |
| 1953 | 99.37 |  |  |  |
| 1954 | 35.77 |  |  |  |
| 1955 | 32.86 |  |  |  |
| 1956 | 53.04 |  |  |  |
| 1957 | 30.09 |  |  |  |
| 1958 | 19.27 |  |  |  |
| 1959 | 48.77 |  |  |  |
| 1960 | 27.67 |  |  |  |
| 1961 | 9.8 | 12.22 |  |  |
| 1962 | 19.34 | 9.22 |  |  |
| 1963 | 7.65 | 7.36 | 1.35 |  |
| 1964 | 6.8 | 7.18 | 1.58 |  |
| 1965 | 13.17 | 5.47 | 1.82 |  |
| 1966 | 79.25 | 8.7 | 4.21 | 42.02 |
| 1967 | 19.06 | 7.37 | 2.08 | 98.69 |
| 1968 | 49.12 | 8.55 | 2.33 | 98.65 |
| 1969 | 75.83 | 8.66 | 1.82 | 95.68 |
| 1970 | 31.46 | 13.65 | 2.4 | 89.86 |
| 1971 | 34.88 | 10.72 | 1.45 | 84.51 |
| 1972 | 56.41 | 9.51 | 1.76 | 104.39 |
| 1973 | 58.34 | 16.91 | 1.88 | 106.35 |
| 1974 | 41.45 | 11.03 | 4.18 | 99.91 |
| 1975 | 17.05 | 11.52 | 1.96 | 84.61 |
| 1976 | 28.11 | 10.77 | 2.2 | 85.51 |
| 1977 | 46.34 | 8.78 | 2.91 | 72.29 |
| 1978 | 7.44 | 7.41 | 1.96 | 51.13 |
| 1979 | 13.91 | 16.49 | 4.49 | 138.99 |
| 1980 | 14.42 | 14.66 | 3.39 | 121.32 |
| 1981 | 49.79 | 14.95 | 5.6 | 120.6 |
| 1982 | 35.34 | 16.1 | 4.89 | 119.1 |
| 1983 | 4.03 | 11.03 | 2.24 | 91.72 |
| 1984 | 16.75 | 6.54 | 2.25 | 103.55 |
| 1985 | 47.07 | 11.33 | 4.68 | 120.04 |
| 1986 | 38.73 | 11.37 | 2.82 | 115.82 |
| 1987 | 55.75 | 12.97 | 5.28 | 121.11 |
| 1988 | 45.16 | 8.68 | 4.43 | 119.9 |
| 1989 | 29.83 | 6.75 | 1.98 | 108.27 |
| 1990 | 28.33 | 8.27 | 3.27 | 118.87 |
| 1991 | 32.25 | 6.3 | 3.14 | 106.22 |
| 1992 | 135.43 | 38.74 | 11.09 | 118.08 |
| 1993 | 45.33 | 15.17 | 5.37 | 89.12 |
| 1994 | 41.69 | 18.44 | 5.6 | 97.81 |
| 1995 | 2.41 | 10 | 3.11 | 81.38 |
| 1996 | 11.27 | 11.65 | 5.39 | 87.24 |
| 1997 | 29.54 | 10.56 | 5.15 | 99.74 |
| 1998 | 3.54 | 10.67 | 2.69 | 91.68 |
| 1999 | 5.91 | 17.55 | 3.55 | 101.91 |
| 2000 | 15.44 | 18.16 | 4.16 | 107.24 |
| 2001 | 13.18 | 23.96 | 6.25 | 115.61 |
| 2002 | 6.61 | 7.02 | 3.88 | 100.43 |
| 2003 | 5.48 | 1.39 | 3.93 | 106.85 |
| 2004 | 65.99 | 16.58 | 6.67 | 123.12 |
| 2005 | 5.03 | 18.06 | 4.58 | 100.56 |
| 2006 | 29.68 | 10.62 | 2.78 | 101.47 |
| 2007 | 108.57 | 7.69 | 4.97 | 158.1 |
| 2008 | 12.88 | 11.26 | 2 | 114.82 |
| 2009 | 21.74 | 17.15 | 4.39 | 118.97 |
| 2010 | 19 | 14.36 | 9.16 | 139.31 |
| 2011 | 33.38 | 64.62 | 3.66 | 153.39 |

|  | ESTACIÓN | | |
| --- | --- | --- | --- |
| AÑO | 27001 | 27005 | 27006 |
| 1952 | 2.13 |  |  |
| 1953 | 0.99 |  |  |
| 1954 | 0.89 |  |  |
| 1955 | 0.62 |  |  |
| 1956 | 1.17 |  |  |
| 1957 | 1.05 |  |  |
| 1958 | 0.89 |  |  |
| 1959 | 1.34 | 0.38 |  |
| 1960 | 1.53 | 0.56 |  |
| 1961 | 0.92 | 0.59 | 0.42 |
| 1962 | 1.11 | 0.61 | 0.86 |
| 1963 | 0.85 | 0.61 | 0.79 |
| 1964 | 0.99 | 0.63 | 0.41 |
| 1965 | 0.91 | 0.68 | 0.43 |
| 1966 | 1.17 | 0.69 | 0.89 |
| 1967 | 0.78 | 0.70 | 0.75 |
| 1968 | 0.74 | 0.73 | 1.22 |
| 1969 | 0.93 | 0.74 | 0.72 |
| 1970 | 0.97 | 0.77 | 0.70 |
| 1971 | 0.92 | 0.77 | 0.79 |
| 1972 | 0.99 | 0.77 | 0.74 |
| 1973 | 1.19 | 0.78 | 1.06 |
| 1974 | 0.90 | 0.80 | 0.74 |
| 1975 | 0.93 | 0.83 | 0.78 |
| 1976 | 0.92 | 0.85 | 1.32 |
| 1977 | 0.87 | 0.86 | 0.54 |
| 1978 | 0.88 | 0.87 | 0.77 |
| 1979 | 1.16 | 0.87 | 1.37 |
| 1980 | 0.99 | 0.87 | 0.82 |
| 1981 | 0.98 | 0.95 | 0.92 |
| 1982 | 0.95 | 0.97 | 0.85 |
| 1983 | 0.77 | 0.99 | 0.72 |
| 1984 | 1.01 | 1.01 | 0.95 |
| 1985 | 0.86 | 1.02 | 1.51 |
| 1986 | 0.89 | 1.03 | 0.78 |
| 1987 | 0.92 | 1.03 | 0.84 |
| 1988 | 0.83 | 1.06 | 0.92 |
| 1989 | 0.65 | 1.15 | 0.86 |
| 1990 | 0.97 | 1.16 | 1.21 |
| 1991 | 0.87 | 1.17 | 0.67 |
| 1992 | 1.09 | 1.26 | 0.62 |
| 1993 | 0.95 | 1.28 | 0.77 |
| 1994 | 0.93 | 1.36 | 0.68 |
| 1995 | 0.79 | 1.40 | 0.55 |
| 1996 | 1.09 | 1.42 | 1.90 |
| 1997 | 0.72 | 1.42 | 1.61 |
| 1998 | 1.41 | 1.43 | 1.82 |
| 1999 | 0.95 | 1.46 | 1.63 |
| 2000 | 1.03 | 1.51 | 2.39 |
| 2001 | 1.11 | 1.58 | 2.26 |
| 2002 | 1.25 | 1.59 | 0.93 |
| 2003 | 0.57 | 1.81 | 1.44 |
| 2004 | 0.81 |  |  |
| 2005 | 0.54 |  |  |
| 2006 | 1.00 |  |  |
| 2007 | 1.08 |  |  |
| 2008 | 1.33 |  |  |
| 2009 | 1.37 |  |  |
| 2010 | 1.38 |  |  |
| 2011 | 1.19 |  |  |

Tabla 7.3.1.28. QMI modulados de las estaciones de la región homogénea dos.

|  | ESTACIÓN | | |
| --- | --- | --- | --- |
| AÑO | 27001 | 27005 | 27006 |
| 1952 | 2.13 |  |  |
| 1953 | 0.99 |  |  |
| 1954 | 0.89 |  |  |
| 1955 | 0.62 |  |  |
| 1956 | 1.17 |  |  |
| 1957 | 1.05 |  |  |
| 1958 | 0.89 |  |  |
| 1959 | 1.34 | 0.38 |  |
| 1960 | 1.53 | 0.56 |  |
| 1961 | 0.92 | 0.59 | 0.42 |
| 1962 | 1.11 | 0.61 | 0.86 |
| 1963 | 0.85 | 0.61 | 0.79 |
| 1964 | 0.99 | 0.63 | 0.41 |
| 1965 | 0.91 | 0.68 | 0.43 |
| 1966 | 1.17 | 0.69 | 0.89 |
| 1967 | 0.78 | 0.70 | 0.75 |
| 1968 | 0.74 | 0.73 | 1.22 |
| 1969 | 0.93 | 0.74 | 0.72 |
| 1970 | 0.97 | 0.77 | 0.70 |
| 1971 | 0.92 | 0.77 | 0.79 |
| 1972 | 0.99 | 0.77 | 0.74 |
| 1973 | 1.19 | 0.78 | 1.06 |
| 1974 | 0.90 | 0.80 | 0.74 |
| 1975 | 0.93 | 0.83 | 0.78 |
| 1976 | 0.92 | 0.85 | 1.32 |
| 1977 | 0.87 | 0.86 | 0.54 |
| 1978 | 0.88 | 0.87 | 0.77 |
| 1979 | 1.16 | 0.87 | 1.37 |
| 1980 | 0.99 | 0.87 | 0.82 |
| 1981 | 0.98 | 0.95 | 0.92 |
| 1982 | 0.95 | 0.97 | 0.85 |
| 1983 | 0.77 | 0.99 | 0.72 |
| 1984 | 1.01 | 1.01 | 0.95 |
| 1985 | 0.86 | 1.02 | 1.51 |
| 1986 | 0.89 | 1.03 | 0.78 |
| 1987 | 0.92 | 1.03 | 0.84 |
| 1988 | 0.83 | 1.06 | 0.92 |
| 1989 | 0.65 | 1.15 | 0.86 |
| 1990 | 0.97 | 1.16 | 1.21 |
| 1991 | 0.87 | 1.17 | 0.67 |
| 1992 | 1.09 | 1.26 | 0.62 |
| 1993 | 0.95 | 1.28 | 0.77 |
| 1994 | 0.93 | 1.36 | 0.68 |
| 1995 | 0.79 | 1.40 | 0.55 |
| 1996 | 1.09 | 1.42 | 1.90 |
| 1997 | 0.72 | 1.42 | 1.61 |
| 1998 | 1.41 | 1.43 | 1.82 |
| 1999 | 0.95 | 1.46 | 1.63 |
| 2000 | 1.03 | 1.51 | 2.39 |
| 2001 | 1.11 | 1.58 | 2.26 |
| 2002 | 1.25 | 1.59 | 0.93 |
| 2003 | 0.57 | 1.81 | 1.44 |
| 2004 | 0.81 |  |  |
| 2005 | 0.54 |  |  |
| 2006 | 1.00 |  |  |
| 2007 | 1.08 |  |  |
| 2008 | 1.33 |  |  |
| 2009 | 1.37 |  |  |
| 2010 | 1.38 |  |  |
| 2011 | 1.19 |  |  |

Una vez formado el registro y ordenándolo de mayor a menor, se realizó un análisis de frecuencias con las distribuciones de probabilidad antes descritas, en la Tabla 7.3.1.29 se muestran los estadísticos de la muestra, el análisis de frecuencias se incluye en el apartado de anexos.

Tabla 7.3.1.29. Estadísticos de la muestra estaciones año, región uno.

|  |  |  |  |
| --- | --- | --- | --- |
| N = | 148 | | |
| MEDIA XR = | 1.000 | | |
| VARIANZA S2 = | 0.121 | | |
| DESVIACIÓN ESTANDAR S = | 0.348 | | |
| COEFICIENTE DE ASIMETRÁA g = | 1.307 | | |
| COEFICIENTE DE CURTOSIS K = | 5.558 | | |
| COEFICIENTE DE VARIACIÓN CV = | 0.348186259 | | |
| N = | 148 |
| MEDIA XR = | 1.000 |
| VARIANZA S2 = | 0.121 |
| DESVIACIÓN ESTANDAR S = | 0.348 |
| COEFICIENTE DE ASIMETRÁA g = | 1.307 |
| COEFICIENTE DE CURTOSIS K = | 5.558 |
| COEFICIENTE DE VARIACIÓN CV = | 0.348186259 |
| N = | 148 | |
| MEDIA XR = | 1.000 | |
| VARIANZA S2 = | 0.121 | |
| DESVIACIÓN ESTANDAR S = | 0.348 | |
| COEFICIENTE DE ASIMETRÁA g = | 1.307 | |
| COEFICIENTE DE CURTOSIS K = | 5.558 | |
| COEFICIENTE DE VARIACIÓN CV = | 0.348186259 | |

Tabla 7.3.1.30. Estadísticos de la muestra estaciones año, región dos

|  |  |
| --- | --- |
| N = | 207 |
| MEDIA XR = | 1.000 |
| VARIANZA S2 = | 0.377 |
| DESVIACIÓN ESTANDAR S = | 0.614 |
| COEFICIENTE DE ASIMETRÁA g = | 2.519 |
| COEFICIENTE DE CURTOSIS K = | 14.149 |
| COEFICIENTE DE VARIACIÓN CV = | 0.614372348 |

Errores estándar de ajuste región uno, Tabla 7.3.1.31.

Tabla 7.3.1.31. Errores estándar, muestra estaciones año.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SELECCION DE LA DISTRIBUCION DE PROBABILIDAD | | | | | | | |
| DISTRIBUCION DE PROBABILIDAD | | | | | |  | **E.E.** |
| ANALISIS DE DISTRIBUCION POR MOMENTOS | | | | | | | |
| 1. DISTRIBUCION NORMAL. | |  |  |  |  |  | 0.350 |
| 2. DISTRIBUCION LOGNORMAL (2 PARAMETROS). | | | | |  |  | 0.092 |
| 3. DISTRIBUCION LOGNORMAL (3 PARAMETROS). | | | | |  |  | 0.044 |
| 4. DISTRIBUCION DE VALORES EXTREMOS TIPO I (GUMBEL). | | | | | |  | 0.045 |
| 5. WEIBULL-2. |  |  |  | 0.068 |  |  | 0.068 |
| 6. DISTRIBUCION GAMMA (2 PARAMETROS). | | | | |  |  | 0.064 |
| 7. DISTRIBUCION GAMMA (3 PARAMETROS). | | | | |  |  | 0.046 |
| 8. GENERAL DE VALORES EXTREMOS | | | |  |  |  | 0.042 |
|  |  |  |  |  |  |  |  |
| ANALISIS DE DISTRIBUCION POR MAXIMA VEROSIMILITUD | | | | | | | |
| 9. DISTRIBUCION NORMAL. | |  |  |  |  |  | 0.350 |
| 10. DISTRIBUCION LOGNORMAL (2 PARAMETROS). | | | | |  |  | 0.092 |
| 11. DISTRIBUCION LOGNORMAL (3 PARAMETROS). | | | | |  |  | 0.342 |
| 12. DISTRIBUCION DE VALORES EXTREMOS TIPO I (GUMBEL). | | | | | |  | 23.136 |
| 14. DISTRIBUCION GAMMA (2 PARAMETROS). | | | | |  |  | 0.408 |
| 15. DISTRIBUCION GAMMA (3 PARAMETROS). | | | | |  |  | 0.798 |
| 16. DISTRIBUCION DOBLE GUMBEL. | | |  |  |  |  | - |
|  |  |  |  |  |  |  |  |
| ANALISIS DE DISTRIBUCION POR MOMENTOS-L | | | | | | | |
| 17. DISTRIBUCION NORMAL. | | |  |  |  |  | 0.578 |
| 18. DISTRIBUCION GAMMA (2 PARAMETROS). | | | | |  |  | 0.301 |
| 19. DISTRIBUCION DE VALORES EXTREMOS TIPO I (GUMBEL). | | | | | |  | 0.374 |
| SELECCION DE LA DISTRIBUCION DE PROBABILIDAD | | | | | | | |
| DISTRIBUCION DE PROBABILIDAD | | | | | |  | **E.E.** |
| ANALISIS DE DISTRIBUCION POR MOMENTOS | | | | | | | |
| 1. DISTRIBUCION NORMAL. | |  |  |  |  |  | 0.350 |
| 2. DISTRIBUCION LOGNORMAL (2 PARAMETROS). | | | | |  |  | 0.092 |
| 3. DISTRIBUCION LOGNORMAL (3 PARAMETROS). | | | | |  |  | 0.044 |
| 4. DISTRIBUCION DE VALORES EXTREMOS TIPO I (GUMBEL). | | | | | |  | 0.045 |
| 5. WEIBULL-2. |  |  |  | 0.068 |  |  | 0.068 |
| 6. DISTRIBUCION GAMMA (2 PARAMETROS). | | | | |  |  | 0.064 |
| 7. DISTRIBUCION GAMMA (3 PARAMETROS). | | | | |  |  | 0.046 |
| 8. GENERAL DE VALORES EXTREMOS | | | |  |  |  | 0.042 |
|  |  |  |  |  |  |  |  |
| ANALISIS DE DISTRIBUCION POR MAXIMA VEROSIMILITUD | | | | | | | |
| 9. DISTRIBUCION NORMAL. | |  |  |  |  |  | 0.350 |
| 10. DISTRIBUCION LOGNORMAL (2 PARAMETROS). | | | | |  |  | 0.092 |
| 11. DISTRIBUCION LOGNORMAL (3 PARAMETROS). | | | | |  |  | 0.342 |
| 12. DISTRIBUCION DE VALORES EXTREMOS TIPO I (GUMBEL). | | | | | |  | 23.136 |
| 14. DISTRIBUCION GAMMA (2 PARAMETROS). | | | | |  |  | 0.408 |
| 15. DISTRIBUCION GAMMA (3 PARAMETROS). | | | | |  |  | 0.798 |
| 16. DISTRIBUCION DOBLE GUMBEL. | | |  |  |  |  | - |
|  |  |  |  |  |  |  |  |
| ANALISIS DE DISTRIBUCION POR MOMENTOS-L | | | | | | | |
| 17. DISTRIBUCION NORMAL. | | |  |  |  |  | 0.578 |
| 18. DISTRIBUCION GAMMA (2 PARAMETROS). | | | | |  |  | 0.301 |
| 19. DISTRIBUCION DE VALORES EXTREMOS TIPO I (GUMBEL). | | | | | |  | 0.374 |

Errores estándar de ajuste región dos, Tabla 7.3.1.32.

Tabla 7.3.1.32. Errores estándar, muestra estaciones año.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ANALISIS DE DISTRIBUCION POR MOMENTOS | | | | | | | |
| 1. DISTRIBUCION NORMAL. | |  |  |  |  |  | 0.959 |
| 2. DISTRIBUCION LOGNORMAL (2 PARAMETROS). | | | | |  |  | 0.137 |
| 3. DISTRIBUCION LOGNORMAL (3 PARAMETROS). | | | | |  |  | 0.138 |
| 4. DISTRIBUCION DE VALORES EXTREMOS TIPO I (GUMBEL). | | | | | |  | 0.184 |
| 5. WEIBULL-2. |  |  |  |  |  |  | 0.059 |
| 6. DISTRIBUCION GAMMA (2 PARAMETROS). | | | | |  |  | 0.185 |
| 7. DISTRIBUCION GAMMA (3 PARAMETROS). | | | | |  |  | 0.166 |
| 8. GENERAL DE VALORES EXTREMOS | | | |  |  |  | 0.132 |
|  |  |  |  |  |  |  |  |
| ANALISIS DE DISTRIBUCION POR MAXIMA VEROSIMILITUD | | | | | | | |
| 9. DISTRIBUCION NORMAL. | |  |  |  |  |  | 0.959 |
| 10. DISTRIBUCION LOGNORMAL (2 PARAMETROS). | | | | |  |  | 0.137 |
| 11. DISTRIBUCION LOGNORMAL (3 PARAMETROS). | | | | |  |  | 0.595 |
| 12. DISTRIBUCION DE VALORES EXTREMOS TIPO I (GUMBEL). | | | | | |  | 29.917 |
| 14. DISTRIBUCION GAMMA (2 PARAMETROS). | | | | |  |  | 0.562 |
| 15. DISTRIBUCION GAMMA (3 PARAMETROS). | | | | |  |  | #¡NUM! |
| 16. DISTRIBUCION DOBLE GUMBEL. | | |  |  |  |  | - |
| ANALISIS DE DISTRIBUCION POR MOMENTOS-L | | | | | | | |
| 17. DISTRIBUCION NORMAL. | | |  |  |  |  | 1.011 |
| 18. DISTRIBUCION GAMMA (2 PARAMETROS). | | | | |  |  | 0.390 |
| 19. DISTRIBUCION DE VALORES EXTREMOS TIPO I (GUMBEL). | | | | | |  | 0.538 |

El menor error lo presento la Distribución tipo I Gumbel y Gamma de 2 parámetros, para la región uno y dos respectivamente. Y con esta se calcularon los eventos de diseño, Tabla 7.3.1.33. y 7.3.1.34.

Tabla 7.3.1.33. Eventos de diseño técnica estaciones año, región uno.

|  |  |  |  |
| --- | --- | --- | --- |
| EVENTOS DE DISEÑO DE ACUERDO | | | |
| A LA DISTRIBUCION SELECCIONADA | | | |
| Tr (AÑOS) | F(x) |  | Q mín (m3) |
| 2 | 0.5000 |  | 0.94 |
| 5 | 0.8000 |  | 0.71 |
| 10 | 0.9000 |  | 0.62 |
| 20 | 0.9500 |  | 0.55 |
| 50 | 0.9800 |  | 0.47 |
| 100 | 0.9900 |  | 0.43 |
| 500 | 0.9980 |  | 0.35 |
| 1000 | 0.9990 |  | 0.32 |
| 5000 | 0.9998 |  | 0.26 |
| 10000 | 0.9999 |  | 0.24 |
| EVENTOS DE DISEÑO DE ACUERDO | | | |
| A LA DISTRIBUCION SELECCIONADA | | | |
| Tr (AÑOS) | F(x) |  | Q mín (m3) |
| 2 | 0.5000 |  | 0.94 |
| 5 | 0.8000 |  | 0.71 |
| 10 | 0.9000 |  | 0.62 |
| 20 | 0.9500 |  | 0.55 |
| 50 | 0.9800 |  | 0.47 |
| 100 | 0.9900 |  | 0.43 |
| 500 | 0.9980 |  | 0.35 |
| 1000 | 0.9990 |  | 0.32 |
| 5000 | 0.9998 |  | 0.26 |
| 10000 | 0.9999 |  | 0.24 |
| EVENTOS DE DISEÑO DE ACUERDO | | | |
| A LA DISTRIBUCION SELECCIONADA | | | |
| Tr (AÑOS) | F(x) |  | Q mín (m3) |
| 2 | 0.5000 |  | 0.94 |
| 5 | 0.8000 |  | 0.71 |
| 10 | 0.9000 |  | 0.62 |
| 20 | 0.9500 |  | 0.55 |
| 50 | 0.9800 |  | 0.47 |
| 100 | 0.9900 |  | 0.43 |
| 500 | 0.9980 |  | 0.35 |
| 1000 | 0.9990 |  | 0.32 |
| 5000 | 0.9998 |  | 0.26 |
| 10000 | 0.9999 |  | 0.24 |

Tabla 7.3.1.34. Eventos de diseño técnica estaciones año, región dos.

|  |  |  |  |
| --- | --- | --- | --- |
| EVENTOS DE DISEÑO DE ACUERDO | | | |
| A LA DISTRIBUCION SELECCIONADA | | | |
| Tr (AÑOS) | F(x) |  | Q mín (m3) |
| 2 | 0.5000 |  | 0.8794 |
| 5 | 0.8000 |  | 0.4899 |
| 10 | 0.9000 |  | 0.3488 |
| 20 | 0.9500 |  | 0.2614 |
| 50 | 0.9800 |  | 0.1912 |
| 100 | 0.9900 |  | 0.1583 |
| 500 | 0.9980 |  | 0.1173 |
| 1000 | 0.9990 |  | 0.1081 |
| 5000 | 0.9998 |  | 0.0962 |
| 10000 | 0.9999 |  | 0.0934 |

Fig. 7.3.1.11. Gráfica de eventos de diseño contra QT, estaciones año, región uno.

Fig. 7.3.1.12. Gráfica de eventos de diseño contra QT, estaciones año, región dos.

Con esta distribución se obtienen los eventos de diseño y con éstos la ecuación regional, posteriormente se calculan los eventos para las estaciones multiplicando la ecuación regional por la media de cada estación, esto se hace cuando la estación en estudio cuenta con escasa información.

Tabla 7.3.1.35. Media de las estaciones de la región uno.

|  |  |
| --- | --- |
| ESTACIÓN | MEDIA |
| 27001 | 137.92 |
| 27005 | 13.07 |
| 27006 | 26.91 |

Tabla 7.3.1.36. Media de las estaciones de la región dos.

|  |  |
| --- | --- |
| ESTACIÓN | MEDIA |
| 28003 | 34.66 |
| 28108 | 13.02 |
| 28111 | 3.73 |
| 28125 | 104.91 |

Tabla 7.3.1.37. Eventos de diseño por estación, técnica estaciones año, región uno.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Tr (AÑOS) | F(x) | Q/Qmed | 27001 | 27005 | 27006 |
| 2 | 0.5 | 0.94 | 130.03 | 12.32 | 25.37 |
| 5 | 0.8 | 0.71 | 98.48 | 9.33 | 19.22 |
| 10 | 0.9 | 0.62 | 85.07 | 8.06 | 16.60 |
| 20 | 0.95 | 0.55 | 75.21 | 7.13 | 14.67 |
| 50 | 0.98 | 0.47 | 65.21 | 6.18 | 12.72 |
| 100 | 0.99 | 0.43 | 59.10 | 5.60 | 11.53 |
| 500 | 0.998 | 0.35 | 47.88 | 4.54 | 9.34 |
| 1000 | 0.999 | 0.32 | 43.92 | 4.16 | 8.57 |
| 5000 | 0.9998 | 0.26 | 36.07 | 3.42 | 7.04 |
| 10000 | 0.9999 | 0.24 | 33.14 | 3.14 | 6.47 |

Tabla 7.3.1.38. Eventos de diseño por estación, técnica estaciones año, región dos.

| Tr (AÑOS) | F(x) | Q/Qmed | 28003 | 28108 | 28111 | 28125 |
| --- | --- | --- | --- | --- | --- | --- |
| 2 | 0.5 | 0.88 | 30.48 | 11.45 | 3.28 | 92.26 |
| 5 | 0.8 | 0.49 | 16.98 | 6.38 | 1.83 | 51.40 |
| 10 | 0.9 | 0.35 | 12.09 | 4.54 | 1.30 | 36.59 |
| 20 | 0.95 | 0.26 | 9.06 | 3.40 | 0.97 | 27.43 |
| 50 | 0.98 | 0.19 | 6.63 | 2.49 | 0.71 | 20.05 |
| 100 | 0.99 | 0.16 | 5.49 | 2.06 | 0.59 | 16.60 |
| 500 | 0.998 | 0.12 | 4.07 | 1.53 | 0.44 | 12.30 |
| 1000 | 0.999 | 0.11 | 3.75 | 1.41 | 0.40 | 11.34 |
| 5000 | 0.9998 | 0.10 | 3.33 | 1.25 | 0.36 | 10.09 |
| 10000 | 0.9999 | 0.09 | 3.24 | 1.22 | 0.35 | 9.80 |

Si la estación en estudio tuviera nula información, lo que se hace es buscar una relación funcional entre las medias de las demás estaciones que pertenecen la región homogénea y alguna característica fisiográfica, la más significativa. En este caso la característica fisiográfica el área de la cuenca.

Por lo tanto, se genera una gráfica de áreas contra altura de precipitación (Hp), Fig. 7.3.1.13 y se obtiene una tendencia en los puntos graficados y al introducir el área de la cuenca en estudio se obtendría el gasto medio de dicha estación. Posteriormente al multiplicar por la ecuación regional se obtendrían los eventos de diseño.

Fig. 7.3.1.13. Gráfica de eventos de diseño contra QT, estaciones año, región homogénea uno.

Fig. 7.3.1.14. Gráfica de eventos de diseño contra QT, estaciones año, región homogénea dos.

###### Avenida índice

En la Tabla 7.3.1.39 se presentan las estaciones y su periodo común, para el análisis con la técnica de avenida índice.

Tabla 7.3.1.39. Registro comun de las estaciones seleccionadas, región homogénea uno.

| AÑO | 27001 | 27005 | 27006 |
| --- | --- | --- | --- |
| 1961 | 126.24 | 10.11 | 11.40 |
| 1962 | 152.47 | 15.21 | 23.20 |
| 1963 | 117.10 | 9.62 | 21.35 |
| 1964 | 136.58 | 16.76 | 11.08 |
| 1965 | 125.64 | 23.63 | 11.47 |
| 1966 | 161.25 | 10.23 | 24.05 |
| 1967 | 108.04 | 11.38 | 20.14 |
| 1968 | 101.47 | 15.34 | 32.82 |
| 1969 | 127.84 | 11.20 | 19.38 |
| 1970 | 134.22 | 10.91 | 18.94 |
| 1971 | 127.16 | 7.99 | 21.34 |
| 1972 | 136.21 | 17.71 | 20.04 |
| 1973 | 163.84 | 20.69 | 28.65 |
| 1974 | 123.90 | 10.01 | 19.85 |
| 1975 | 127.76 | 14.97 | 20.98 |
| 1976 | 127.02 | 16.44 | 35.55 |
| 1977 | 120.27 | 10.05 | 14.65 |
| 1978 | 121.73 | 7.34 | 20.59 |
| 1979 | 160.30 | 20.75 | 36.91 |
| 1980 | 136.61 | 13.18 | 22.20 |
| 1981 | 135.22 | 18.24 | 24.84 |
| 1982 | 131.00 | 11.40 | 22.75 |
| 1983 | 105.85 | 4.92 | 19.42 |
| 1984 | 138.72 | 11.13 | 25.60 |
| 1985 | 118.79 | 13.83 | 40.73 |
| 1986 | 122.94 | 13.49 | 21.09 |
| 1987 | 126.77 | 18.52 | 22.65 |
| 1988 | 114.01 | 18.53 | 24.89 |
| 1989 | 89.71 | 10.49 | 23.20 |
| 1990 | 133.92 | 19.75 | 32.60 |
| 1991 | 120.23 | 12.66 | 18.08 |
| 1992 | 150.53 | 7.67 | 16.69 |
| 1993 | 131.43 | 12.43 | 20.69 |
| 1994 | 128.66 | 9.53 | 18.29 |
| 1995 | 109.64 | 7.94 | 14.77 |
| 1996 | 150.07 | 11.41 | 51.24 |
| 1997 | 98.62 | 12.99 | 43.25 |
| 1998 | 194.43 | 8.96 | 48.87 |
| 1999 | 130.93 | 8.91 | 43.84 |
| 2000 | 141.87 | 13.28 | 64.42 |
| 2001 | 152.99 | 13.40 | 60.85 |
| 2002 | 172.08 | 8.18 | 24.92 |
| 2003 | 78.29 | 9.09 | 38.84 |
| AÑO | **27001** | **27005** | **27006** |
| 1961 | 126.24 | 10.11 | 11.40 |
| 1962 | 152.47 | 15.21 | 23.20 |
| 1963 | 117.10 | 9.62 | 21.35 |
| 1964 | 136.58 | 16.76 | 11.08 |
| 1965 | 125.64 | 23.63 | 11.47 |
| 1966 | 161.25 | 10.23 | 24.05 |
| 1967 | 108.04 | 11.38 | 20.14 |
| 1968 | 101.47 | 15.34 | 32.82 |
| 1969 | 127.84 | 11.20 | 19.38 |
| 1970 | 134.22 | 10.91 | 18.94 |
| 1971 | 127.16 | 7.99 | 21.34 |
| 1972 | 136.21 | 17.71 | 20.04 |
| 1973 | 163.84 | 20.69 | 28.65 |
| 1974 | 123.90 | 10.01 | 19.85 |
| 1975 | 127.76 | 14.97 | 20.98 |
| 1976 | 127.02 | 16.44 | 35.55 |
| 1977 | 120.27 | 10.05 | 14.65 |
| 1978 | 121.73 | 7.34 | 20.59 |
| 1979 | 160.30 | 20.75 | 36.91 |
| 1980 | 136.61 | 13.18 | 22.20 |
| 1981 | 135.22 | 18.24 | 24.84 |
| 1982 | 131.00 | 11.40 | 22.75 |
| 1983 | 105.85 | 4.92 | 19.42 |
| 1984 | 138.72 | 11.13 | 25.60 |
| 1985 | 118.79 | 13.83 | 40.73 |
| 1986 | 122.94 | 13.49 | 21.09 |
| 1987 | 126.77 | 18.52 | 22.65 |
| 1988 | 114.01 | 18.53 | 24.89 |
| 1989 | 89.71 | 10.49 | 23.20 |
| 1990 | 133.92 | 19.75 | 32.60 |
| 1991 | 120.23 | 12.66 | 18.08 |
| 1992 | 150.53 | 7.67 | 16.69 |
| 1993 | 131.43 | 12.43 | 20.69 |
| 1994 | 128.66 | 9.53 | 18.29 |
| 1995 | 109.64 | 7.94 | 14.77 |
| 1996 | 150.07 | 11.41 | 51.24 |
| 1997 | 98.62 | 12.99 | 43.25 |
| 1998 | 194.43 | 8.96 | 48.87 |
| 1999 | 130.93 | 8.91 | 43.84 |
| 2000 | 141.87 | 13.28 | 64.42 |
| 2001 | 152.99 | 13.40 | 60.85 |
| 2002 | 172.08 | 8.18 | 24.92 |
| 2003 | 78.29 | 9.09 | 38.84 |
| AÑO | 27001 | 27005 | 27006 |
| 1961 | 126.24 | 10.11 | 11.40 |
| 1962 | 152.47 | 15.21 | 23.20 |
| 1963 | 117.10 | 9.62 | 21.35 |
| 1964 | 136.58 | 16.76 | 11.08 |
| 1965 | 125.64 | 23.63 | 11.47 |
| 1966 | 161.25 | 10.23 | 24.05 |
| 1967 | 108.04 | 11.38 | 20.14 |
| 1968 | 101.47 | 15.34 | 32.82 |
| 1969 | 127.84 | 11.20 | 19.38 |
| 1970 | 134.22 | 10.91 | 18.94 |
| 1971 | 127.16 | 7.99 | 21.34 |
| 1972 | 136.21 | 17.71 | 20.04 |
| 1973 | 163.84 | 20.69 | 28.65 |
| 1974 | 123.90 | 10.01 | 19.85 |
| 1975 | 127.76 | 14.97 | 20.98 |
| 1976 | 127.02 | 16.44 | 35.55 |
| 1977 | 120.27 | 10.05 | 14.65 |
| 1978 | 121.73 | 7.34 | 20.59 |
| 1979 | 160.30 | 20.75 | 36.91 |
| 1980 | 136.61 | 13.18 | 22.20 |
| 1981 | 135.22 | 18.24 | 24.84 |
| 1982 | 131.00 | 11.40 | 22.75 |
| 1983 | 105.85 | 4.92 | 19.42 |
| 1984 | 138.72 | 11.13 | 25.60 |
| 1985 | 118.79 | 13.83 | 40.73 |
| 1986 | 122.94 | 13.49 | 21.09 |
| 1987 | 126.77 | 18.52 | 22.65 |
| 1988 | 114.01 | 18.53 | 24.89 |
| 1989 | 89.71 | 10.49 | 23.20 |
| 1990 | 133.92 | 19.75 | 32.60 |
| 1991 | 120.23 | 12.66 | 18.08 |
| 1992 | 150.53 | 7.67 | 16.69 |
| 1993 | 131.43 | 12.43 | 20.69 |
| 1994 | 128.66 | 9.53 | 18.29 |
| 1995 | 109.64 | 7.94 | 14.77 |
| 1996 | 150.07 | 11.41 | 51.24 |
| 1997 | 98.62 | 12.99 | 43.25 |
| 1998 | 194.43 | 8.96 | 48.87 |
| 1999 | 130.93 | 8.91 | 43.84 |
| 2000 | 141.87 | 13.28 | 64.42 |
| 2001 | 152.99 | 13.40 | 60.85 |
| 2002 | 172.08 | 8.18 | 24.92 |
| 2003 | 78.29 | 9.09 | 38.84 |

Tabla 7.3.1.40. Registro comun de las estaciones seleccionadas, región homogénea dos.

| AÑO | 28003 | 28108 | 28111 | 28125 |
| --- | --- | --- | --- | --- |
| 1966 | 79.25 | 8.70 | 4.21 | 42.02 |
| 1967 | 19.06 | 7.37 | 2.08 | 98.69 |
| 1968 | 49.12 | 8.55 | 2.33 | 98.65 |
| 1969 | 75.83 | 8.66 | 1.82 | 95.68 |
| 1970 | 31.46 | 13.65 | 2.40 | 89.86 |
| 1971 | 34.88 | 10.72 | 1.45 | 84.51 |
| 1972 | 56.41 | 9.51 | 1.76 | 104.39 |
| 1973 | 58.34 | 16.91 | 1.88 | 106.35 |
| 1974 | 41.45 | 11.03 | 4.18 | 99.91 |
| 1975 | 17.05 | 11.52 | 1.96 | 84.61 |
| 1976 | 28.11 | 10.77 | 2.20 | 85.51 |
| 1977 | 46.34 | 8.78 | 2.91 | 72.29 |
| 1978 | 7.44 | 7.41 | 1.96 | 51.13 |
| 1979 | 13.91 | 16.49 | 4.49 | 138.99 |
| 1980 | 14.42 | 14.66 | 3.39 | 121.32 |
| 1981 | 49.79 | 14.95 | 5.60 | 120.60 |
| 1982 | 35.34 | 16.10 | 4.89 | 119.10 |
| 1983 | 4.03 | 11.03 | 2.24 | 91.72 |
| 1984 | 16.75 | 6.54 | 2.25 | 103.55 |
| 1985 | 47.07 | 11.33 | 4.68 | 120.04 |
| 1986 | 38.73 | 11.37 | 2.82 | 115.82 |
| 1987 | 55.75 | 12.97 | 5.28 | 121.11 |
| 1988 | 45.16 | 8.68 | 4.43 | 119.90 |
| 1989 | 29.83 | 6.75 | 1.98 | 108.27 |
| 1990 | 28.33 | 8.27 | 3.27 | 118.87 |
| 1991 | 32.25 | 6.30 | 3.14 | 106.22 |
| 1992 | 135.43 | 38.74 | 11.09 | 118.08 |
| 1993 | 45.33 | 15.17 | 5.37 | 89.12 |
| 1994 | 41.69 | 18.44 | 5.60 | 97.81 |
| 1995 | 2.41 | 10.00 | 3.11 | 81.38 |
| 1996 | 11.27 | 11.65 | 5.39 | 87.24 |
| 1997 | 29.54 | 10.56 | 5.15 | 99.74 |
| 1998 | 3.54 | 10.67 | 2.69 | 91.68 |
| 1999 | 5.91 | 17.55 | 3.55 | 101.91 |
| 2000 | 15.44 | 18.16 | 4.16 | 107.24 |
| 2001 | 13.18 | 23.96 | 6.25 | 115.61 |
| 2002 | 6.61 | 7.02 | 3.88 | 100.43 |
| 2003 | 5.48 | 1.39 | 3.93 | 106.85 |
| 2004 | 65.99 | 16.58 | 6.67 | 123.12 |
| 2005 | 5.03 | 18.06 | 4.58 | 100.56 |
| 2006 | 29.68 | 10.62 | 2.78 | 101.47 |
| 2007 | 108.57 | 7.69 | 4.97 | 158.10 |
| 2008 | 12.88 | 11.26 | 2.00 | 114.82 |
| 2009 | 21.74 | 17.15 | 4.39 | 118.97 |
| 2010 | 19.00 | 14.36 | 9.16 | 139.31 |
| 2011 | 33.38 | 64.62 | 3.66 | 153.39 |

Se obtienen los eventos de diseño para todas las estaciones usando los parámetros de la distribución Gumbel que hayan dado el menor EEA y adicionalmente se obtiene el evento de diseño para 2.33 años, Tabla 7.3.1.41.

Tabla 7.3.1.41, Eventos de diseño para todas las estaciones, avenida índice, región homogénea uno.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tr (AÑOS) | F(x) | 27001 | 27005 | 27006 |
| 2 | 0.5 | 126.96 | 12.10 | 24.84 |
| 5 | 0.8 | 112.71 | 9.31 | 16.55 |
| 10 | 0.9 | 106.65 | 8.12 | 13.02 |
| 20 | 0.95 | 102.20 | 7.25 | 10.44 |
| 50 | 0.98 | 97.68 | 6.36 | 7.81 |
| 100 | 0.99 | 94.93 | 5.82 | 6.20 |
| 500 | 0.998 | 89.85 | 4.83 | 3.25 |
| 1000 | 0.999 | 88.07 | 4.48 | 2.21 |
| 5000 | 0.9998 | 84.52 | 3.78 | 0.15 |
| 10000 | 0.9999 | 83.20 | 3.52 | -0.62 |
| 2.3 | 0.56521739 | 123.85 | 11.49 | 23.03 |
|  | υ = | 120.76 | 10.88 | 21.23 |
|  | α = | 16.92 | 3.32 | 9.84 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tr (AÑOS) | F(x) | 27001 | 27005 | 27006 |
| 2 | 0.5 | 126.96 | 12.10 | 24.84 |
| 5 | 0.8 | 112.71 | 9.31 | 16.55 |
| 10 | 0.9 | 106.65 | 8.12 | 13.02 |
| 20 | 0.95 | 102.20 | 7.25 | 10.44 |
| 50 | 0.98 | 97.68 | 6.36 | 7.81 |
| 100 | 0.99 | 94.93 | 5.82 | 6.20 |
| 500 | 0.998 | 89.85 | 4.83 | 3.25 |
| 1000 | 0.999 | 88.07 | 4.48 | 2.21 |
| 5000 | 0.9998 | 84.52 | 3.78 | 0.15 |
| 10000 | 0.9999 | 83.20 | 3.52 | -0.62 |
| 2.3 | 0.56521739 | 123.85 | 11.49 | 23.03 |
|  | υ = | 120.76 | 10.88 | 21.23 |
|  | α = | 16.92 | 3.32 | 9.84 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tr (AÑOS) | F(x) | 27001 | 27005 | 27006 |
| 2 | 0.5 | 126.96 | 12.10 | 24.84 |
| 5 | 0.8 | 112.71 | 9.31 | 16.55 |
| 10 | 0.9 | 106.65 | 8.12 | 13.02 |
| 20 | 0.95 | 102.20 | 7.25 | 10.44 |
| 50 | 0.98 | 97.68 | 6.36 | 7.81 |
| 100 | 0.99 | 94.93 | 5.82 | 6.20 |
| 500 | 0.998 | 89.85 | 4.83 | 3.25 |
| 1000 | 0.999 | 88.07 | 4.48 | 2.21 |
| 5000 | 0.9998 | 84.52 | 3.78 | 0.15 |
| 10000 | 0.9999 | 83.20 | 3.52 | -0.62 |
| 2.3 | 0.56521739 | 123.85 | 11.49 | 23.03 |
|  | υ = | 120.76 | 10.88 | 21.23 |
|  | α = | 16.92 | 3.32 | 9.84 |

Tabla 7.3.1.42, Eventos de diseño para todas las estaciones, avenida índice, región homogénea dos.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Tr (AÑOS) | F(x) | 28003 | 28108 | 28111 | 28125 |
| 2 | 0.50 | 29.58 | 10.97 | 3.55 | 101.34 |
| 5 | 0.80 | 11.52 | 7.08 | 2.28 | 87.03 |
| 10 | 0.90 | 3.84 | 5.43 | 1.75 | 80.94 |
| 20 | 0.95 | -1.80 | 4.22 | 1.35 | 76.47 |
| 50 | 0.98 | -7.52 | 2.99 | 0.95 | 71.94 |
| 100 | 0.99 | -11.02 | 2.23 | 0.70 | 69.17 |
| 500 | 1.00 | -17.44 | 0.85 | 0.25 | 64.08 |
| 1000 | 1.00 | -19.71 | 0.36 | 0.09 | 62.28 |
| 2.3 | 0.57 | 25.64 | 10.12 | 3.28 | 98.22 |
|  | υ = | 21.72 | 9.28 | 3.00 | 95.11 |
|  | α = | 21.44 | 4.61 | 1.51 | 16.99 |

Se modulan los gastos, se ordenan por bloques de periodo de retorno y se obtiene la mediana de cada bloque, Tabla 7.3.1.43.

Tabla 7.3.1.43. Cálculo de mediana para cada estación, región uno.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Estación | 2 | 5 | 10 | 20 | 50 | 100 | 500 | 1000 | 5000 | 10000 |
| 27001 | 126.96 | 112.71 | 106.65 | 102.20 | 97.68 | 94.93 | 89.85 | 88.07 | 84.52 | 83.20 |
| 27005 | 12.10 | 9.31 | 8.12 | 7.25 | 6.36 | 5.82 | 4.83 | 4.48 | 3.78 | 3.52 |
| 27006 | 24.84 | 16.55 | 13.02 | 10.44 | 7.81 | 6.20 | 3.25 | 2.21 | 0.15 | -0.62 |
| 27001 | 1.03 | 0.91 | 0.86 | 0.83 | 0.79 | 0.77 | 0.73 | 0.71 | 0.68 | 0.67 |
| 27005 | 1.05 | 0.81 | 0.71 | 0.63 | 0.55 | 0.51 | 0.42 | 0.39 | 0.33 | 0.31 |
| 27006 | 1.08 | 0.72 | 0.57 | 0.45 | 0.34 | 0.27 | 0.14 | 0.10 | 0.01 | -0.03 |
| 27001 | 1.08 | 0.91 | 0.86 | 0.83 | 0.79 | 0.77 | 0.73 | 0.71 | 0.68 | 0.67 |
| 27005 | 1.05 | 0.81 | 0.71 | 0.63 | 0.55 | 0.51 | 0.42 | 0.39 | 0.33 | 0.31 |
| 27006 | 1.03 | 0.72 | 0.57 | 0.45 | 0.34 | 0.27 | 0.14 | 0.10 | 0.01 | -0.03 |
| MEDIANA | 1.05 | 0.81 | 0.71 | 0.63 | 0.55 | 0.51 | 0.42 | 0.39 | 0.33 | 0.31 |

Tabla 7.3.1.44. Cálculo de mediana para cada estación, región dos.

| Estación | 2 | 5 | 10 | 20 | 50 | 100 | 500 | 1000 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 28003 | 29.58 | 11.52 | 3.84 | -1.80 | -7.52 | -11.02 | -17.44 | -19.71 |
| 28108 | 10.97 | 7.08 | 5.43 | 4.22 | 2.99 | 2.23 | 0.85 | 0.36 |
| 28111 | 3.55 | 2.28 | 1.75 | 1.35 | 0.95 | 0.70 | 0.25 | 0.09 |
| 28125 | 101.34 | 87.03 | 80.94 | 76.47 | 71.94 | 69.17 | 64.08 | 62.28 |
| 28003 | 1.15 | 0.45 | 0.15 | -0.07 | -0.29 | -0.43 | -0.68 | -0.77 |
| 28108 | 1.08 | 0.70 | 0.54 | 0.42 | 0.30 | 0.22 | 0.08 | 0.04 |
| 28111 | 1.08 | 0.70 | 0.53 | 0.41 | 0.29 | 0.21 | 0.08 | 0.03 |
| 28125 | 1.03 | 0.89 | 0.82 | 0.78 | 0.73 | 0.70 | 0.65 | 0.63 |
| 28003 | 1.15 | 0.89 | 0.82 | 0.78 | 0.73 | 0.70 | 0.65 | 0.63 |
| 28108 | 1.08 | 0.70 | 0.54 | 0.42 | 0.30 | 0.22 | 0.08 | 0.04 |
| 28111 | 1.08 | 0.70 | 0.53 | 0.41 | 0.29 | 0.21 | 0.08 | 0.03 |
| 28125 | 1.03 | 0.45 | 0.15 | -0.07 | -0.29 | -0.43 | -0.68 | -0.77 |
| MEDIANA | 1.08 | 0.70 | 0.53 | 0.41 | 0.29 | 0.22 | 0.08 | 0.03 |

La mediana de cada bloque se considera la ecuación regional, para obtener los eventos de diseño de las demás estaciones sólo se multiplica la ecuación regional por el q 2.33 de cada estación. Esto es cuando la estación en estudio cuenta con escasa información. A manera de ejemplo, se calcularon los gastos para las estaciones utilizadas en esta técnica, Tabla 7.3.1.45.

Tabla 7.3.1.45. Avenida índice, región uno.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Estación | | 27001 | 27005 | 27006 |
| Tr | **(Q/Q2.33)R** | **Q 27001** | **Q 27005** | **Q 27006** |
| 2 | 1.05 | 130.42 | 12.10 | 24.25 |
| 5 | 0.81 | 100.31 | 9.31 | 18.65 |
| 10 | 0.71 | 87.51 | 8.12 | 16.27 |
| 20 | 0.63 | 78.11 | 7.25 | 14.53 |
| 50 | 0.55 | 68.57 | 6.36 | 12.75 |
| 100 | 0.51 | 62.74 | 5.82 | 11.67 |
| 500 | 0.42 | 52.03 | 4.83 | 9.68 |
| 1000 | 0.39 | 48.26 | 4.48 | 8.97 |
| 5000 | 0.33 | 40.77 | 3.78 | 7.58 |
| 10000 | 0.31 | 37.97 | 3.52 | 7.06 |

Tabla 7.3.1.46. Avenida índice, región dos.

| Estación | | 28003 | 28108 | 28111 | 28125 |
| --- | --- | --- | --- | --- | --- |
| Tr | (Q/Q2.33)R | Q 28003 | Q 28108 | Q 28111 | Q 28125 |
| 2 | 1.08 | 27.80 | 10.97 | 3.55 | 106.47 |
| 5 | 0.70 | 17.91 | 7.07 | 2.29 | 68.61 |
| 10 | 0.53 | 13.71 | 5.41 | 1.75 | 52.52 |
| 20 | 0.41 | 10.62 | 4.19 | 1.36 | 40.69 |
| 50 | 0.29 | 7.49 | 2.96 | 0.96 | 28.70 |
| 100 | 0.22 | 5.58 | 2.20 | 0.71 | 21.36 |
| 500 | 0.08 | 2.06 | 0.81 | 0.26 | 7.89 |
| 1000 | 0.03 | 0.82 | 0.32 | 0.10 | 3.14 |

Si la estación en estudio tuviera nula información, se busca una relación funcional entre los q 2.33 y la característica fisiográfica más significativa, Tabla 7.3.1.47.

Tabla 7.3.1.47. Área y Q2.33 de las estaciones utilizadas para la relación funcional, región uno.

|  |  |  |
| --- | --- | --- |
| ESTACIÓN | Hp | Q2.33 |
| 27001 | 220.61 | 123.85 |
| 27006 | 289.82 | 23.03 |
| 27005 | 275.70 | 11.49 |

Fig. 7.1. Relación funcional, avenida índice, región uno.