

Figures 11 and 12 in Griffis and Stedinger (2007)

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At page 489 Griffis and Stedinger (2007) write:

To allow use of the LP3 distribution in future L-moment frequency analyses, simple expressions were developed for τ_4 as a function of τ_3 of the form

$$\tau_4 = a + b\tau_3 + c\tau_3^2 + d\tau_3^3$$

For given τ_3 , with the coefficients in Table 3, the approximations yield values of τ_4 accurate to within 0.008 over the range $\tau_{3(min)} \leq \tau_3 \leq 0.9$, wherein Table 3 specifies the minimum value $\tau_{3(min)}$ for each value of γ_x with $\sigma_x = 0$.

The following function uses the above equation and Table 3 in Griffis and Stedinger (2007):

```
> tau4_LP3 <- function (tau3_LP3) {
+   # the approximations yield values of tau4 accurate to
+   # within 0.008 over the range tau3min <= tau3 <= 0.9
+   gammax <- c(-1.4, -1, -0.5, 0, 0.5, 1, 1.4)
+   table3abcd <- matrix(c(0.0602, -0.1673, 0.8010, 0.2897,
+                           0.0908, -0.1267, 0.7636, 0.2562,
+                           0.1166, -0.0439, 0.6247, 0.2939,
+                           0.1220, 0.0238, 0.6677, 0.1677,
+                           0.1152, 0.0639, 0.7486, 0.0645,
+                           0.1037, 0.0438, 0.9327, -0.0951,
+                           0.0776, 0.0762, 0.9771, -0.1394),
+                           ncol=4, nrow=7, byrow=TRUE,
+                           dimnames=list(paste("gammax=", gammax, sep=""),
+                                         c("a", "b", "c", "d"))))
+
+   tau3s <- matrix(c(rep(1, length(tau3_LP3)), tau3_LP3, tau3_LP3^2, tau3_LP3^3),
+                     nrow=4, ncol=length(tau3_LP3), byrow=TRUE,
+                     dimnames=list(c("1", "tau3", "tau3^2", "tau3^3"),
+                                   paste("tau3=", tau3_LP3, sep="")))
+
+   tau3min <- c(-0.2308, -0.1643, -0.0740, 0, 0.0774, 0.1701, 0.2366) %*%
+             t(rep(1, length(tau3_LP3)))
+   tau3max <- rep(0.9, 7) %*% t(rep(1, length(tau3_LP3)))
+   tau3s2 <- rep(1, 7) %*% t(tau3_LP3)
+   keeptau4 <- (tau3s2 >= tau3min*0.9999) & (tau3s2 <= tau3max*1.0001)
+
+   tau4s <- table3abcd %*% tau3s
+   tau4s[!keeptau4] <- NA
+
+   return(tau4s)
+ }
```

Figure 11 is then given by:

```
> gammax <- c(-1.4, -1, -0.5, 0, 0.5, 1, 1.4)
> tau3 <- seq(-0.2, 1, by=0.1)
> tau4 <- tau4_LP3(tau3)
> plot(c(-0.4, 1), c(0, 1), type="n", xlab="L-skewness, tau3",
+       ylab="L-Kurtosis, tau4")
> grid()
> for (i in 1:7) {
```

```

+ lines(tau3, tau4[i,], type="b", lty=i, pch=i)
+ }
> legend("topleft", legend=c(gammax, "OLB"), title=expression(gamma[x]),
+         pch=c(1:7,NA), lty=c(1:7,1), lwd=c(rep(1,7),2))
> curve((5*x^2 - 1)/4, add=TRUE, lwd=2)

```

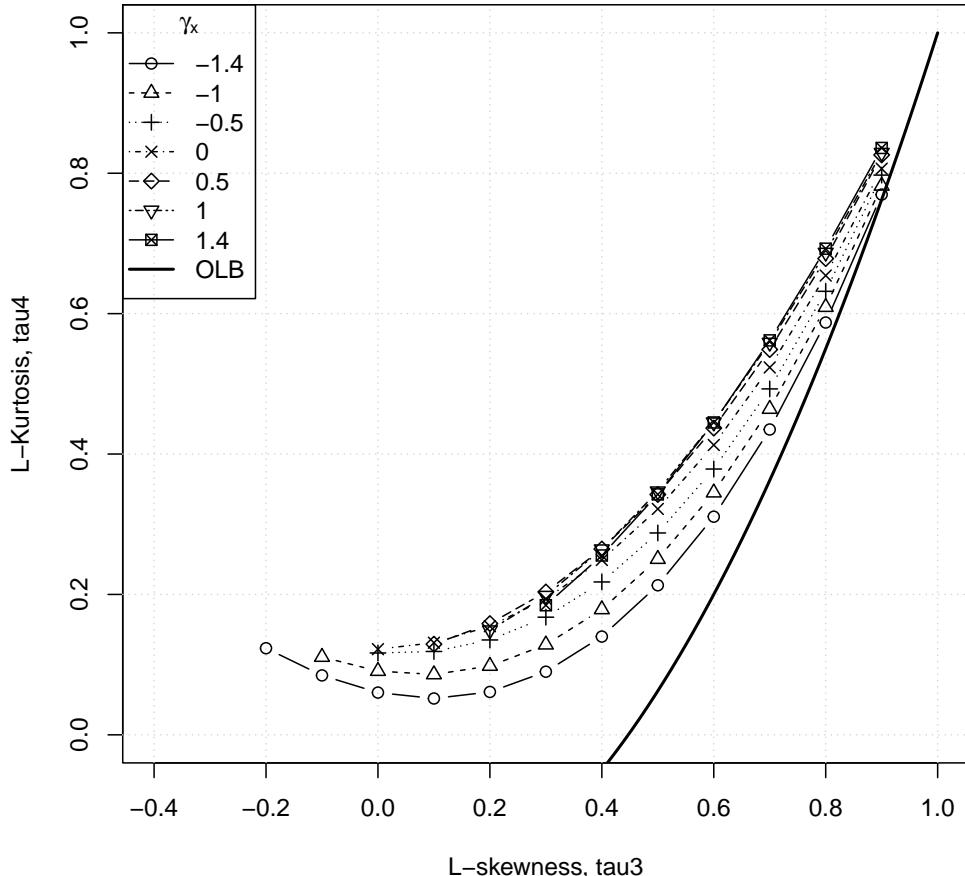


Fig. 11. L-moment ratio diagram for the LP3 distribution as a function of log space skew (OLB represents the overall theoretical lower bound of the $\tau_3 - \tau_4$ space).

For Figure 12 load the library

```

> library(nsRFA)

```

and do the following:

```

> t3b=-0.2; t3t=0.9; t4b=-0.1; t4t=0.8
> plot(c(t3b+0.05, t3t-0.05), c(t4b, t4t), type="n",
+       xlab=expression(tau[3]), ylab=expression(tau[4]), main="")
> grid()
> tipi <- c(1,2,1,4,5,6)
> spessori <- c(1,1.3,1.1,1.3,1.1,1.1)
> colori <- c(1,1,"darkgrey",1,1,1)
> tau3 <- seq(0, 0.9, by=0.1)
> tau4 <- tau4_LP3(tau3)
> tau4r <- apply(tau4, 2, range, na.rm=TRUE)

```

```

> polygon(x=c(tau3, rev(tau3)), y=c(tau4r[1,], rev(tau4r[2,])),  

+         density=20, col="darkgrey", border="darkgrey", angle=-45)  

> GPA <- function(x) 0.20196*x + 0.95924*x^2 - 0.20096*x^3 + 0.04061*x^4  

> curve(GPA, t3b, t3t, add=TRUE, lty=tipi[5], lwd=spessori[5])  

> GEV <- function(x) {  

+   0.10701 + 0.1109*x + 0.84838*x^2 - 0.06669*x^3 +  

+   0.00567*x^4 - 0.04208*x^5 + 0.03763*x^6  

+ }  

> curve(GEV, t3b, t3t, add=TRUE, lty=tipi[4], lwd=spessori[4])  

> GL0 <- function(x) 0.16667 + 0.83333*x^2  

> curve(GL0, t3b, t3t, add=TRUE, lty=tipi[6], lwd=spessori[6])  

> LN3 <- function(x) 0.12282 + 0.77518*x^2 + 0.12279*x^4 - 0.13638*x^6 + 0.11368*x^8  

> curve(LN3, t3b, t3t, add=TRUE, lty=tipi[1], lwd=spessori[1])  

> PE3 <- function(x) 0.1224 + 0.30115*x^2 + 0.95812*x^4 - 0.57488*x^6 + 0.19383*x^8  

> curve(PE3, t3b, t3t, add=TRUE, lty=tipi[2], lwd=spessori[2])  

> points(0, 0, pch=3, cex=1.2)  

> points(0, 0.1226, pch=2, cex=1.2)  

> points(1/3, 1/6, pch=5, cex=1.2)  

> points(0.1699, 0.1504, pch=6, cex=1.2)  

> points(0, 1/6, pch=4, cex=1.2)  

> curve((5*x^2 - 1)/4, t3b, t3t, add=TRUE, lwd=2)  

> legend("bottomright", c("EXP", "EV1", "LOG", "NOR", "UNIF"),  

+        pch=c(5, 6, 4, 2, 3), bty="n")  

> legend("topleft", legend=c("LN3", "P3", "LP3", "GEV", "GP", "GL", "OLB"),  

+        lty=c(tipi, 1), lwd=c(spessori, 2), col=c(colori, 1), bty="n")

```

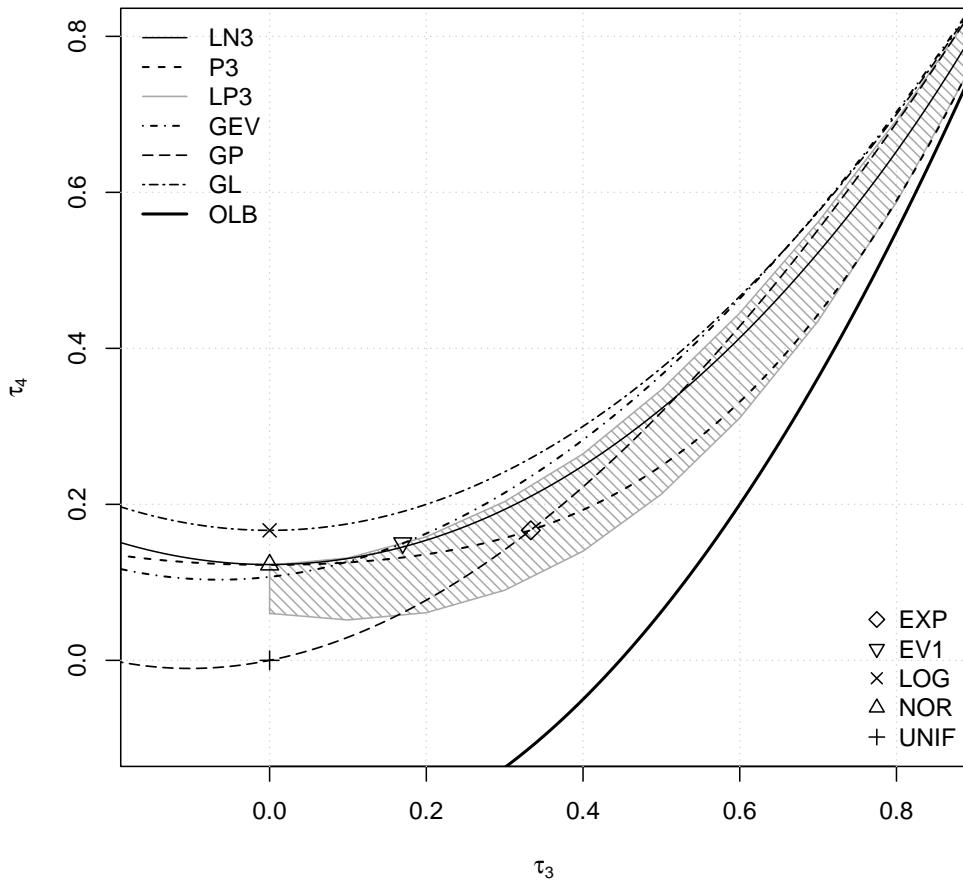


Fig. 12. L-moment ratio diagram including GLO, GEV, LN, generalized Pareto GPA , P3, Gumbel, normal, and LP3 (light gray region represents LP3 distribution with $|\gamma_x| \leq 1.414$; I have not plotted the dark gray region with restricted values of σ_x ; I added some other distributions.

References

- Griffis, V.W., and Stedinger, J.R. (2007). Log-Pearson Type 3 distribution and its application in Flood Frequency Analysis. 1: Distribution characteristics. *Journal of Hydrologic Engineering*, 12(5):482–491, DOI:10.1061/(ASCE)1084-0699(2007)12:5(482).