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) {
+     gammax <- c(-1.4, -1, -0.5, 0, 0.5, 1, 1.4)
+     table3abcd <- matrix(c(0.0602, -0.1673, 0.801, 0.2897, 0.0908,
+         -0.1267, 0.7636, 0.2562, 0.1166, -0.0439, 0.6247, 0.2939,
+         0.122, 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, -0.074, 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)
```

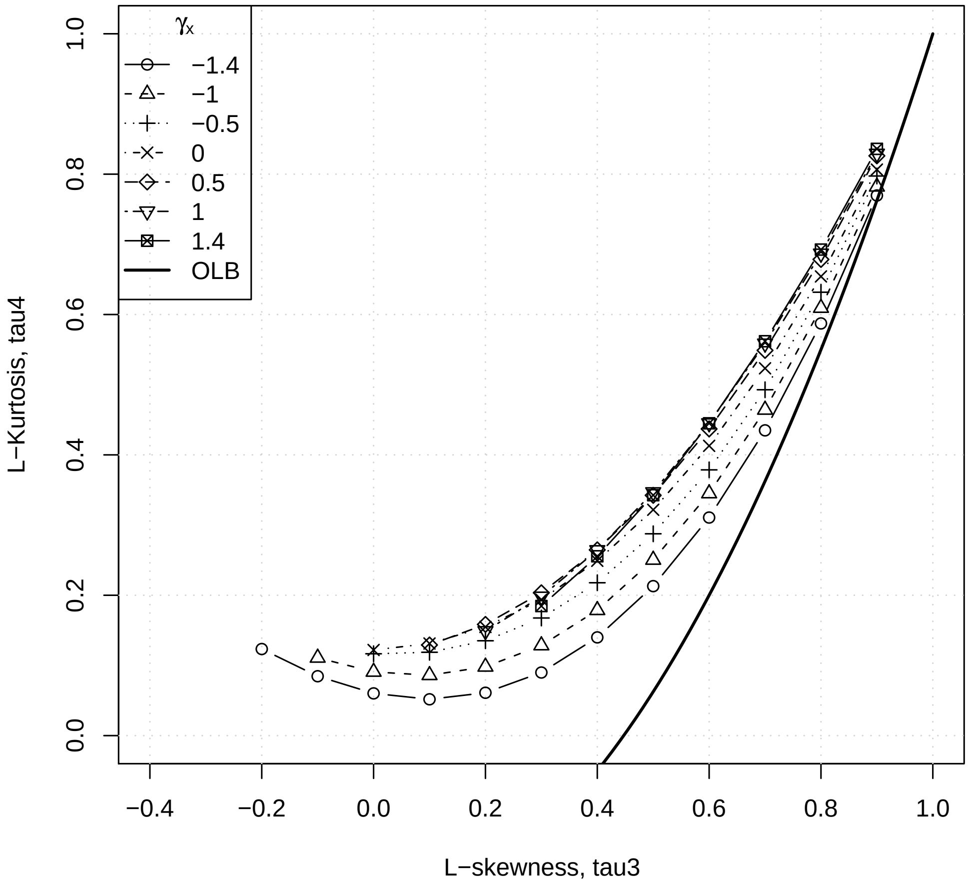

Fig. 11. L-moment ratio diagram for the LP3 distribution as a function of log space skew (OLB represents the overall theoretical lower bound of the $\tau_3 - \tau_4$ space).

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])
> GLO <- function(x) 0.16667 + 0.83333 * x^2
> curve(GLO, 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")
```

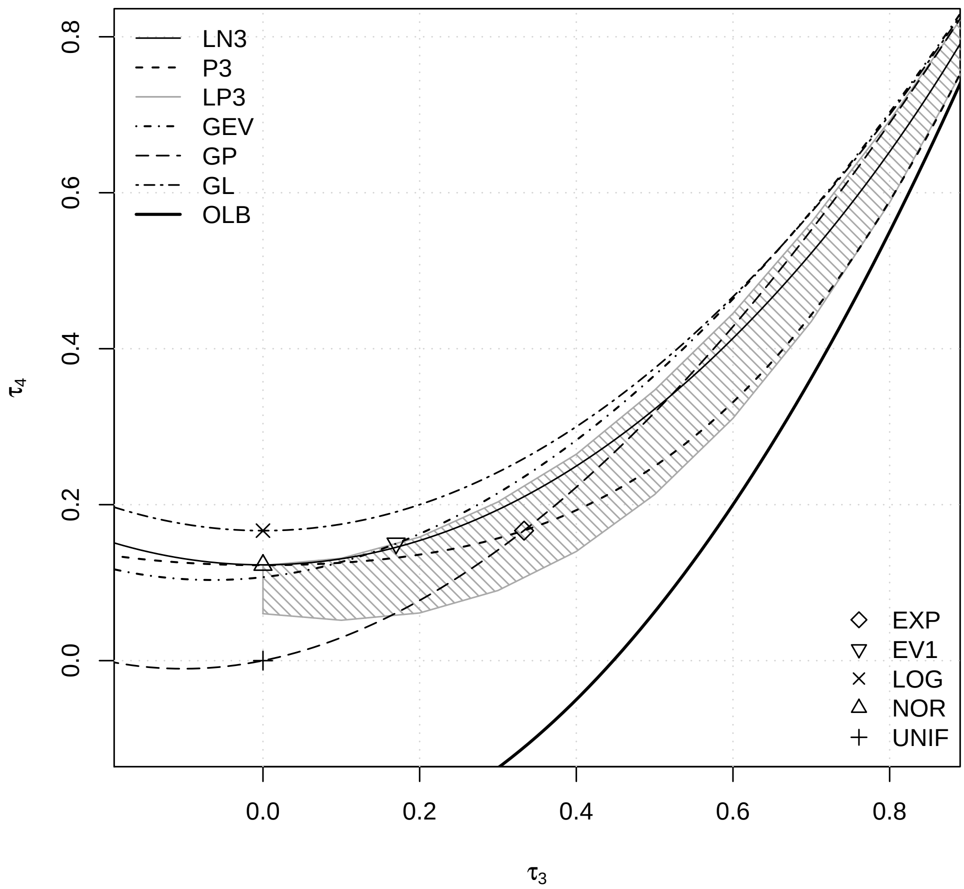

Fig. 12. L-moment ratio diagram including GLO, GEV, LN, generalized Pareto GPA , P3, Gumbel, normal, and LP3 (light gray region represents LP3 distribution with $|\gamma_x| \leq 1.414$; *I have not plotted the dark gray region with restricted values of* σ_x*; I added some other distributions.*

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).