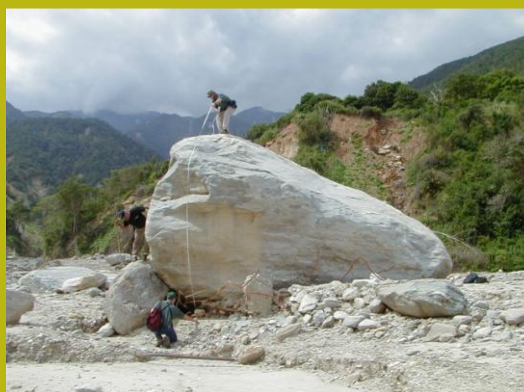
Deconvolution of Mixture's Components Inside Particle Size Distributions



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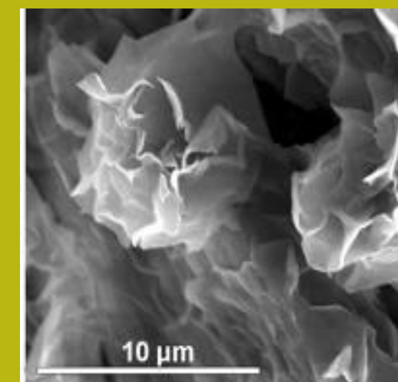
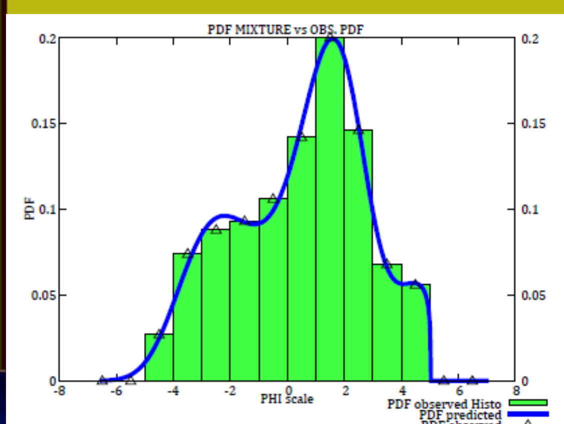
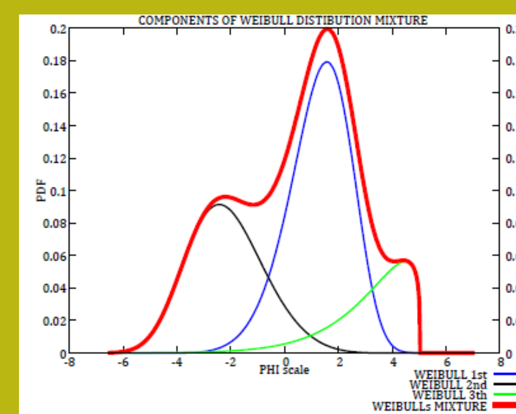
Av. M. Nava No 5, Zona Universitaria,
San Luis Potosí, 78240, Mexico



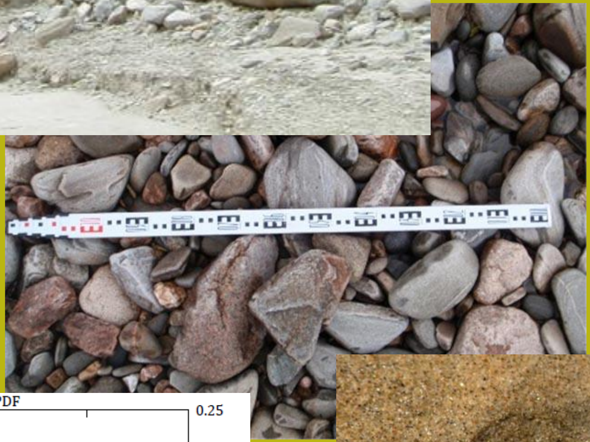
lborselli@gmail.com
http://www.lorenzo-borselli.eu

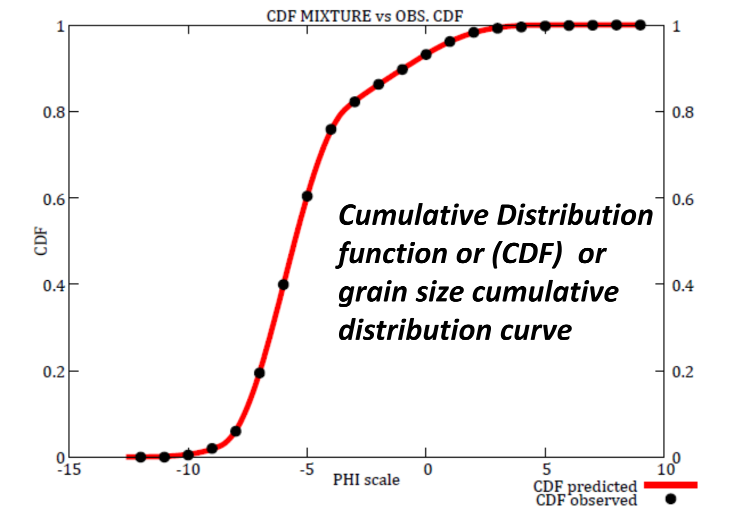


DICIM- UASLP

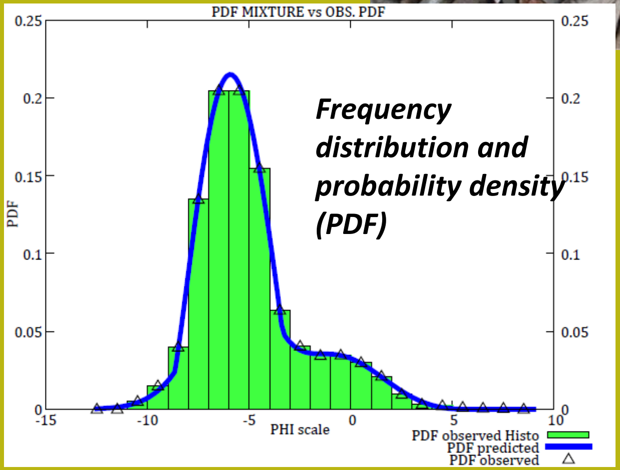


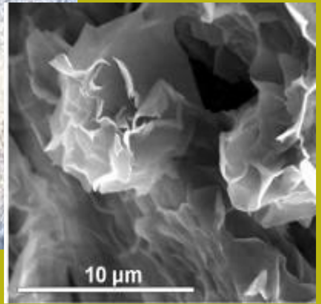
How to descibe quantitatively particles size distribution Ia natural deposits/outcrop of sediments , soil, rock mass , or geomaterials ?



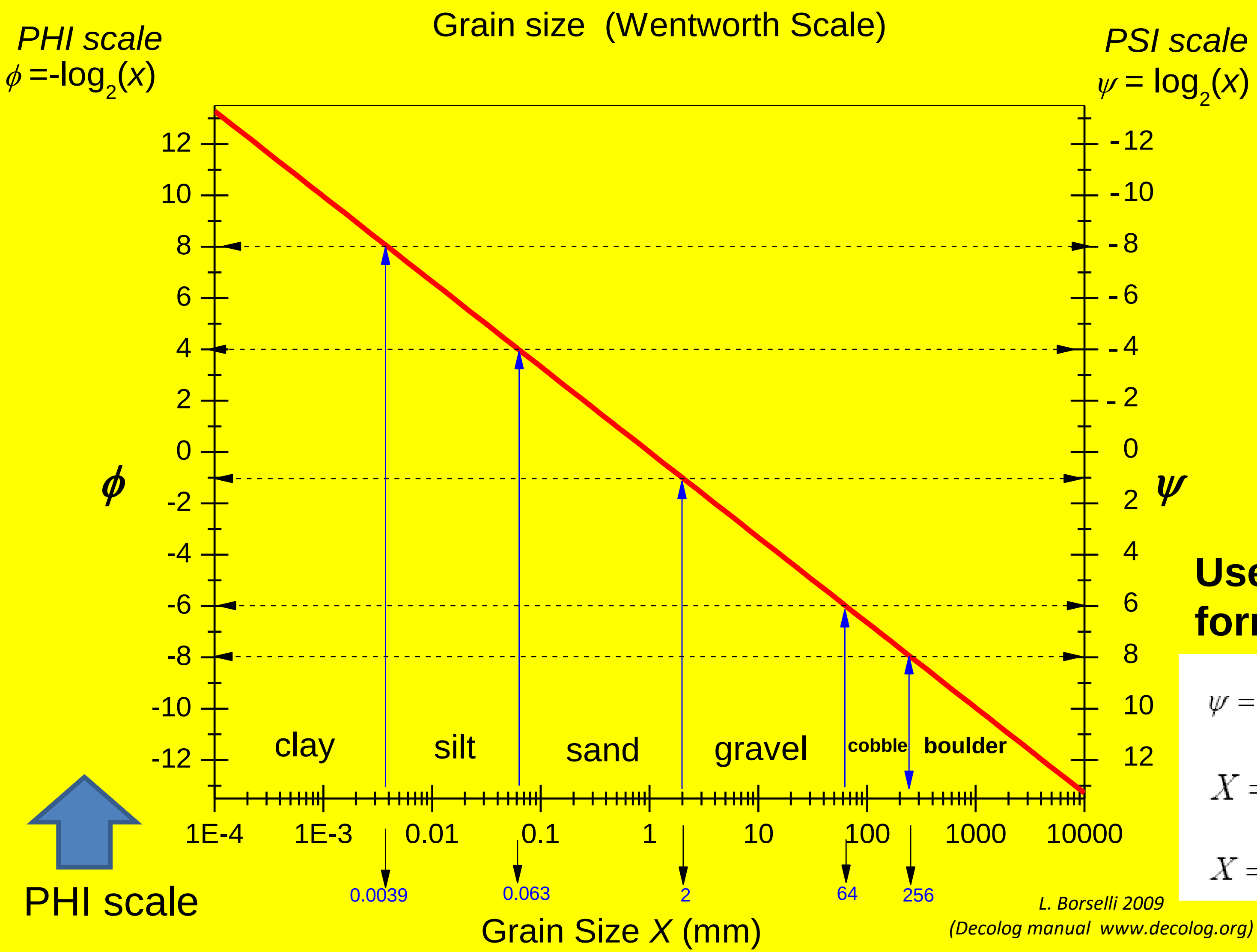


How much is the information content inside CDFs y PDFs of Particle size distribution (PSD) ?





PARTICLE SIZE AND SEDIMENTOLOGICAL SCALE



Useful formulas:

$$\psi = 3.3219 \log_{10} X$$

$$X = 10^{-0.301\phi}$$

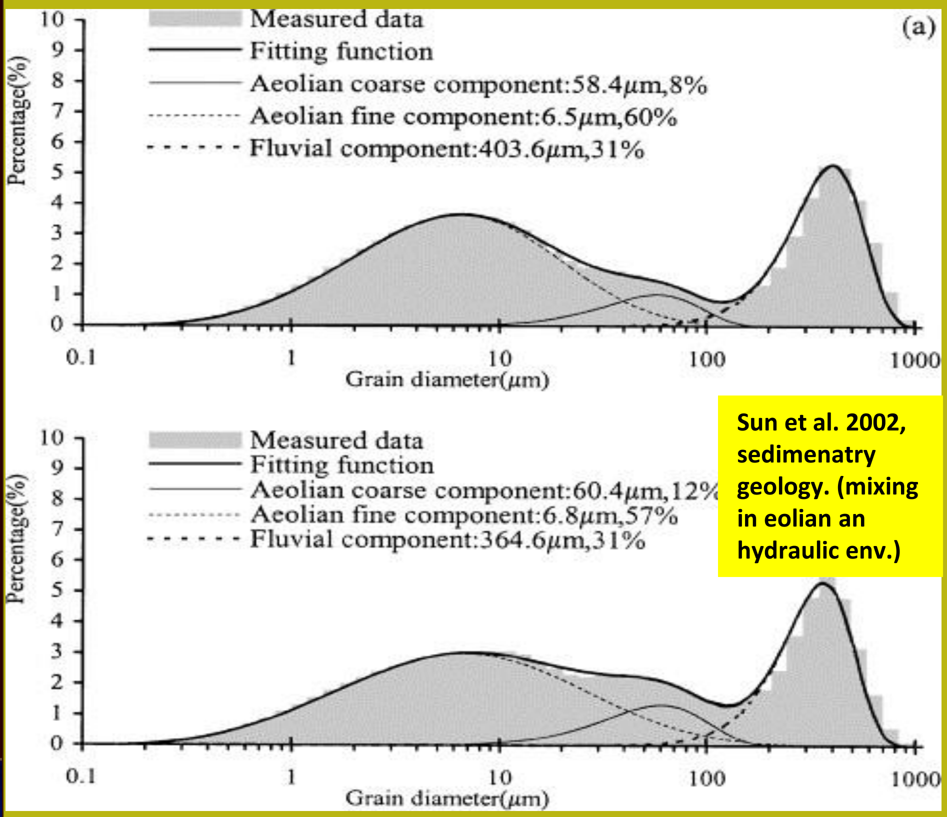
$$X = 10^{0.301\psi}$$

$$\phi = -\log_2 X$$

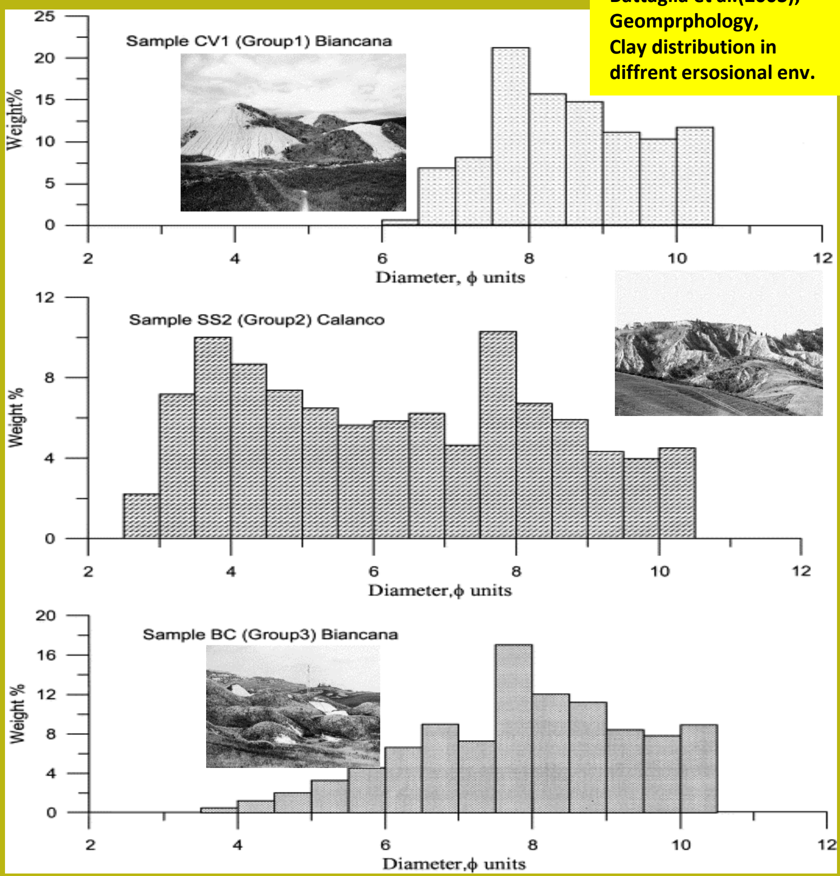
$$\phi = -3.3219 \log_{10} X$$

Experimentally derived PSD often shown multimodal shape and this characteristic is usually interpreted as a mixture of two or more populations. In geosciences the origin of these mixtures has been commonly interpreted as the result of complex processes: the different origin of the sediment ad clasts ; the transport and their final deposition. The geological cycle of sediment transport, the weathering or edaphological processes may affect the final PSD in the deposit.

The basic idea is that each type of process left a fingerprint inside the granulometric distribution and in the presence of different components. In other words the whole properties of the mixture are coded in the properties of experimental PSD.

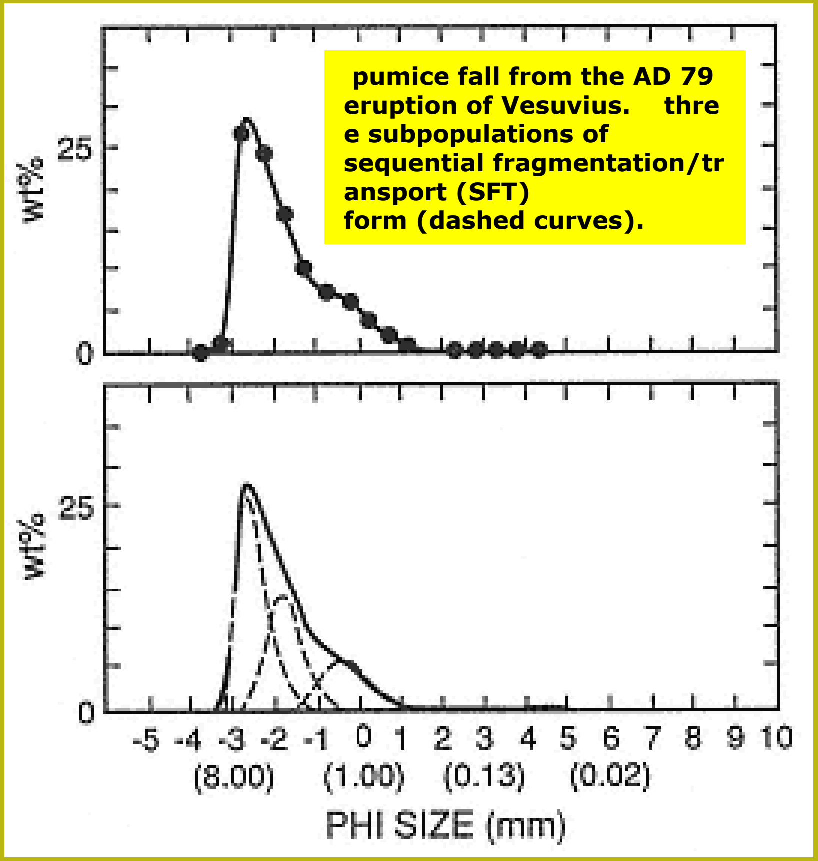


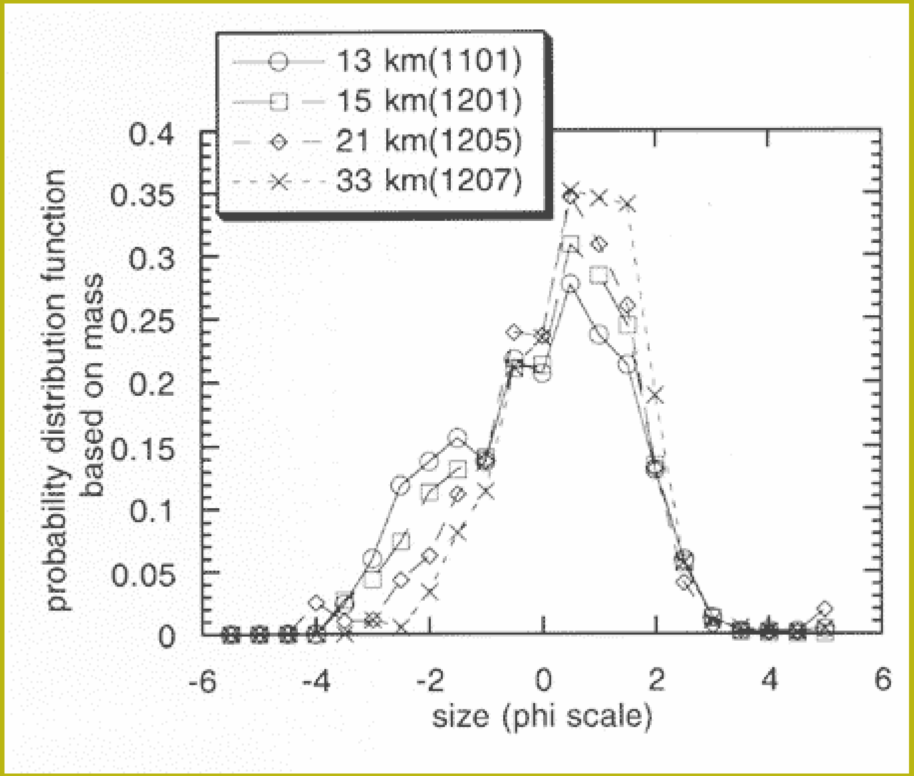
Sun et al. 2002, sedimenatry geology. (mixing in eolian an hydraulic env.)



Battaglia et al.(2003), Geomprphology, Clay distribution in diffrent ersosional env.

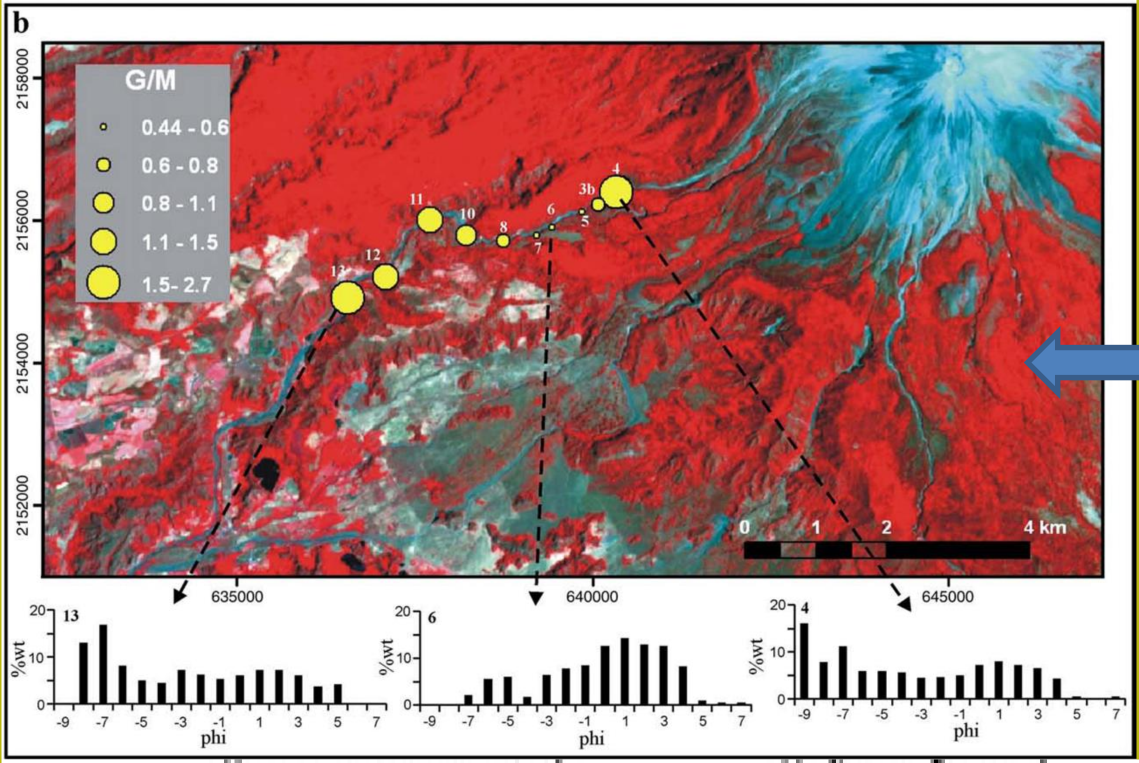
Each PSD may be interpreted as a mixture of different phase or separate components . The knowledge of these components is important in order to understand the processes (or their combination) which produced them. Application of this concept is important in geology, engineering geology and material science.





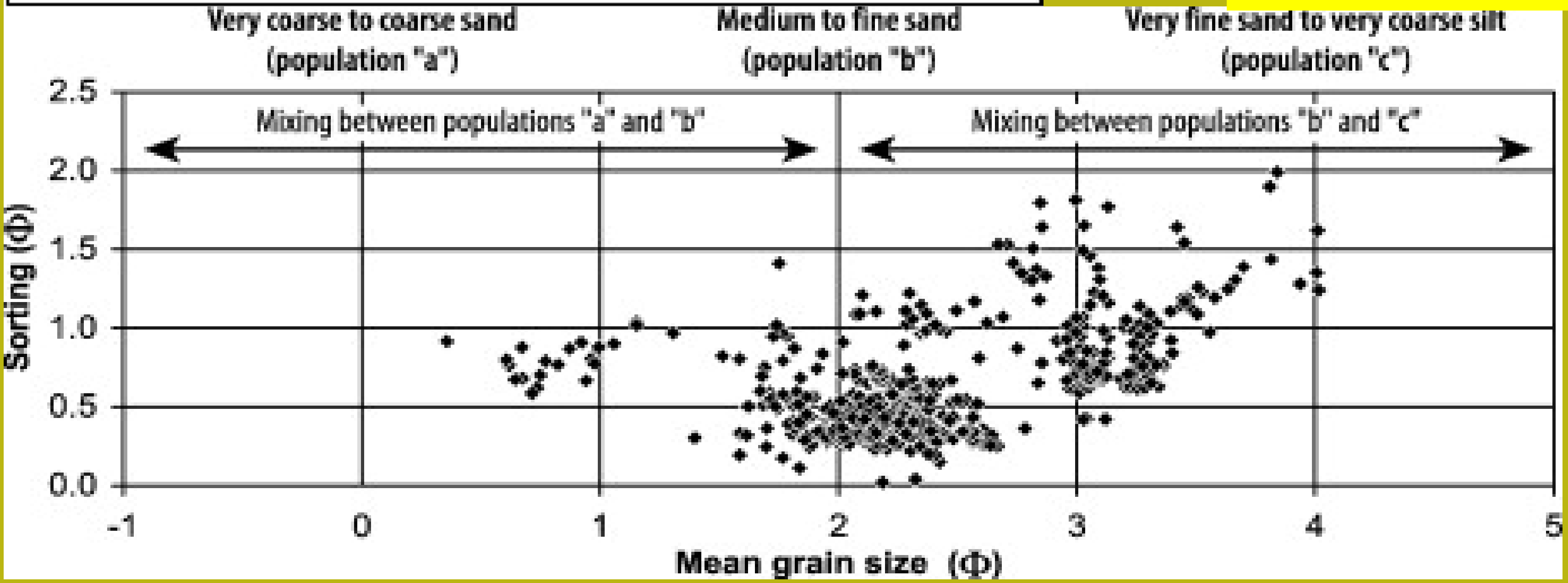
Wohletz, Kenneth, and Grant Heiken. Volcanology and Geothermal Energy. Berkeley: University of California Press, 1992. http://ark.cdlib.org/ark:/13030/ft6v19p151/

Tephra-Fall Deposits *from the Tefra deposits une 15, 1991, Eruption of Mount Pinatubo (**Koyaguchi, 1999)***
http://pubs.usgs.gov/pinatubo/koya



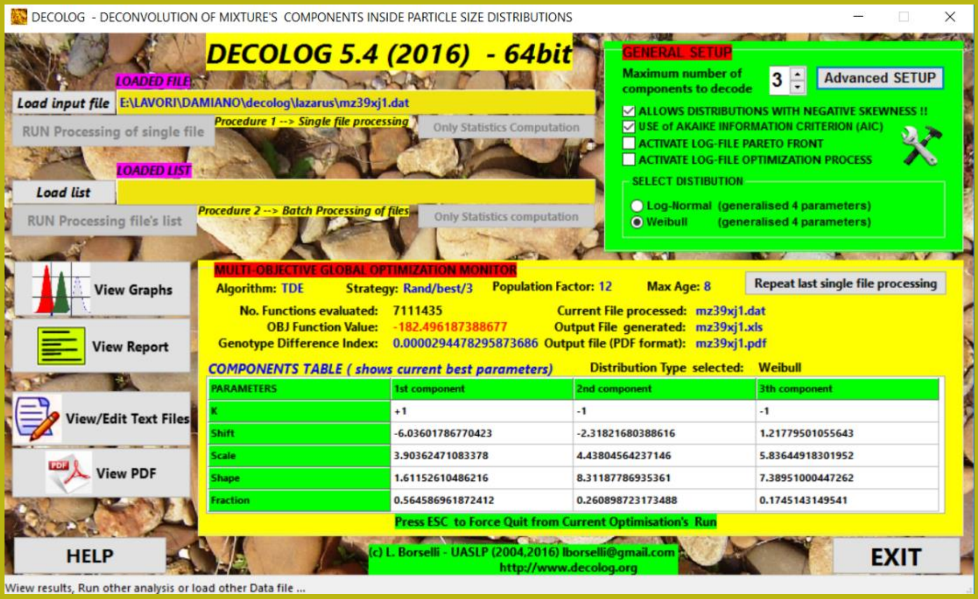
Total PSD in samples of Debris flow deposits at diferents distance from the source, with example of poly-modality (Volcan de Fuego, Colima, MX) (Capra et al., 2010, JVGR)

Antony & Héquette (2007) sedimentary Geology, (**tides sediment sorting and mixing**)



DECOLOG's OBJECTIVES

- **Problem solving for separating and decoding components inside a experimental PSD.**
- **Use as paradigm a mixture of Lognormal and Weibull distributions**
- **Automatic process by innovative non-linear multi-objetives optimization techniques**
- **It Do not requires (as other software does) the manual preliminary selection (by User) of the peaks of each component.**



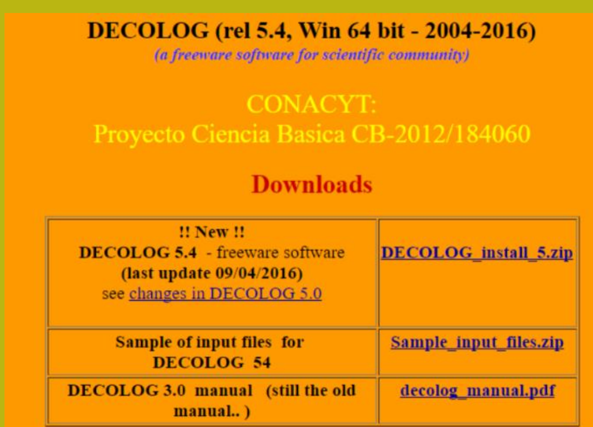
WWW.DECOLOG.ORG

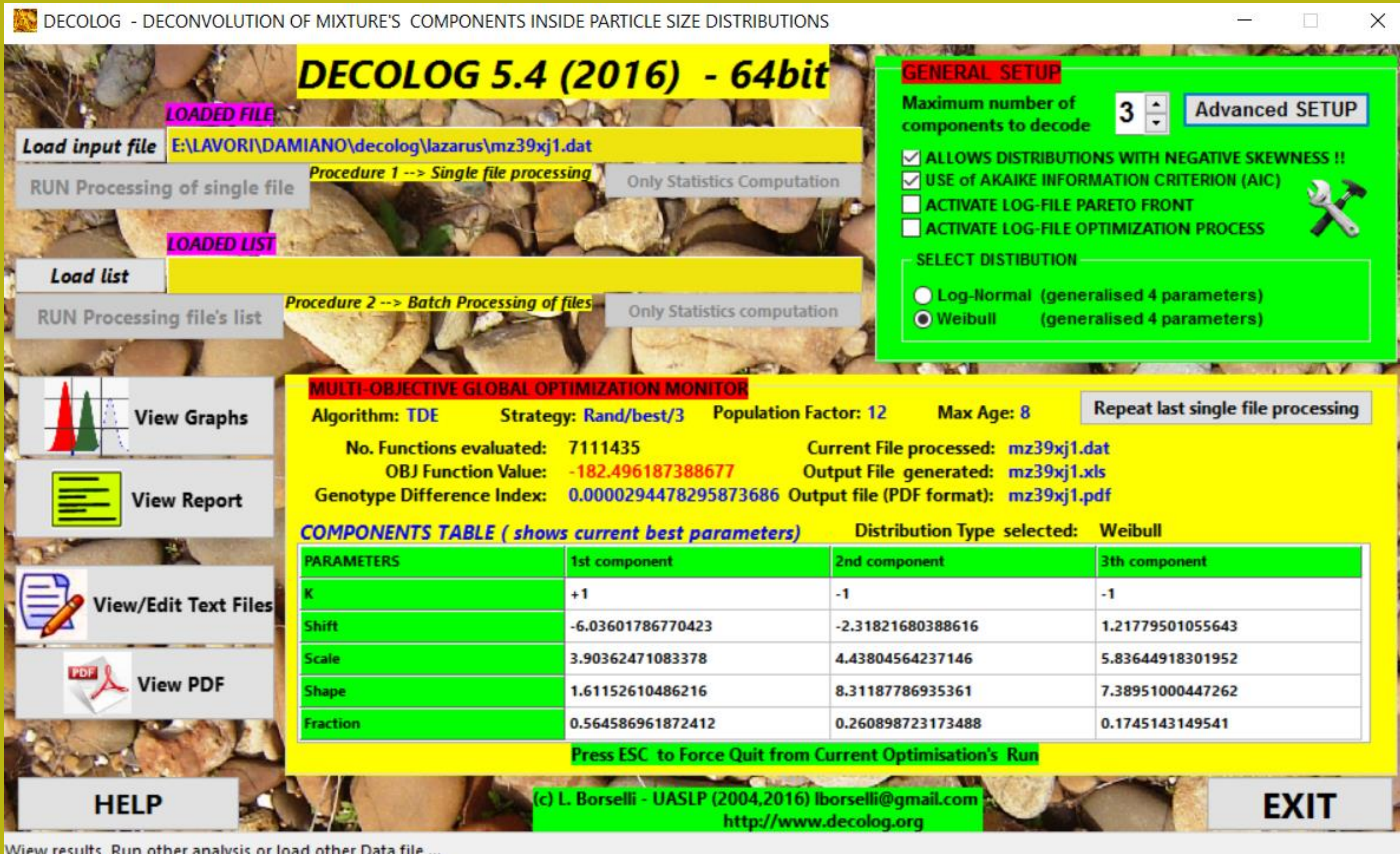
DECOLOG 5.4 is fully free (freeware) for scientific community (Windows 7/8.x/10 64bit)

Web site DECOLOG

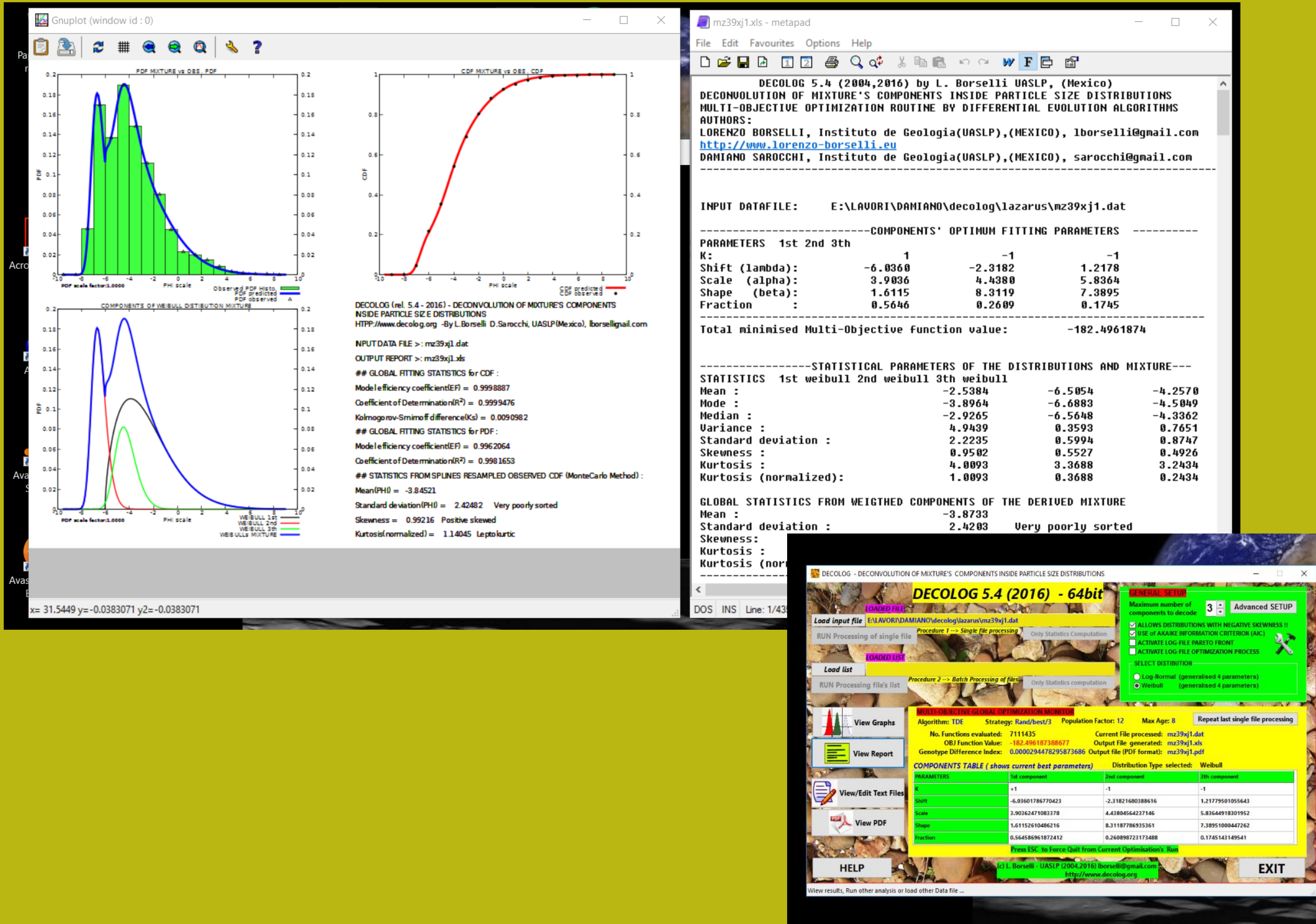
WWW.DECOLOG.ORG

Version 5.4
Para descargar

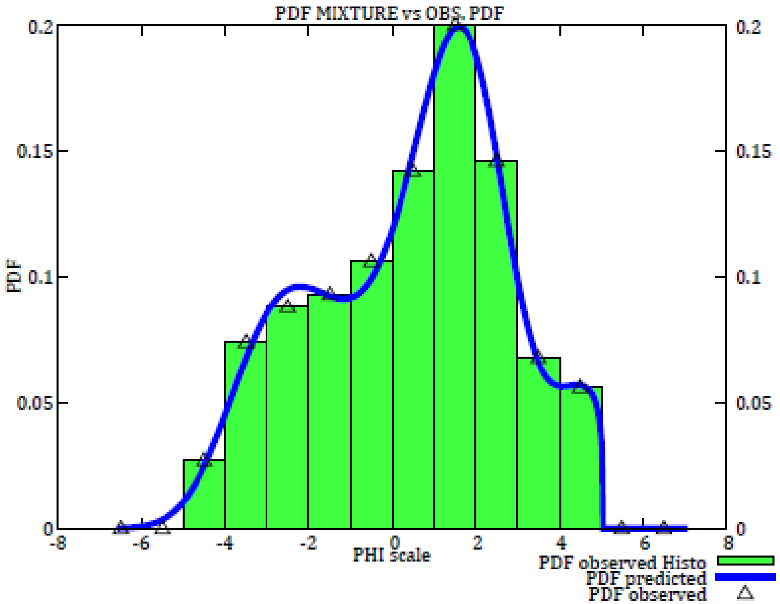


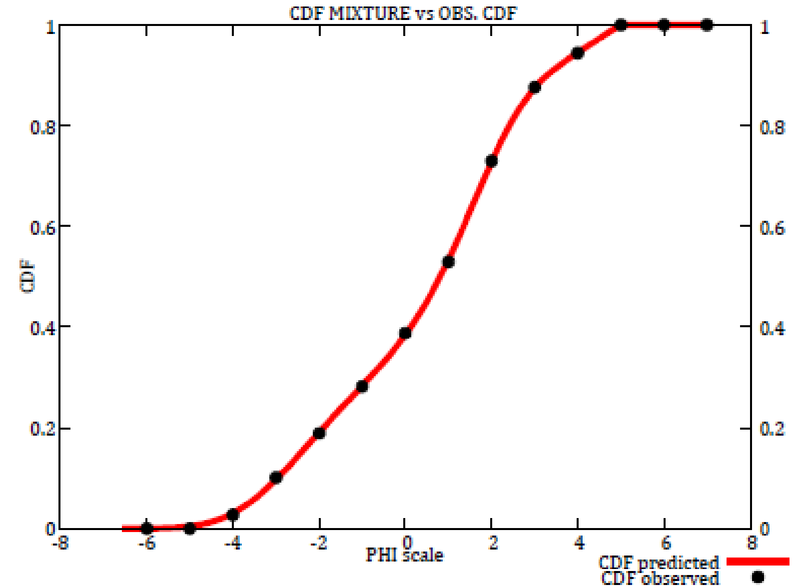


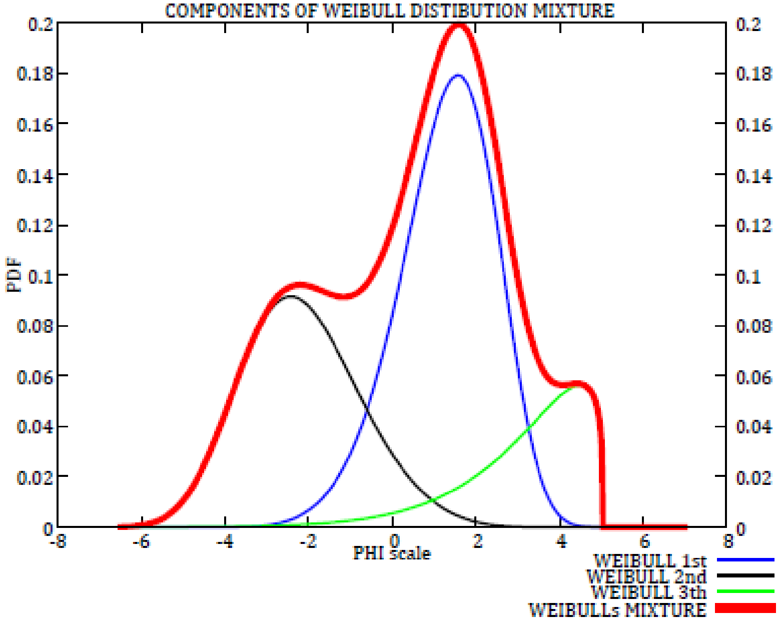
Graphical User Interface DECOLOG 5.4 (2016)



Graphical User Interface DECOLOG 5.4 (2016)







DECOLOG (rel. 5.0 - 2013) - DECONVOLUTION OF MIXTURE'S COMPONENTS INSIDE PARTICLE SIZE DISTRIBUTIONS

HTTP://www.decolog.org -By L.Borselli % D.Sarocchi, UASLP(Mexico), lborselli@gmail.com

INPUT DATA FILE____ sthelens81R-114b.dat

OUTPUT REPORT_____ mtsthelens81tris2.xls

GLOBAL FITTING STATISTICS for CDF:

Model efficiency coefficient(EF)__________ 0.9999614

Coefficient of Determination(R^2)________ 0.9999828

Kolmogorov-Smirnoff difference(Ks)______ 0.0045434

GLOBAL FITTING STATISTICS for PDF:

Model efficiency coefficient(EF)_________ 0.9959659

Coefficient of Determination(R^2)_______ 0.9980127

STATISTICS FROM SPLINES RESAMPLED OBSERVED CDF (MonteCarlo Method):

Mean(PHI)_______________ 0.43117

Standard deviation(PHI)_____ 2.29695 Very poorly sorted

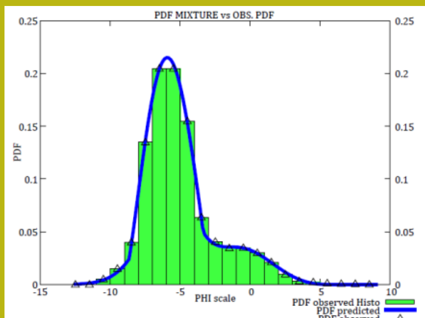
Skewness_______________ -0.27800 Symmetrical

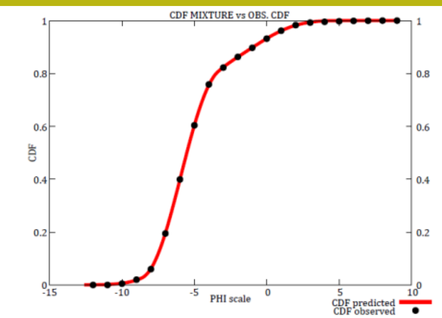
Kurtosis(normalized)_______ -0.76955 Platykurtic

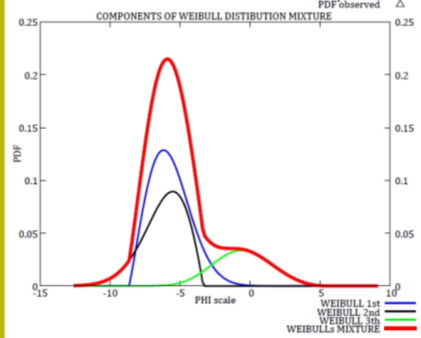
Reporte Grafico en formato generado en DECOLOG 5.4

RESULTS

- Each distribution can be analyzed globally or by components
- Statistical parameters of each identified sub-population.
- global statistics by Monte Carlo "*resampling*" or Folk-Ward optimized
- Analysis's report in text or graphical formats: CSV(XLS), PDF







DECOLOG (rel. 5.0 - 2013) - DECONVOLUTION OF MIXTURE'S COMPONENTS
INSIDE PARTICLE SIZE DISTRIBUTIONS
HTPP://www.decolog.org -By L.Borselli % D.Sarocchi, UASLP(Mexico), lborselli@gmail.com

INPUT DATA FILE____ colsa1a.dat

OUTPUT REPORT_____ colsa1a_weibull.xls

GLOBAL FITTING STATISTICS for CDF:

Model efficiency coefficient(EF)___________ 0.9999859

Coefficient of Determination(R^2)_________ 0.9999940

Kolmogorov-Smirnoff difference(Ks)______ 0.0033575

GLOBAL FITTING STATISTICS for PDF:

Model efficiency coefficient(EF)_________ 0.9994078

Coefficient of Determination(R^2)_______ 0.9997300

STATISTICS FROM SPLINES RESAMPLED OBSERVED CDF (MonteCarlo Method):

Mean(PHI)__________________ -4.97694

Standard deviation(PHI)_____ 2.60269 Very poorly sorted

Skewness__________________ 1.12896 Positive skewed

Kurtosis(normalized)________ 1.37040 Leptokurtic

-------------------------COMPONENTS' OPTIMUM FITTING PARAMETERS ----------			
PARAMETERS	1st	2nd	3th
K:	1	-1	-1
Shift (lambda):	-8.6756	-3.3761	5.6786
Scale (alpha):	3.3375	3.205	6.9788
Shape (beta):	2.1241	1.9072	3.4806
Fraction :	0.4806	0.3444	0.175
--			
Total minimised Multi-Ol	743.1047119		
----------------STATISTICAL PARAMETERS OF THE DISTRIBUTIONS AND MIXTURE---			
STATISTICS	1st weibull	2nd weibull	3th weibull
Mean :	-5.7197	-6.2198	-0.5987
Mode :	-6.202	-5.547	-0.6531
Median :	-5.867	-6.0208	-0.6027
Variance :	2.1424	2.407	3.9858
Standard deviation :	1.4637	1.5515	1.9965
Skewness :	0.5526	-0.6959	-0.03
Kurtosis :	3.1084	3.3732	2.7122
Kurtosis (normalized):	0.1084	0.3732	-0.2878
GLOBAL STATISTICS FROM WEIGTHED COMPONENTS OF THE DERIVED MIXTURE			
Mean :	-4.9957		
Standard deviation :	2.59	Very poorly sorted	
Skewness:	1.0352	Positive skewed	
Kurtosis :	3.9755		
Kurtosis (normalized):	0.9755	Leptokurtic	

METHODS

DECOLOG 5.4 Contains a new optimization engines that allow to consider components of Lognormal and Weibull distribution with negative skewness (left tailed distribution) , a set of generalized 4 parameters distributions.

DECOLOG's internal engine was improved a lot considering a set of multi-objective optimization genetic algorithms: "Differential evolution" (DE) y "Trigonometric differential evolution (TDE). These algorithm produced a relevant increase of convergence to global minima, significance and reproducibility of final results.

See Differential Evolution Application In Earth Sciences(2008)

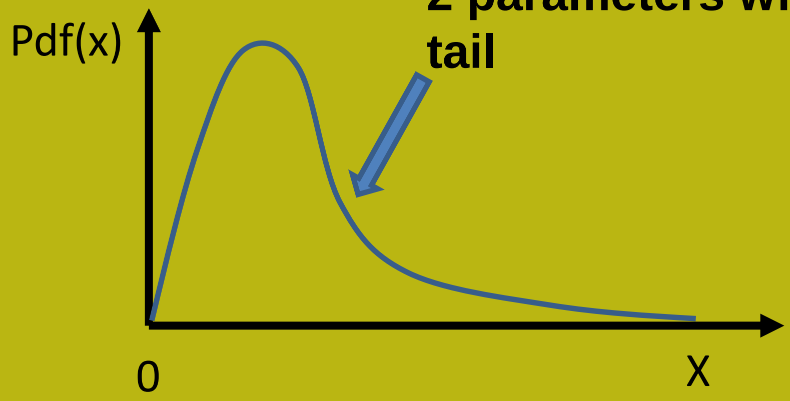
http://www.lorenzo-borselli.eu/presentations/DifferentialEvolutionApplicationInEarthSciences_Borselli2008.pdf

(Invited seminar Centro De Geociencias - UNAM, Queretaro (MEXICO) – May 7th 2008)

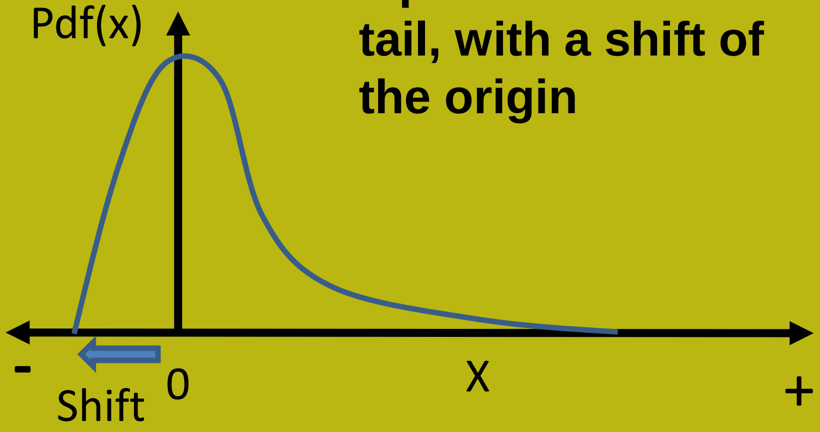
See at Presentation section, in the web site : www.lorenzo-borselli.eu

Continue distributions of 4,3 and 2 Parameters

PDF (probability density function) 2 parameters with tail



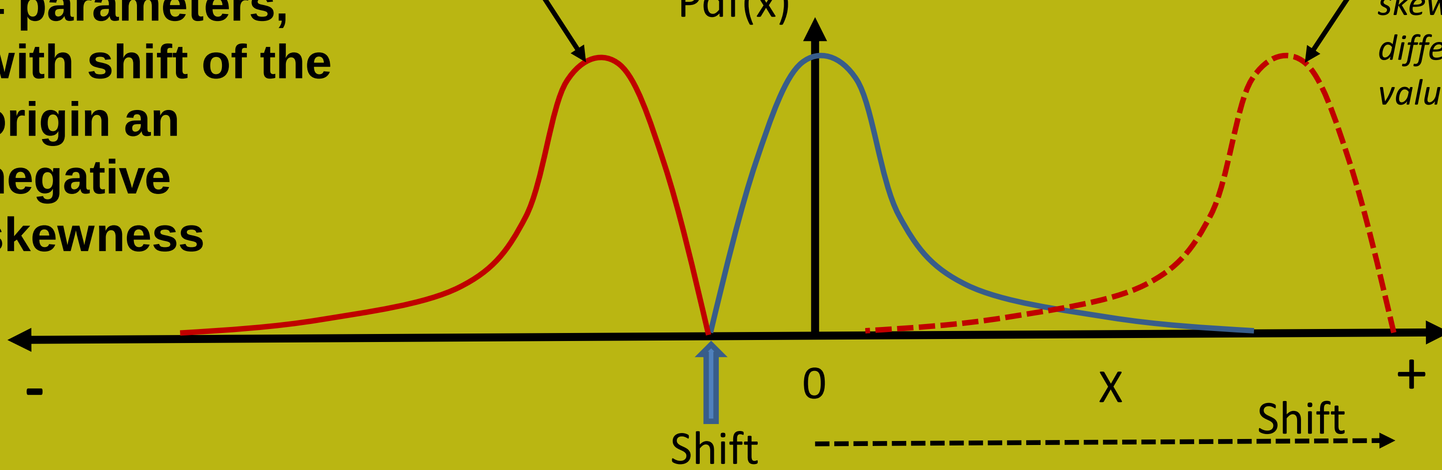
PDF (probability density function) 3 parameters with tail, with a shift of the origin



PDF (probability density function) 4 parameters, with shift of the origin an negative skewness

Simmetrical but with negative skewed

Simmetrical but with negative skewed and different shift value



Details on Lognormal Dist. 4,3 and 2 Parameters

PDF (probability density function)

$$f(x)=\frac{e^{\frac{-\left(\ln(k(x-\lambda))-\alpha\right)^2}{2\beta^2}}}{\sqrt{2\pi}\,\beta\left(k(x-\lambda)\right)}$$

CDF (Cumulative distribution function)

$$F(x)=\frac{1}{2}\left(1+erf\left(\frac{k(\ln(k(x-\lambda))-\alpha)}{\beta\sqrt{2}}\right)\right)$$

Note:
with K=+1 we have a standard Lognormal 3 parameters, and with λ =0 it became a standard _ognormal 2 Parameters

Notes: The value k= +1 produces a classical right tailed distribution – (positive skewness), the value k= -1 produces a left tailed distribution – (negative skewness) by Aitchison and Brown (1957) (reflected distribution).K assumes only integer values.

λ *is : the location/shift parameters related to the shifting on x axis with respect the origin of the axis. Valid values are in the interval* $[-\infty,+\infty]$

α *the scale parameter v. valid values are in the interval* $[0,+\infty]$

β *is the shape parameter. Valid values are in th interval* $[0,+\infty]$

Details on Weibulll Dist. 4,3 and 2 Parameters

PDF (probability density function)

$$f(x)=\frac{\beta}{\alpha}\left(\frac{k(x-\lambda)}{\alpha}\right)^{\beta-1}e^{\left(\frac{k(x-\lambda)}{\alpha}\right)^{\beta}}$$

CDF (Cumulative distribution function)

$$F(x)=\frac{1+k}{2k}-ke^{\left(\frac{k(x-\lambda)}{\alpha}\right)^{\beta}}$$

Note:
with K=+1 we have a standard weibull 3 parameters, y con λ =0 it became a standard weibull 2 parámetros

Notes: The value k= +1 produces a classical weibull distribution , the value k= -1 produces … reflected Weibull distribution Cohen(1973) – K assumes only integer values. $[-\infty,+\infty]$

λ *is the location/shift parameters related to the shifting on x axis with respect the origin of the axis. Valid values are in the interval* $[-\infty,+\infty]$

α *the scale parameter. valid values are in the interval* $[0,+\infty]$.

β *is the shape parameter. Valid values are in th interval* $[0,+\infty]$

Deconvolution by ***not linear multi-objective global optimization***

A Procedure for Global Optimization , not linear, multi-objectives has been developed (since 2004) in order to obtain a robust and efficient decoding of information inside PSD. We obtain 5 parameters identifying the fingerprint of ech distribution and their relativeimportance in total PSD: $\alpha_i, \beta_i, \lambda_i, k_i, w_i$

$$f(x)_{mix} = w_1 f_1(x) + w_2 f_2(x) + ... + w_n f_n(x)$$

Mixture of PDFs

$$F(x)_{mix} = w_1 F_1(x) + w_2 F_2(x) + ... + w_n F_n(x)$$

Mixture of CDFs

$$\sum_{i=1}^{n} w_i = 1$$

The multi-objective optimization we produce a concurrent fitting of observed PDF and CDF, or in other words on PDF function and on its integral (CDF). <u>This is ma more efficent that on the PDF or CDF alone</u> (Wanga et al. ,2004) The goal can be obtained transforming a multi-objective process in single objective optimization (Andersson, 2000), using the following eqs:

$$\min[obj] = \max[CEF_{cdf} + CEF_{pdf}]$$

Where

$$CEF_{cdf/pdf} = 1 - EF_{cdf/pdf}$$

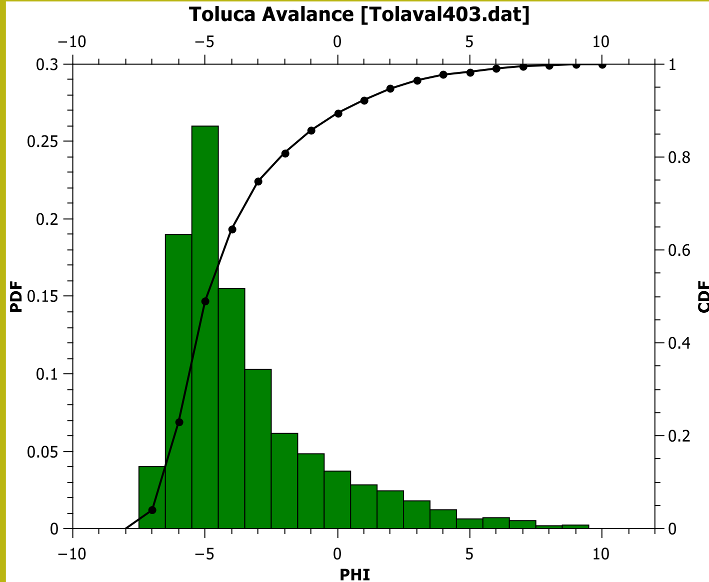
Based on efficiency modellig parameter (EF) By Nash and Sutcliffe (1970)

Based on Akaike inf. criteria

$$\min[obj] = \max[Caik_{cdf} + Caik_{pdf}]$$

where :

$Caik_{cdf/pdf} =$ Akaike information criteria (AIC)



Folk-Ward statistics

mean	-4.18608
std dev	2.56410
skewness	0.52551
Kurtosis (Folk-ward)	1.24688
kurtosis(normalised)	1.70032

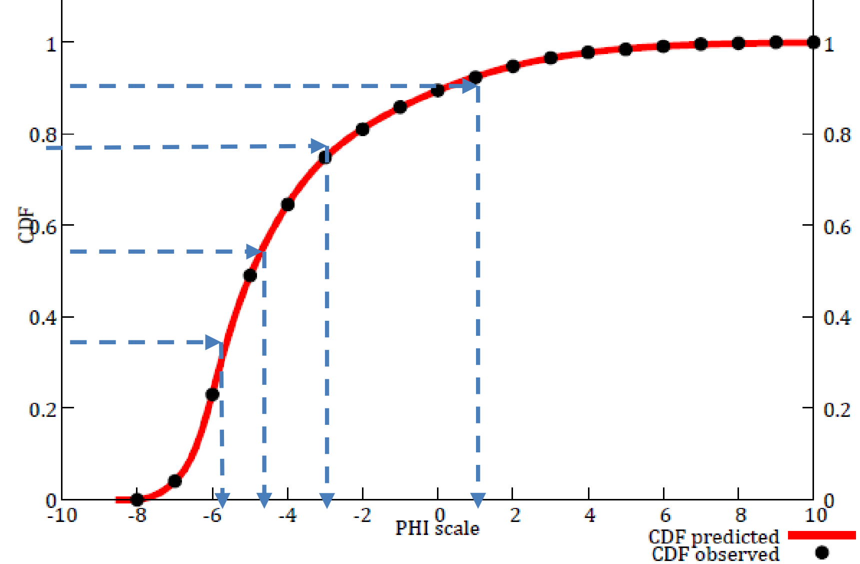
$$\text{Mean} = \frac{\phi_{16} + \phi_{50} + \phi_{84}}{3}$$

$$\text{Median} = \phi_{50}$$

$$\text{Sorting} = \frac{\phi_{16} + \phi_{84}}{4} + \frac{\phi_{95} - \phi_{5}}{6.6}$$

$$\text{Skewness} = \frac{\phi_{16} + \phi_{84} - 2\phi_{50}}{2(\phi_{84} - \phi_{16})} + \frac{\phi_{5} + \phi_{95} - 2\phi_{50}}{2(\phi_{95} - \phi_{5})}$$

$$\text{Kurtosis} = \frac{\phi_{95} - \phi_{5}}{2.44(\phi_{75} - \phi_{25})}$$



Statistics (method of the Moments) from resampled OBSERVED CDF (MONTE CARLO METHOD)

mean	-3.98504
std dev	2.83190
skewness	1.54300
kurtosis (normalised)	2.29259

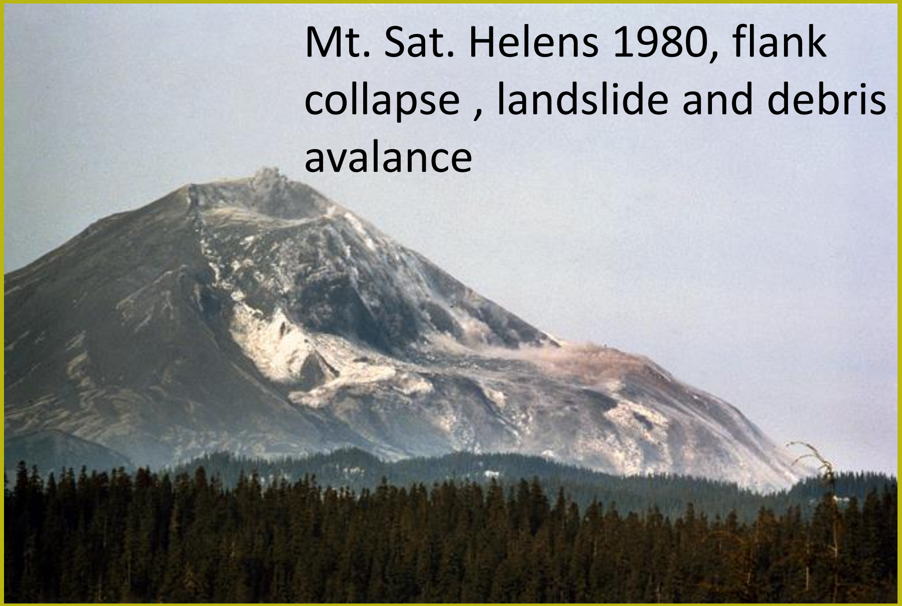
Monte carlo resampling of interpolated observed CDF. Interpolation made with Convex Cubic Rational splines with tensión with C1 and C2 properties.
Usually **20000 random resampling on CDF**.

Global statistics calculations

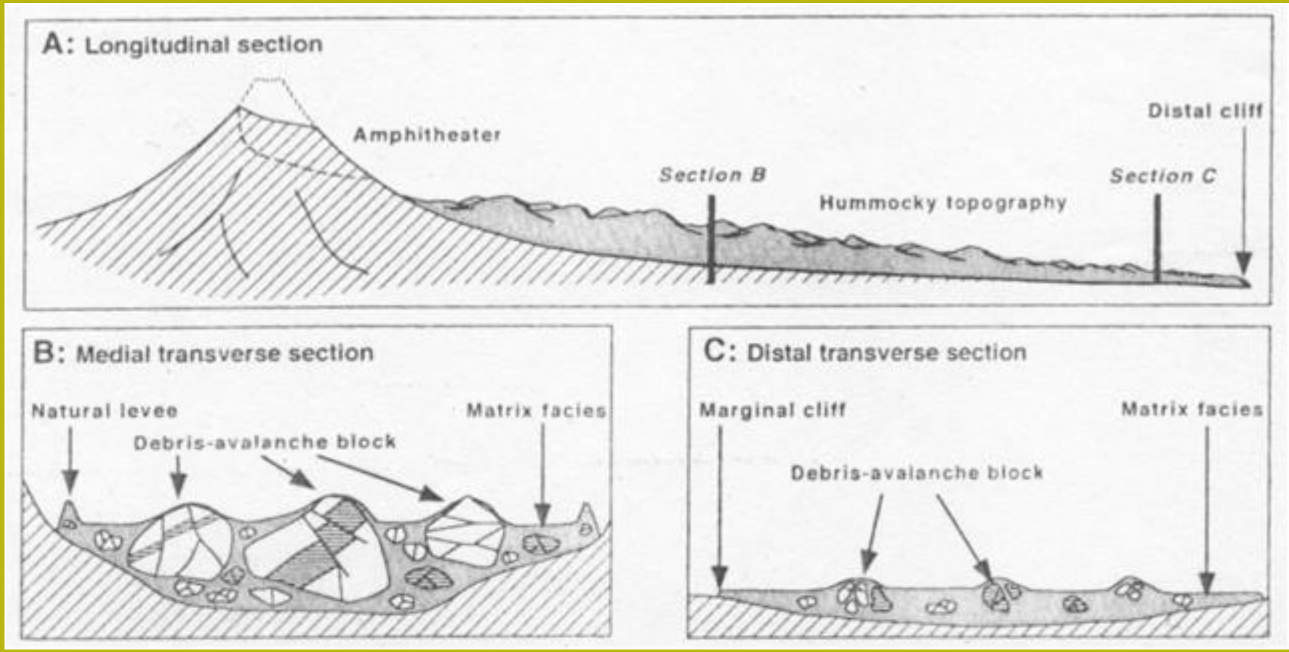
Two example of aplication:

- Debris avalance in volcano, Nevado de Toluca, Mexico
- Olistostrome formation (large Deep-sea landslide deposits), Turkey

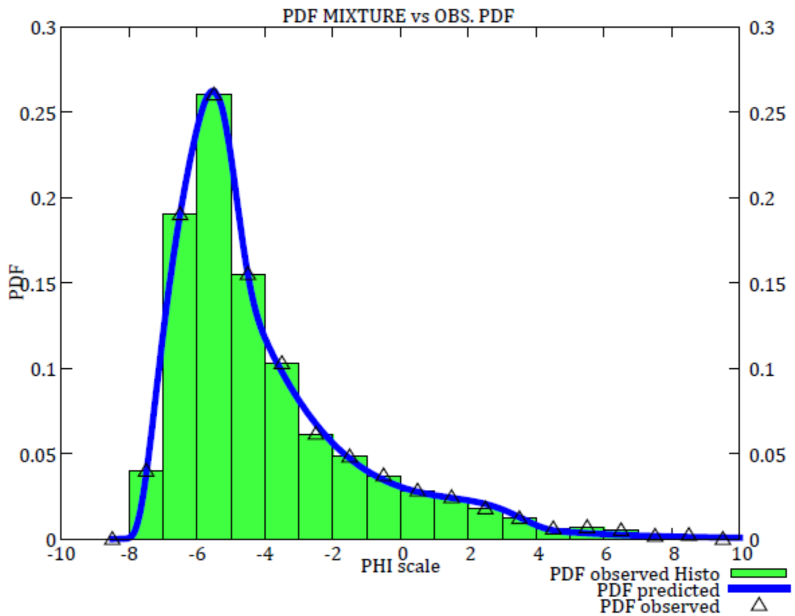
- Debris avalance in volcano, Nevado de Toluca, Mexico

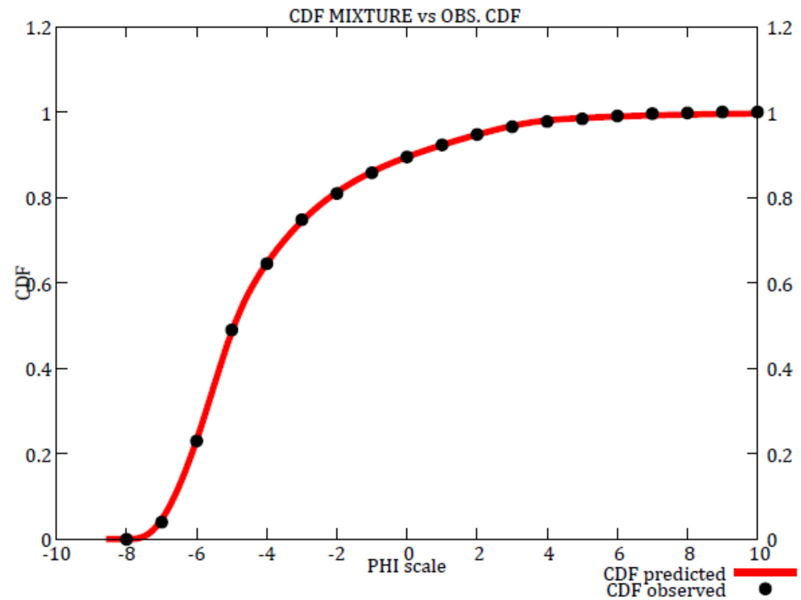


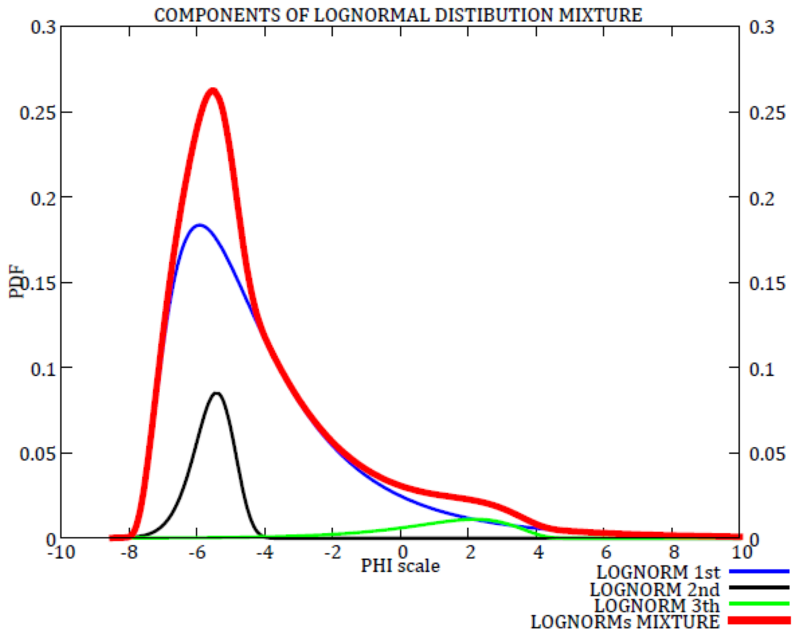
http://www.mshslc.org/wp-content/uploads/2013/05/2_debris_avalanche_intro.jpg



https://volcaniccollapse.files.wordpress.com/2011/10/image8.png







DECOLOG (rel. 5.0 - 2013) - DECONVOLUTION OF MIXTURE'S COMPONENTS INSIDE PARTICLE SIZE DISTRIBUTIONS

HTTP://www.decolog.org -By L.Borselli % D.Sarocchi, UASLP(Mexico), lborselli@gmail.com

INPUT DATA FILE____ tolaval0403.dat

OUTPUT REPORT____ tolaval0403bis-lognorm.xls

GLOBAL FITTING STATISTICS for CDF:

Model efficiency coefficient(EF)__________ 0.9999066

Coefficient of Determination(R^2)________ 0.9999607

Kolmogorov-Smirnoff difference(Ks)______ 0.0062678

GLOBAL FITTING STATISTICS for PDF:

Model efficiency coefficient(EF)________ 0.9989007

Coefficient of Determination(R^2)_______ 0.9994797

STATISTICS FROM SPLINES RESAMPLED OBSERVED CDF (MonteCarlo Method):

Mean(PHI)_________________ -3.98537

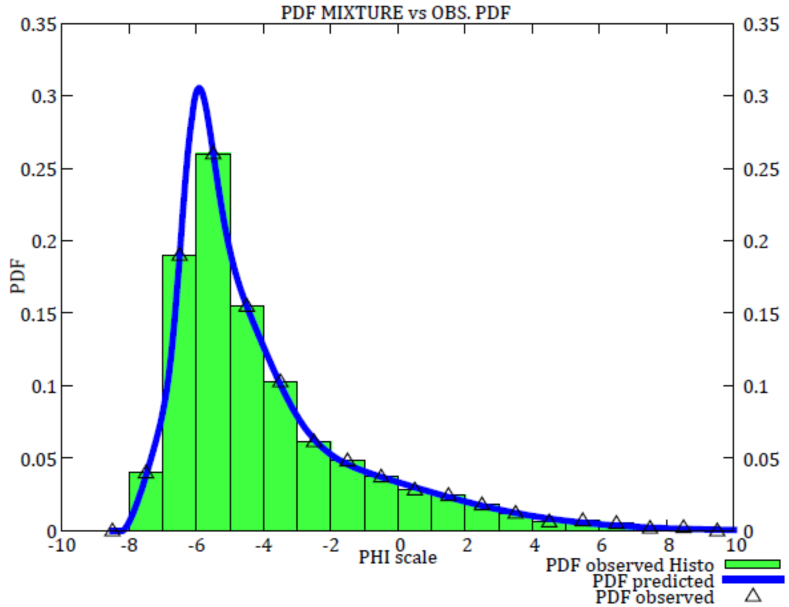
Standard deviation(PHI)_____ 2.84015 Very poorly sorted

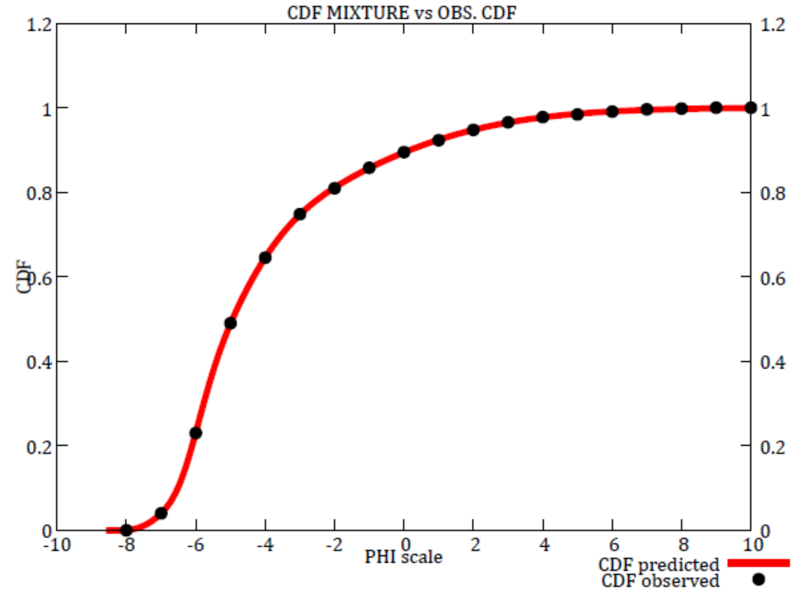
Skewness__________________ 1.55503 Very positive skewed

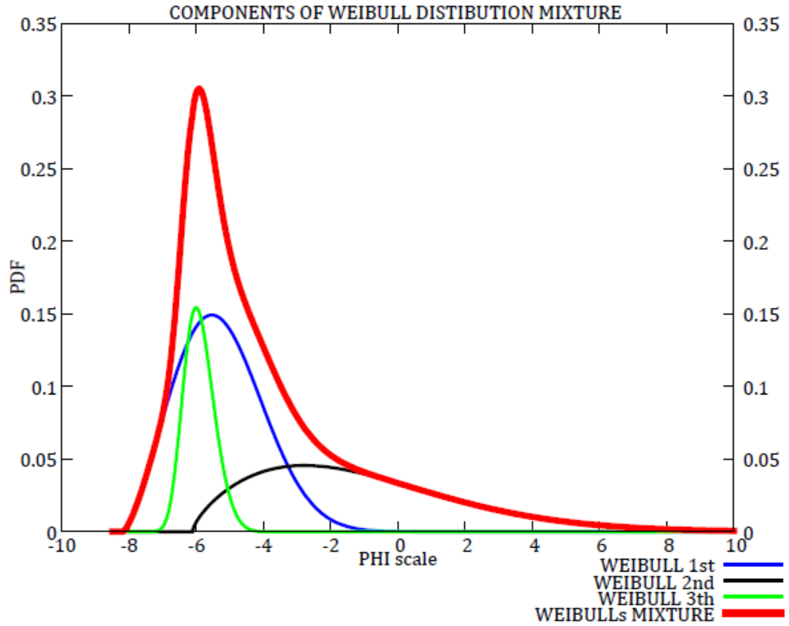
Kurtosis(normalized)_______ 2.37742 Leptokurtic

lognormal 4 parámetros – 3 componentes

Nevado de Toluca avalance - global Akaike inf criteria -196.53







DECOLOG (rel. 5.0 - 2013) - DECONVOLUTION OF MIXTURE'S COMPONENTS INSIDE PARTICLE SIZE DISTRIBUTIONS

HTTP://www.decolog.org -By L.Borselli % D.Sarocchi, UASLP(Mexico), lborselli@gmail.com

INPUT DATA FILE____tolaval0403.dat

OUTPUT REPORT_____tolaval0403bis.xls

GLOBAL FITTING STATISTICS for CDF:

Model efficiency coefficient(EF)__________0.9999907

Coefficient of Determination(R^2)________0.9999958

Kolmogorov-Smirnoff difference(Ks)______0.0017719

GLOBAL FITTING STATISTICS for PDF:

Model efficiency coefficient(EF)_________0.9996499

Coefficient of Determination(R^2)_______0.9998347

STATISTICS FROM SPLINES RESAMPLED OBSERVED CDF (MonteCarlo Method):

Mean(PHI)_________________ -3.98537

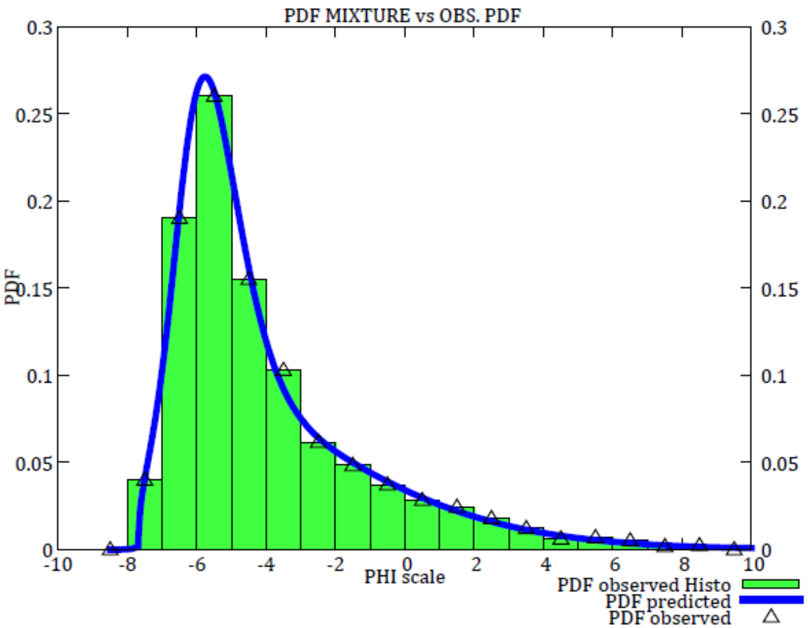
Standard deviation(PHI)_____ 2.84015 Very poorly sorted

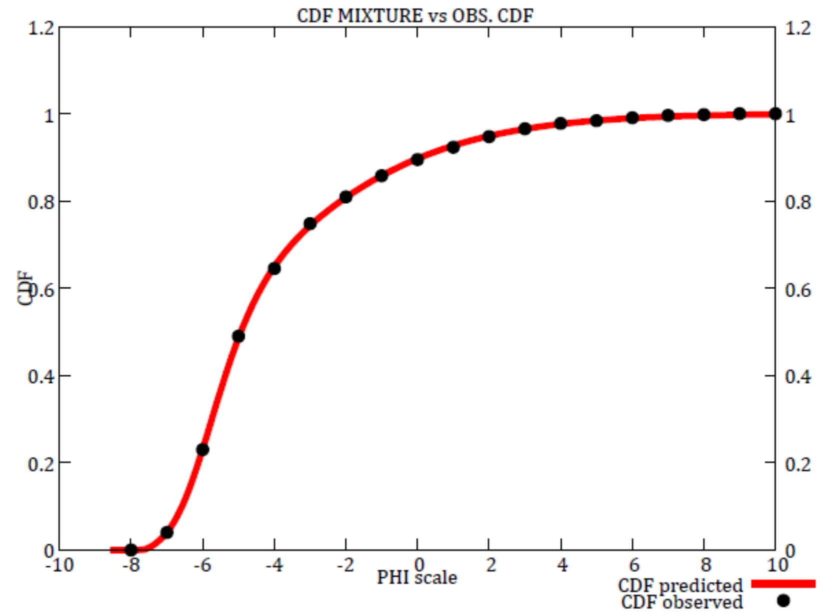
Skewness_________________ 1.55503 Very positive skewed

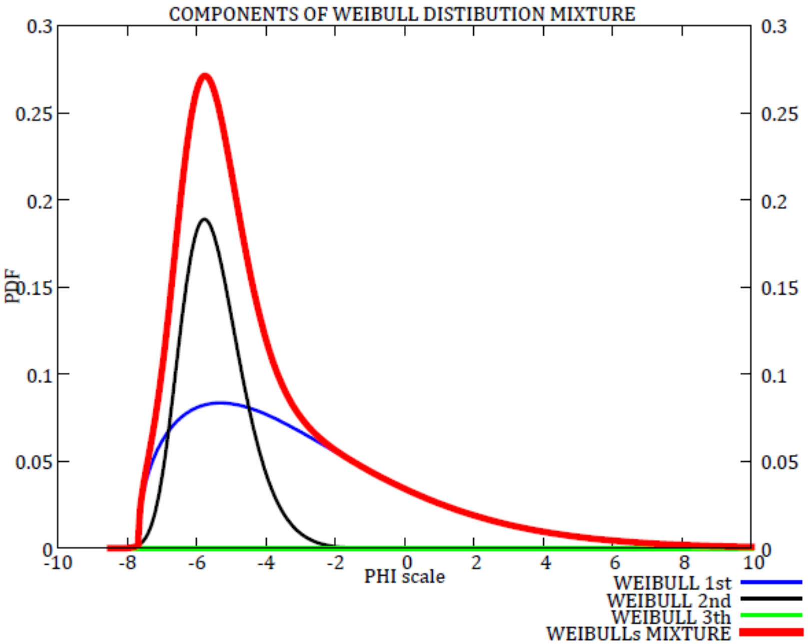
Kurtosis(normalized)_______ 2.37742 Leptokurtic

Weibull 4 parámetros – 3 componentes

Nevado de Toluca avalance - global Akaike inf. criteria -229.35







DECOLOG (rel. 5.0 - 2013) - DECONVOLUTION OF MIXTURE'S COMPONENTS INSIDE PARTICLE SIZE DISTRIBUTIONS

HTPP://www.decolog.org -By L.Borselli % D.Sarocchi, UASLP(Mexico), lborselli@gmail.com

INPUT DATA FILE____ tolaval0403.dat

OUTPUT REPORT_____ tolaval0403bis-weibul_only2.xls

GLOBAL FITTING STATISTICS for CDF:

Model efficiency coefficient(EF)__________ 0.9999473

Coefficient of Determination(R^2)________ 0.9999751

Kolmogorov-Smirnoff difference(Ks)______ 0.0046800

GLOBAL FITTING STATISTICS for PDF:

Model efficiency coefficient(EF)_________ 0.9977339

Coefficient of Determination(R^2)_______ 0.9990113

STATISTICS FROM SPLINES RESAMPLED OBSERVED CDF (MonteCarlo Method):

Mean(PHI)_________________ -3.98537

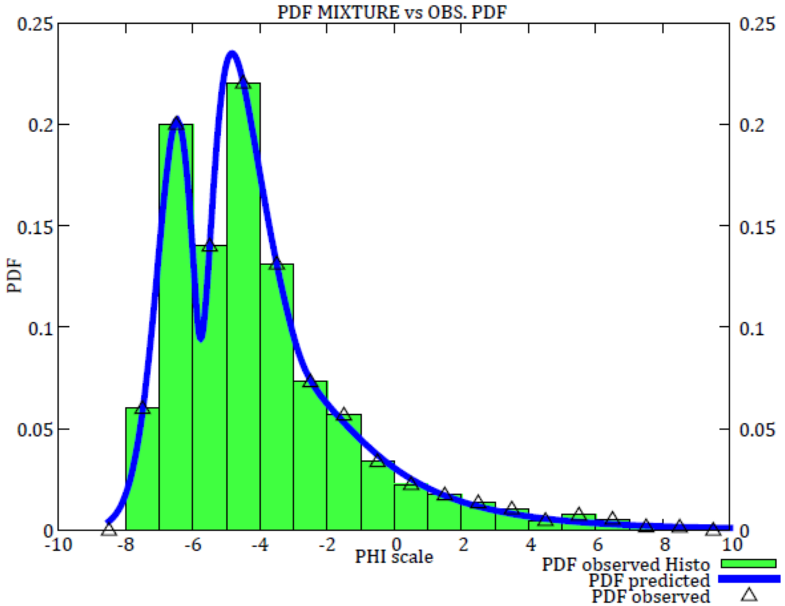
Standard deviation(PHI)_____ 2.84015 Very poorly sorted

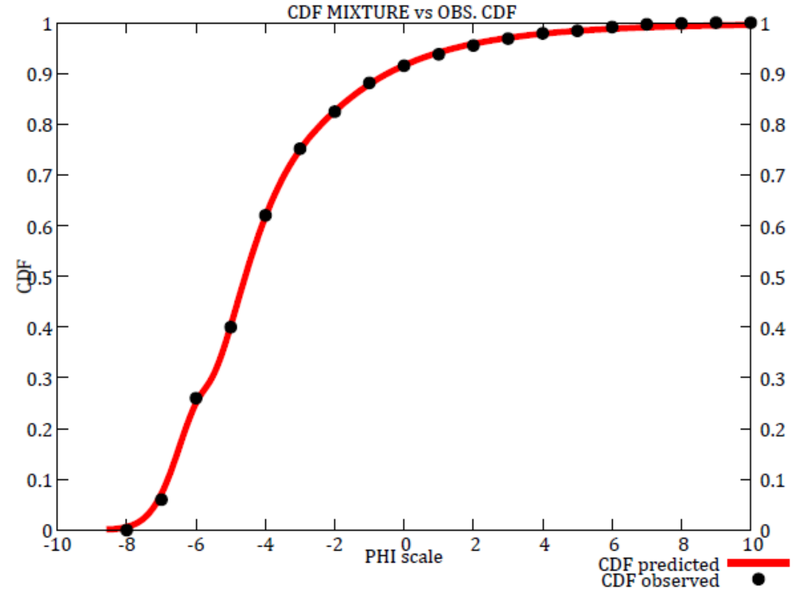
Skewness__________________ 1.55503 Very positive skewed

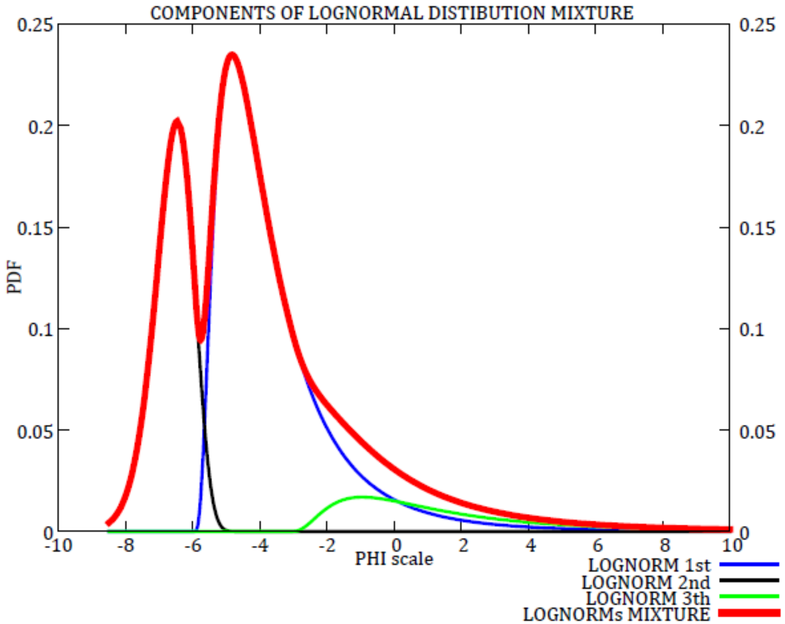
Kurtosis(normalized)_______ 2.37742 Leptokurtic

Weibull 4 parámetros – 2 componentes

Nevado de Toluca avalance - global Akaike inf criteria -205.10







DECOLOG (rel. 5.0 - 2013) - DECONVOLUTION OF MIXTURE'S COMPONENTS INSIDE PARTICLE SIZE DISTRIBUTIONS

HTTP://www.decolog.org -By L.Borselli % D.Sarocchi, UASLP(Mexico), lborselli@gmail.com

INPUT DATA FILE____ tolaval0401.dat

OUTPUT REPORT_____ tolaval0401_lognormal3.xls

GLOBAL FITTING STATISTICS for CDF:

Model efficiency coefficient(EF)__________ 0.9997794

Coefficient of Determination(R^2)________ 0.9999125

Kolmogorov-Smirnoff difference(Ks)______ 0.0115849

GLOBAL FITTING STATISTICS for PDF:

Model efficiency coefficient(EF)_________ 0.9990028

Coefficient of Determination(R^2)_______ 0.9995068

STATISTICS FROM SPLINES RESAMPLED OBSERVED CDF (MonteCarlo Method):

Mean(PHI)_________________ -4.02092

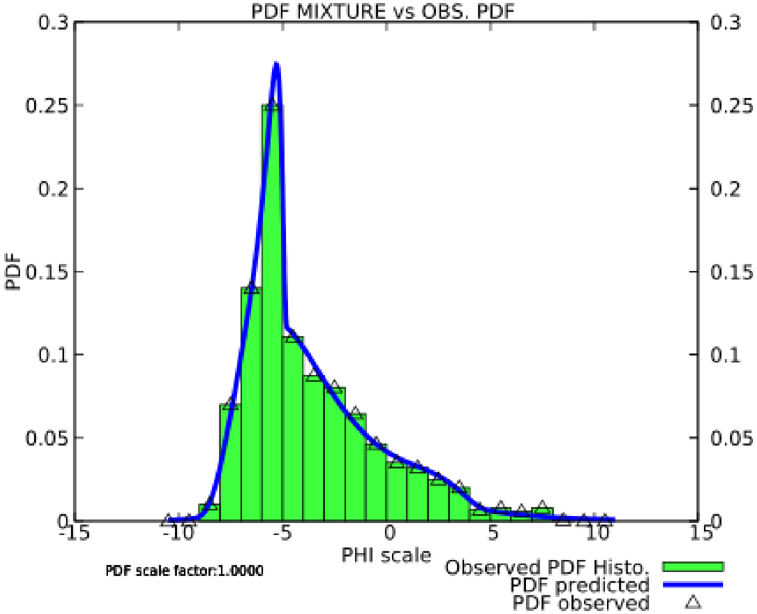
Standard deviation(PHI)_____ 2.72428 Very poorly sorted

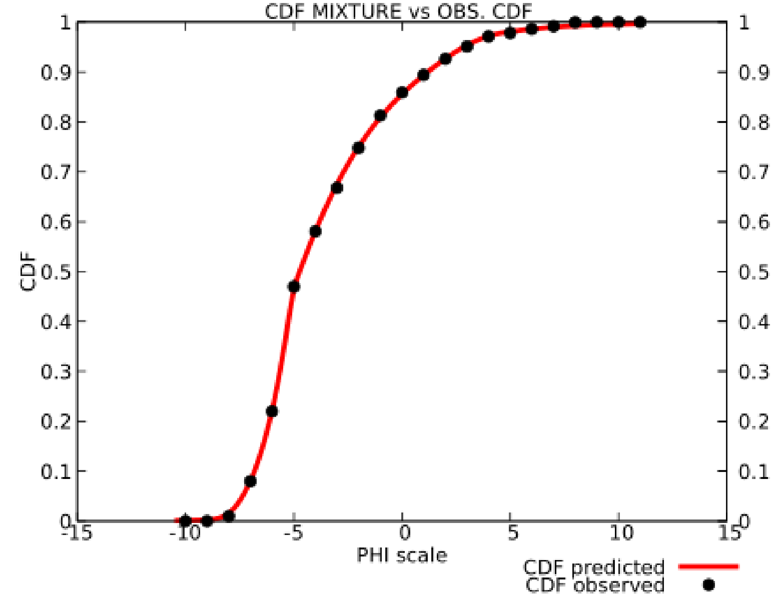
Skewness__________________ 1.50172 Very positive skewed

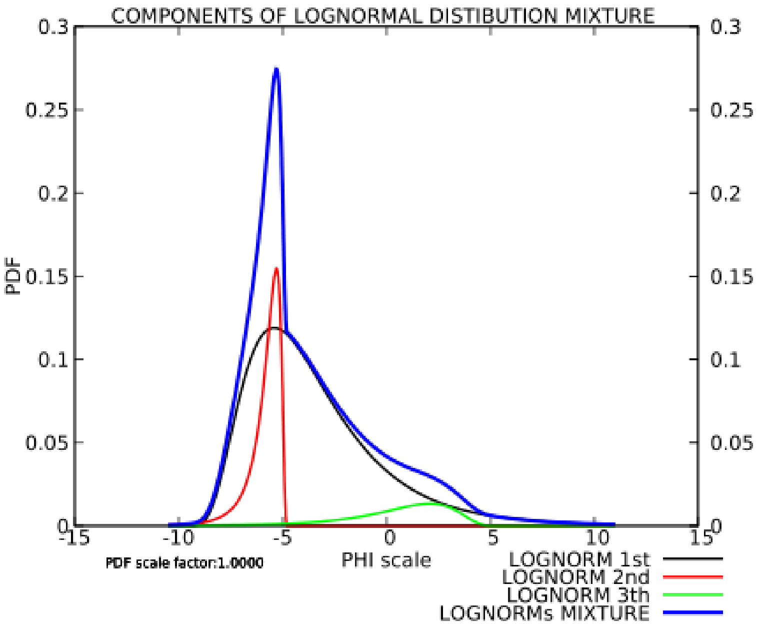
Kurtosis(normalized)_______ 2.74593 Leptokurtic

lognormal 4 parámetros – 3 componentes

Nevado de Toluca avalance - global Akaike inf criteria -190.15







DECOLOG (rel. 5.4 - 2016) - DECONVOLUTION OF MIXTURE'S COMPONENTS INSIDE PARTICLE SIZE DISTRIBUTIONS
HTPP://www.decolog.org -By L.Borselli D.Sarocchi, UASLP(Mexico), lborselligmail.com

INPUT DATA FILE >: tolaval0408.dat

OUTPUT REPORT >: tolaval0408.xls

GLOBAL FITTING STATISTICS for CDF :

Model efficiency coefficient(EF) = 0.9998961

Coefficient of Determination(R^2) = 0.9999575

Kolmogorov-Smirnoff difference(Ks) = 0.0072604

GLOBAL FITTING STATISTICS for PDF :

Model efficiency coefficient(EF) = 0.9959844

Coefficient of Determination(R^2) = 0.9983303

STATISTICS FROM SPLINES RESAMPLED OBSERVED CDF (MonteCarlo Method) :

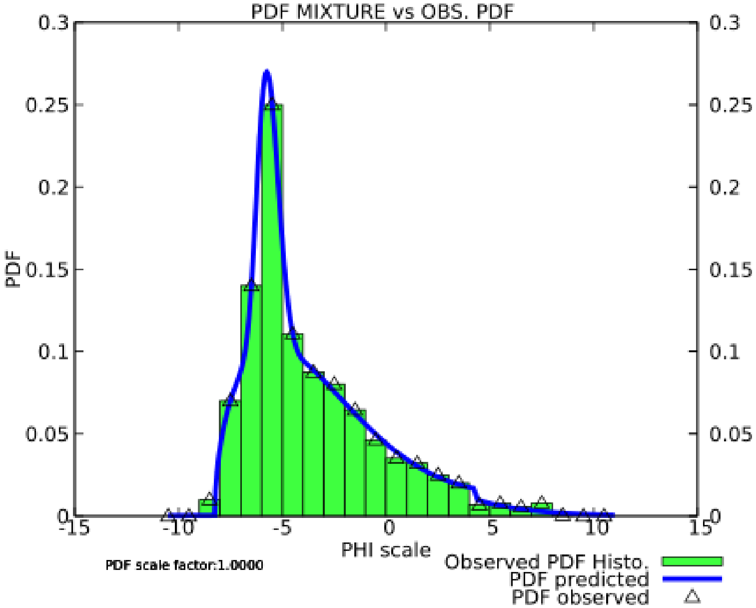
Mean(PHI) = -3.64004

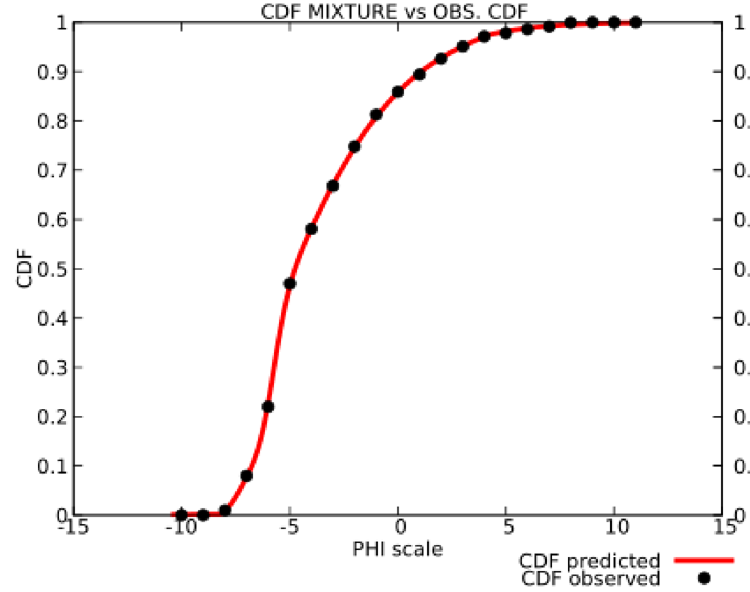
Standard deviation(PHI) = 3.19899 Very poorly sorted

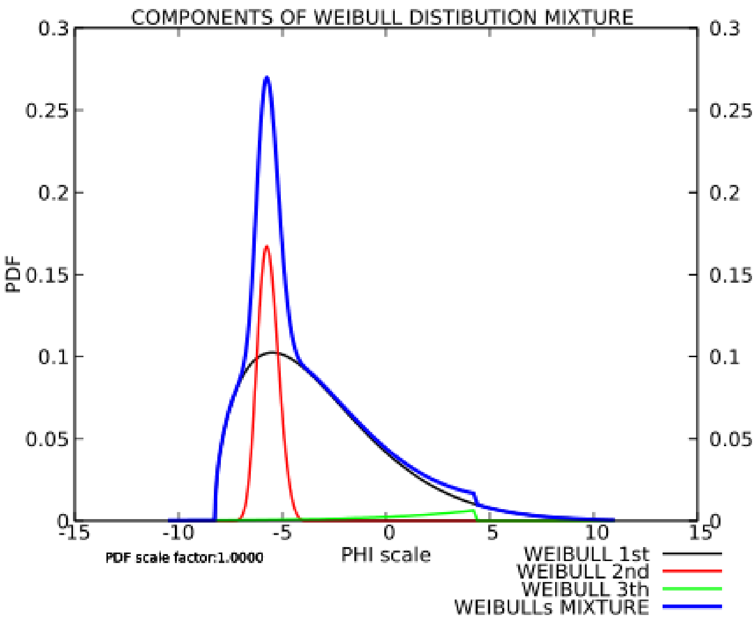
Skewness = 1.19434 Positive skewed

Kurtosis(normalized) = 1.04242 Leptokurtic

LogNormal 4 parámetros – 3 componentes :algorithm TDE
Nevado de Toluca avalance - global Akaike inf. criteria -227.43







DECOLOG (rel. 5.4 - 2016) - DECONVOLUTION OF MIXTURE'S COMPONENTS INSIDE PARTICLE SIZE DISTRIBUTIONS

HTPP://www.decolog.org -By L.Borselli D.Sarocchi, UASLP(Mexico), lborselligmail.com

INPUT DATA FILE >: tolaval0408.dat

OUTPUT REPORT >: tolaval0408.xls

GLOBAL FITTING STATISTICS for CDF :

Model efficiency coefficient(EF) = 0.9999338

Coefficient of Determination(R^2) = 0.9999672

Kolmogorov-Smirnoff difference(Ks) = 0.0078636

GLOBAL FITTING STATISTICS for PDF :

Model efficiency coefficient(EF) = 0.9974407

Coefficient of Determination(R^2) = 0.9988103

STATISTICS FROM SPLINES RESAMPLED OBSERVED CDF (MonteCarlo Method) :

Mean(PHI) = -3.64004

Standard deviation(PHI) = 3.19899 Very poorly sorted

Skewness = 1.19434 Positive skewed

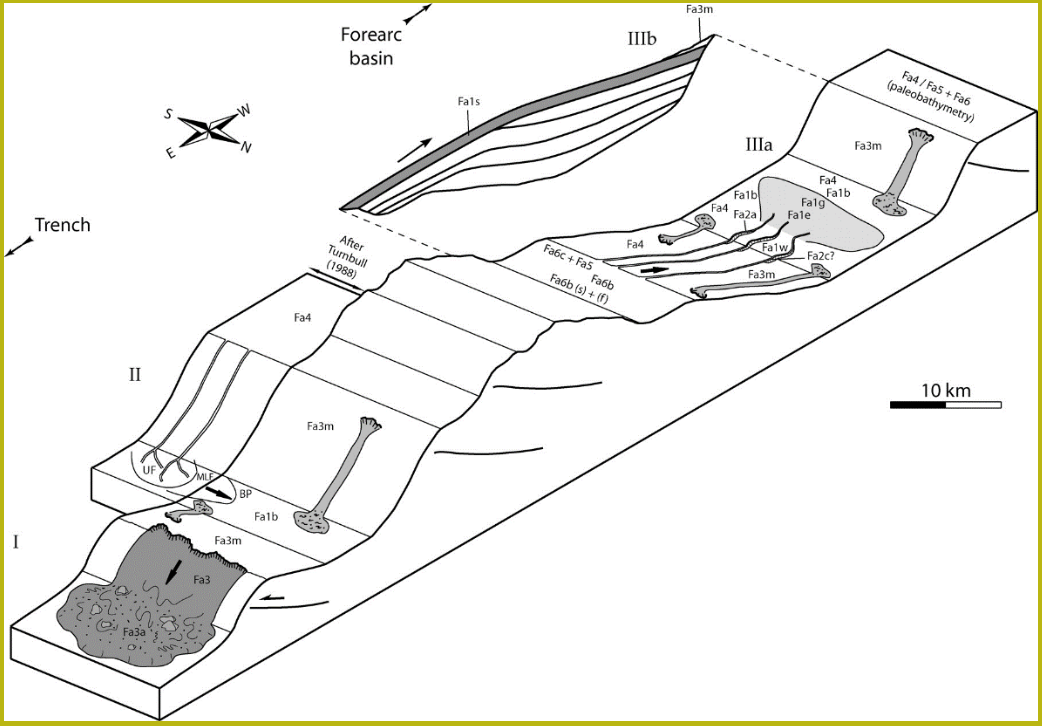
Kurtosis(normalized) = 1.04242 Leptokurtic

Weibull 4 parámetros – 3 componentes :algorithm TDE

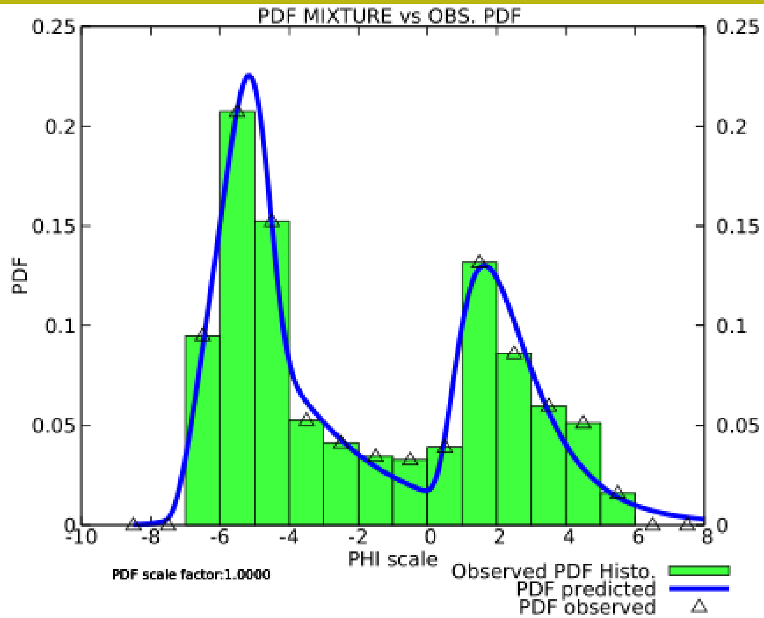
Nevado de Toluca avalance - global Akaike inf. criteria -227.43

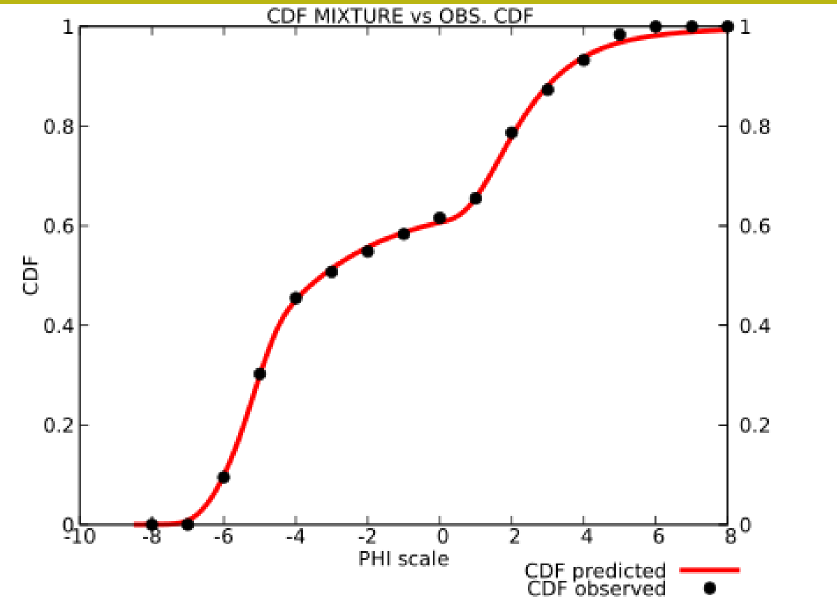
- Olistostrome formation (large Deep-sea landslide deposits, usually then tectonized by orogenic process), Turkey

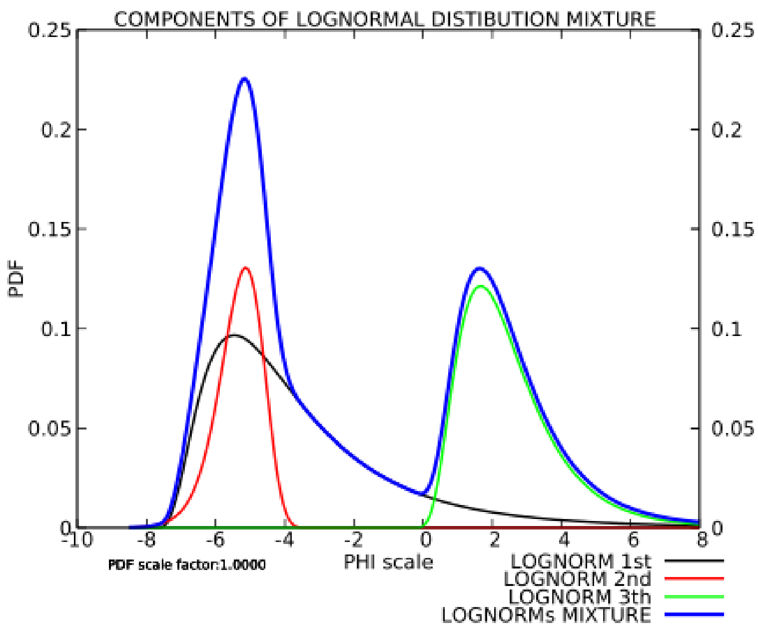
http://www.ub.edu/ggac/images/olistostrome.jpg



http://jsedres.sepmonline.org/content/77/4/263/F10.large.jpg







DECOLOG (rel. 5.4 - 2016) - DECONVOLUTION OF MIXTURE'S COMPONENTS INSIDE PARTICLE SIZE DISTRIBUTIONS
HTPP://www.decolog.org -By L.Borselli D.Sarocchi, UASLP(Mexico), lborselligmail.com

INPUT DATA FILE >: oli2.dat

OUTPUT REPORT >: oli2.xls

GLOBAL FITTING STATISTICS for CDF :

Model efficiency coefficient(EF) = 0.9993700

Coefficient of Determination(R^2) = 0.9997679

Kolmogorov-Smirnoff difference(Ks) = 0.0178862

GLOBAL FITTING STATISTICS for PDF :

Model efficiency coefficient(EF) = 0.9781112

Coefficient of Determination(R^2) = 0.9891733

STATISTICS FROM SPLINES RESAMPLED OBSERVED CDF (MonteCarlo Method) :

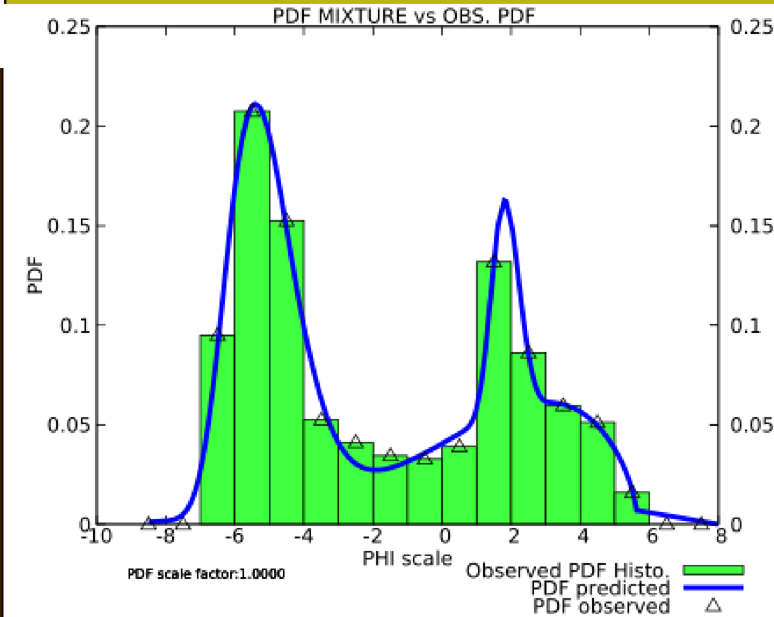
Mean(PHI) = -1.82910

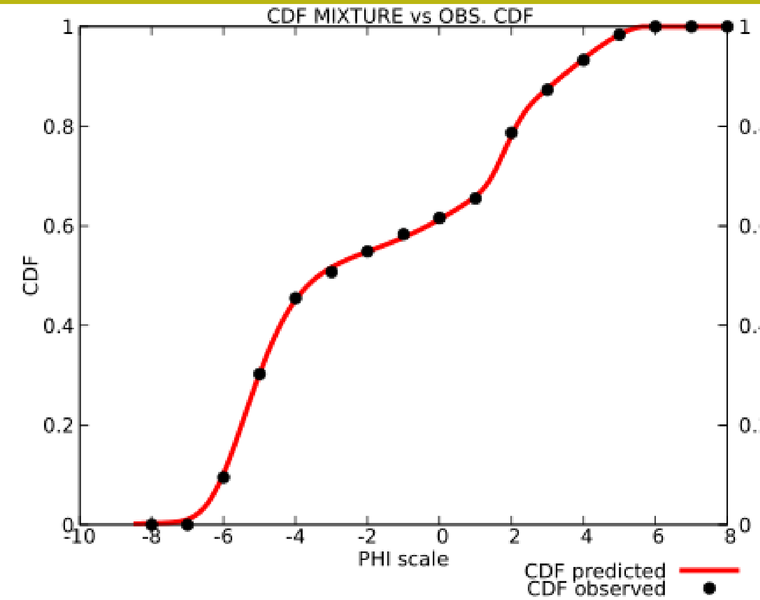
Standard deviation(PHI) = 3.73188 Very poorly sorted

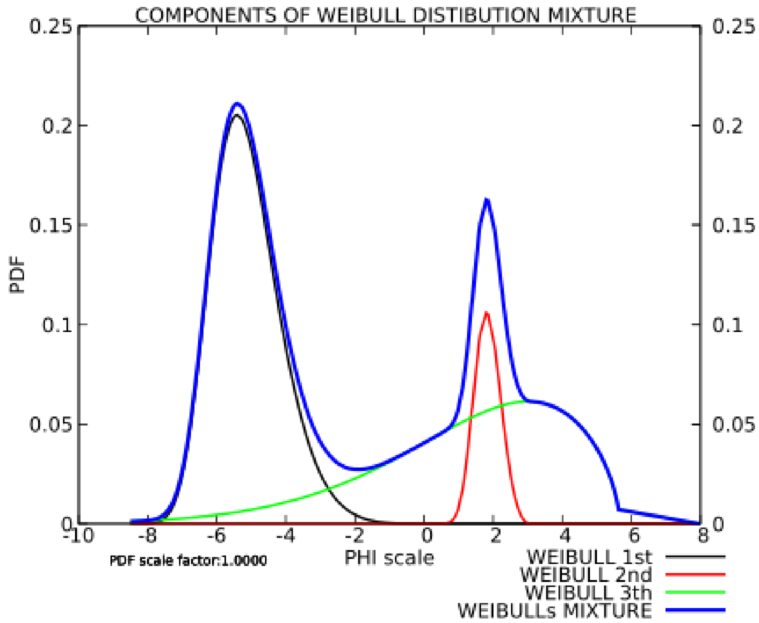
Skewness = 0.35674 Symmetrical

Kurtosis(normalized) = -1.42413 Very platykurtic

lognormal 4 parámetros – 3 componentes – algorithm: DE classic
Olistostrome formation Turkey - global Akaike inf criteria -134.13







DECOLOG (rel. 5.4 - 2016) - DECONVOLUTION OF MIXTURE'S COMPONENTS INSIDE PARTICLE SIZE DISTRIBUTIONS
HTPP://www.decolog.org -By L.Borselli D.Sarocchi, UASLP(Mexico), lborselligmail.com

INPUT DATA FILE >: oli2.dat

OUTPUT REPORT >: oli2.xls

GLOBAL FITTING STATISTICS for CDF :

Model efficiency coefficient(EF) = 0.9997953

Coefficient of Determination(R^2) = 0.9999260

Kolmogorov-Smirnoff difference(Ks) = 0.0109127

GLOBAL FITTING STATISTICS for PDF :

Model efficiency coefficient(EF) = 0.9928880

Coefficient of Determination(R^2) = 0.9964424

STATISTICS FROM SPLINES RESAMPLED OBSERVED CDF (MonteCarlo Method) :

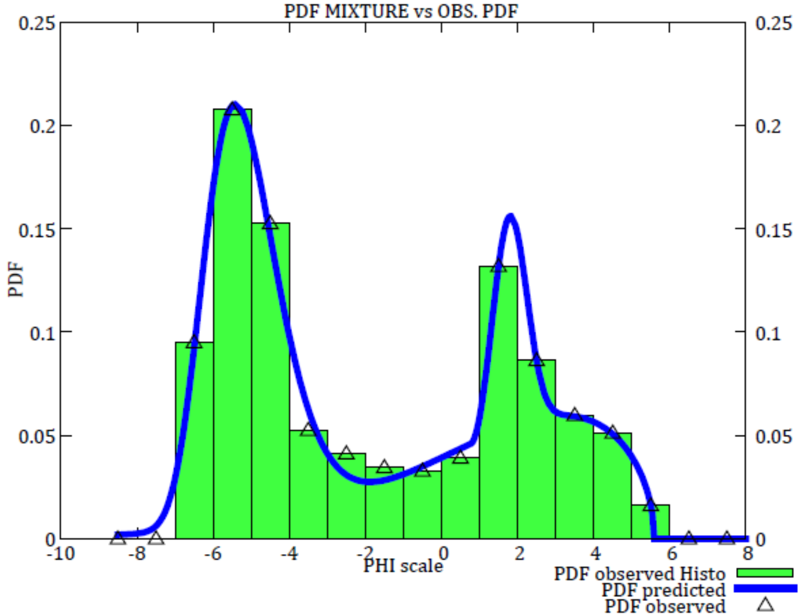
Mean(PHI) = -1.82910

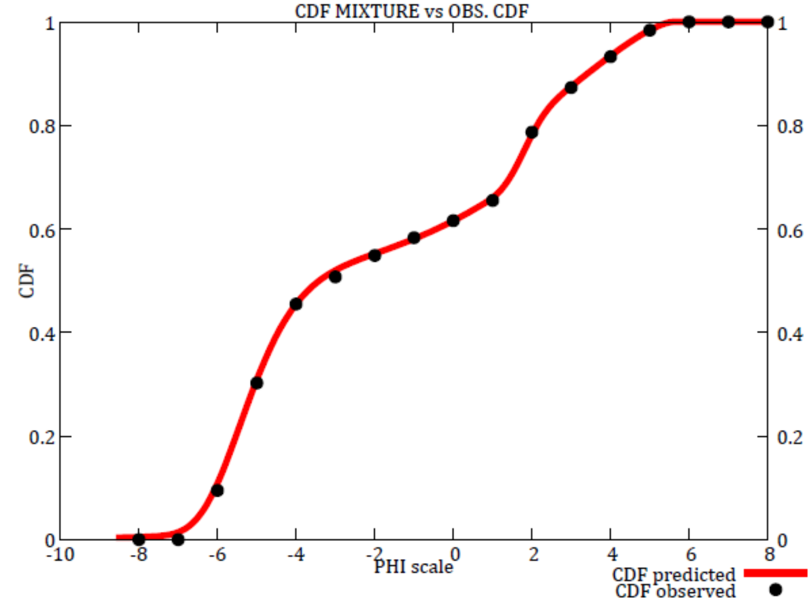
Standard deviation(PHI) = 3.73188 Very poorly sorted

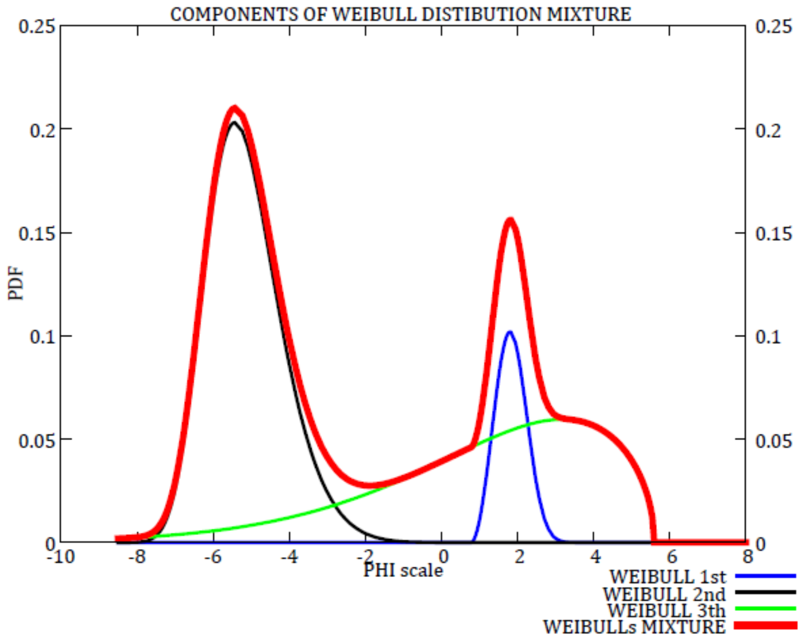
Skewness = 0.35674 Symmetrical

Kurtosis(normalized) = -1.42413 Very platykurtic

Weibull 4 parámetros – 3 componentes – algoritm: DE classic
Olistostrome formation Turkey - global Akaike inf criteria -153.24







DECOLOG (rel. 5.0 - 2013) - DECONVOLUTION OF MIXTURE'S COMPONENTS INSIDE PARTICLE SIZE DISTRIBUTIONS

HTTP://www.decolog.org -By L.Borselli % D.Sarocchi, UASLP(Mexico), lborselli@gmail.com

INPUT DATA FILE____ oli2.dat

OUTPUT REPORT_____ oli2_weibull3_ef.xls

GLOBAL FITTING STATISTICS for CDF:

Model efficiency coefficient(EF)__________ 0.9996391

Coefficient of Determination(R^2)________ 0.9999305

Kolmogorov-Smirnoff difference(Ks)______ 0.0142404

GLOBAL FITTING STATISTICS for PDF:

Model efficiency coefficient(EF)________ 0.9935265

Coefficient of Determination(R^2)______ 0.9967832

STATISTICS FROM SPLINES RESAMPLED OBSERVED CDF (MonteCarlo Method):

Mean(PHI)________________ -1.82910

Standard deviation(PHI)_____ 3.73188 Very poorly sorted

Skewness_________________ 0.35674 Symmetrical

Kurtosis(normalized)_______ -1.42413 Very platykurtic

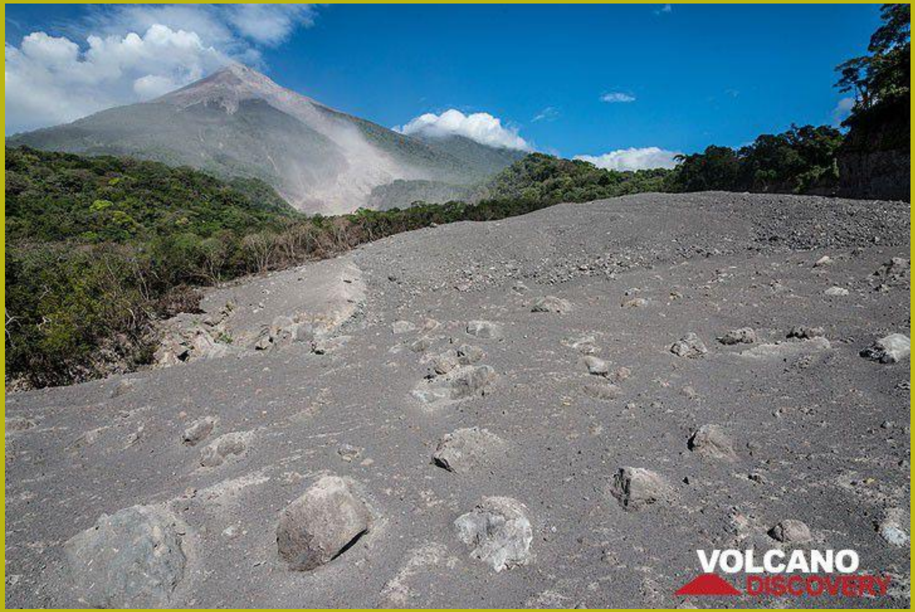
Weibull 4 parámetros – 3 componentes

Olistostrome formation Turkey – estrategia de optimización “Eficiency modeling”

Now two practical real time examples of aplication of DECOLOG :

- Debris flow deposits, Motozintla, Chiapas, Mexico

http://4.bp.blogspot.com/-D_vO0Nzz65w/VdAxu5T2FHI/AAAAAAAABfY/EBShgYoUhZc/s1600/IMG_7882.jpg



http://images.volcanodiscovery.com/fileadmin/photos/guatemala/gua_1215/fuego/fuego_j17499.jpg

- Block and ash flow (piroclastic flow with large blocks due to dome collapse), Colima Volcano, Colima Mexico

Conclusions

- DECOLOG is a tool able to decode part of the information usually blind inside total particle size distribution PSD).
- DECOLOG allows the easy calculation of global statistic of using the el modelo optimized folk-Ward and by new Montecarlo resampling method (much better in complex polymodal distributions).
- A lot of options for deconvolution engine applied to the PSD that is in many cases a Mixture of components (phases)
- Algorithm of Multi-objective optimization by de combined non-linear fitting of experimental PDF y CDF using self-organizing and self evolving genetic algorithm: Trigonometric differential evolution (Fan y Lampinen 2003)..
- Software fully FREWWARE for scientific community (WWW.DECOLOG.ORG)

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- *Storn R.and Price K., 1997. Differential Evolution-a simple and efficient heuristic for global optimization over continuous spaces, Journal of Global Optimization, 11: 341-359*
- *Wanga Y., Yamb R.C.M., M. J. Zuoc. 2004. A multi-criterion evaluation approach to selection of the best statistical distribution. Computers & Industrial Engineering 47 :165–180. doi:10.1016/j.cie.2004.06.003*


Gracias por Su atención !!!
Many thanks for Yours attention !!!