
# Practical approaches on estimating uncertainty

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*JRC's KP LULUCF workshop, 27-28 February -1 March 2013, Ispra (IT)*

## *UNFCCC requirements on uncertainty estimates*

Parties shall quantitatively estimate the uncertainties … using at least the tier 1 method

*Uncertainty* estimation … purpose is to 'help prioritizing efforts to improve the accuracy of national inventories …… and guide decisions on methodological choice' ...

*but inevitably …*

- *… allow assessing the quality of "emission reduction"*
- *… helps verification (especially with independent estimates)*

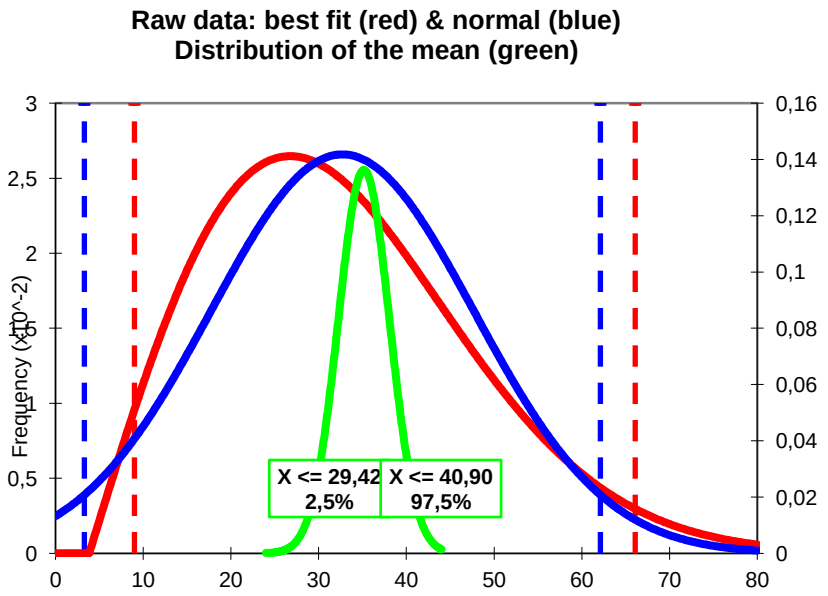
# General statistical knowledge

**Populations descriptors**

- Data comes from random/non-systematic/heterogenous data pools (small sets)
- This is often the case for: BEFs, root-to-shoot , SOC, wood density
- Mean, STD provide variability of the population, thus overestimation of the uncertainty
- Variable can have any type of distribution

**Inferential statistics of the estimate**

- Data from systematic studies (representative, large sampling)
- Mean, SEM, normal distribution
- Provides 'true uncertainty of the estimate' as CI95%
- This is for: NFI data on standing stock, annual growth, dead wood, SOC, …..

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# Gathering data on uncertainty

- Datasources should provide **basic statistical parameters** (quantitative - appropriate, qualitative – need further processing)
- Need of information on available data
  - main issue is **covariation/correlation** among parameters
  - **allows correct interpretation** of results, potential improvements
- A **small set of data** may be enough for 1st order conclusion
- Expert elicitation (little used!  e.g. **min, max , mean** are generally known)

## IPCC guidelines (IPCC 2000, 2003, 2006)

- offer ‘step by step’ estimation approach as spreadsheet for Tier 1 , advice for Tier 2

- default values (uncertainty as 2*STD)

Tier 1 – error propagation is enough! (Excel spreadsheets following Table 6.1 GPG 2000)

Tier 2 – re-simulations (dedicated tools, but very flexible in terms of input’s distribution types, copes well with limited information, easy account of covariations/correlations

# Calculation considerations

- Uncertainty estimation **follows computation pathway** of the GHG inventory !
- Removal/emissions uncertainty **depends on the amounts** involved and **on method** used
- Uncertainty of **major contributors** is most important (LB vs. SOM/DOM)
- Multiplications result in asymmetric distributions
- Aggregations (sum, difference) result in normal distributions
- **Assuming normal for asymmetric** distributions results in shifts of bounds, over/underestimation of the uncertainty (mostly affects absolute, not relative uncertainty)

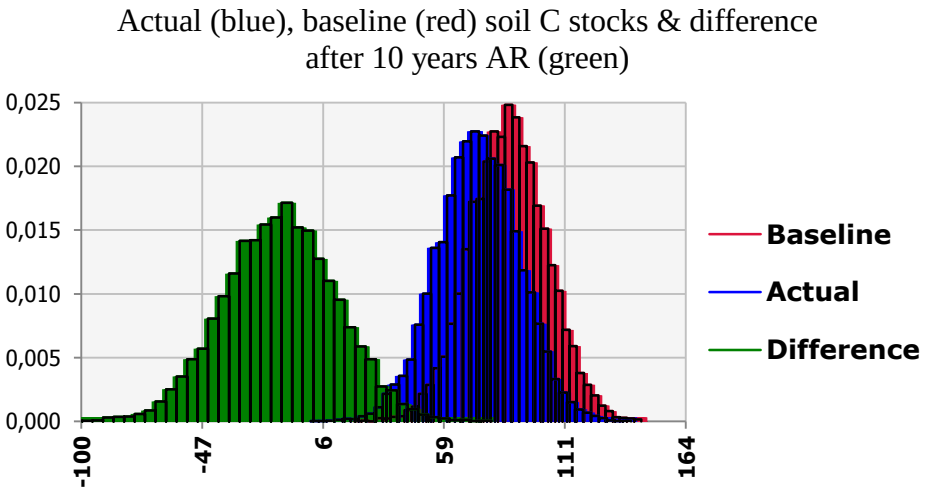
# Calculation considerations

- Monte Carlo best / realistic estimate is computed based on most likely value (i.e. mean) and 2.5/97.5% bounds, because involving StDev yields overestimation due to outliers in the outputs

- Covariation table is very important. e.g. at country level data from NFI is correlated in time (repetitive sampling, parameters from proxies) in space (e.g. AD for LB, SOM, DW)

# Relative uncertainty on land conversions is significant

## SOM change = small change vs. large stocks




Ex: soil C stock change in AR on grassland
Baseline C stock (±39%)
Actual C stock (± 47%)
Steck difference (±363 %)

# Uncertainty of KP accounted amount ≠ UNFCCC inventory

| EU 15 LULUCF sector | Net EU 15 CO2eq 2010 | Trend EU 15 1990-current | Net EU 27 CO2eq 2010 | Trend EU 27 1990-current |
|---|---|---|---|---|
| **Total EU E/R** | **-156280** | **13,4%** | **-286923** | **6,4%** |
| Absolute low (0.025) | -203373 | -26,9% | -337704 | -16,9% |
| Absolute up (0.975) | -108670 | 77,9% | -236723 | 36,7% |
| **Uncertainty (%)** | **30%** | | **18%** | |
| Uncertainty low (0.025) | 23% | | 15% | |
| Uncertainty up (0.975) | 43% | | 21% | |

| E/R category | 5A1 | 5A2 | 5B1 | 5B2 | 5C1 | 5C2 |
|---|---|---|---|---|---|---|
| ***Total E/R on land category*** | ***229028*** | ***27895*** | ***-21621*** | ***-27773*** | ***-8620*** | ***6213*** |
| Absolute low (0.025) | 197775 | 20883 | -49468 | -34394 | -19920 | -7433 |
| Absolute up (0.975) | 259789 | 35007 | 5276 | -21183 | 2652 | 20053 |
| ***Uncertainty (%)*** | ***14%*** | ***25%*** | ***-127%*** | ***-24%*** | ***-131%*** | ***221%*** |
| Uncertainty low (0.025) | 12% | 20% | -1088% | -31% | -1205% | -2138% |
| Uncertainty up (0.975) | 16% | 33% | 819% | -19% | 940% | 1923% |

- Accounting rules affect uncertainty of KP accounting amount (17%)
- We may assume that application of "not a source" introduces insignificant uncertainty to accounting amount (although such removals are expected negligible), at least for FM
- FM cap would anyway be reached with highest accuracy even considering the uncertainty of annual sink estimates

# Recommendations

Tier 1 spreadsheet is enough to estimate uncertainty

Approach the experts for data

Pls provide explicit uncertainty estimate on ***each pool change and land subcategory***

Focus on major contributors (key categories)

Uncertainty discussions on 'KP support project' on Wikidot