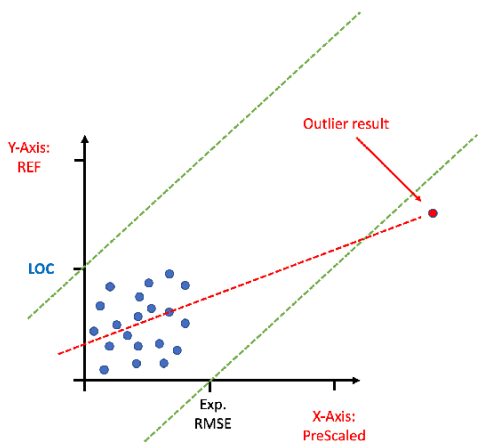


If the range of the pollution being measured is all below the stated LOC, or expected RMSE level, or alternatively below the range of uncertainty then there is no linearity to the regression, resulting in a low R2 or even a result of zero.

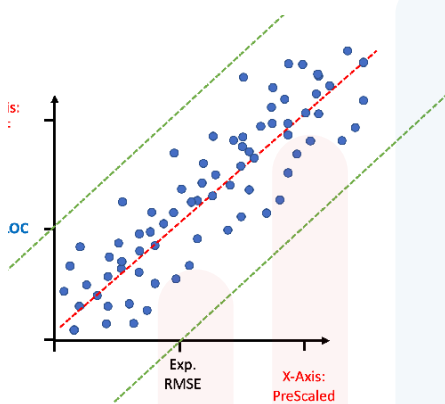
This is why MCERTs, TUV and other EU certification standards for reference equipment require a full range of testing to be completed. As without this range the candidate instrument can be adversely judged due to factors beyond its control.

This is also why running small sensor system comparisons at different times is often an invalid form of comparison as without all the criteria for a fair comparison, which is out of control of the tester in a field study, it is very difficult to just list results side by side.



Alternatively, the regression analysis can provide an erroneously high R2. For example if a single outlier skews the result in the right direction it can force a high R2 by providing an increased range and therefore linearity to the plot.

However, this outlier might not be trustworthy and inadvertently cause a negative skew to the slope and offset correction the user is looking to apply. Not providing the accuracy improvement expected.



Ideally, what is needed to confidently use R2 as a measure of the instruments linearity to the reference is as close to an even distribution of events across an adequate range.

This distribution will obviously vary depending on the pollutant species, location and season and the range will be determined by the intra instrument uncertainty given the compromises made for the co-location, i.e. distance between inlets, vicinity to trees and other interferences, etc. which could alter the pollution levels for one or more species being compared.

This isn't to say that R2 isn't a useful tool, it just needs to be used in context of the comparison. As such, average accuracy of the candidate to the reference may be a more consistent measure of performance across different comparisons, so RMSE should also be considered when testing a small sensor system.