

# Time Series Consistency

Regional African Workshops on REDD+ National Forest Monitoring Systems and Greenhouse Gas National Inventory Systems

25-27 February 2014

Livingstone, Zambia

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INTERGOVERNMENTAL PANEL ON climate change

# Time Series

- An inventory is not just an estimate of a single year. It includes estimates for a number of years (time series of estimates)
  - Information on historical emissions trend
  - Tracking the effects of strategies to reduce emissions at the national level
- Annual estimates should be comparable
  - Should reflect the real annual fluctuations in emissions and removals
- Therefore, emissions and removals in time series should be estimated consistently
  - Use of the same method and data sources in all years, where possible
- However, it is not always possible to use the same method and data sets for the entire time series due to a lack of data

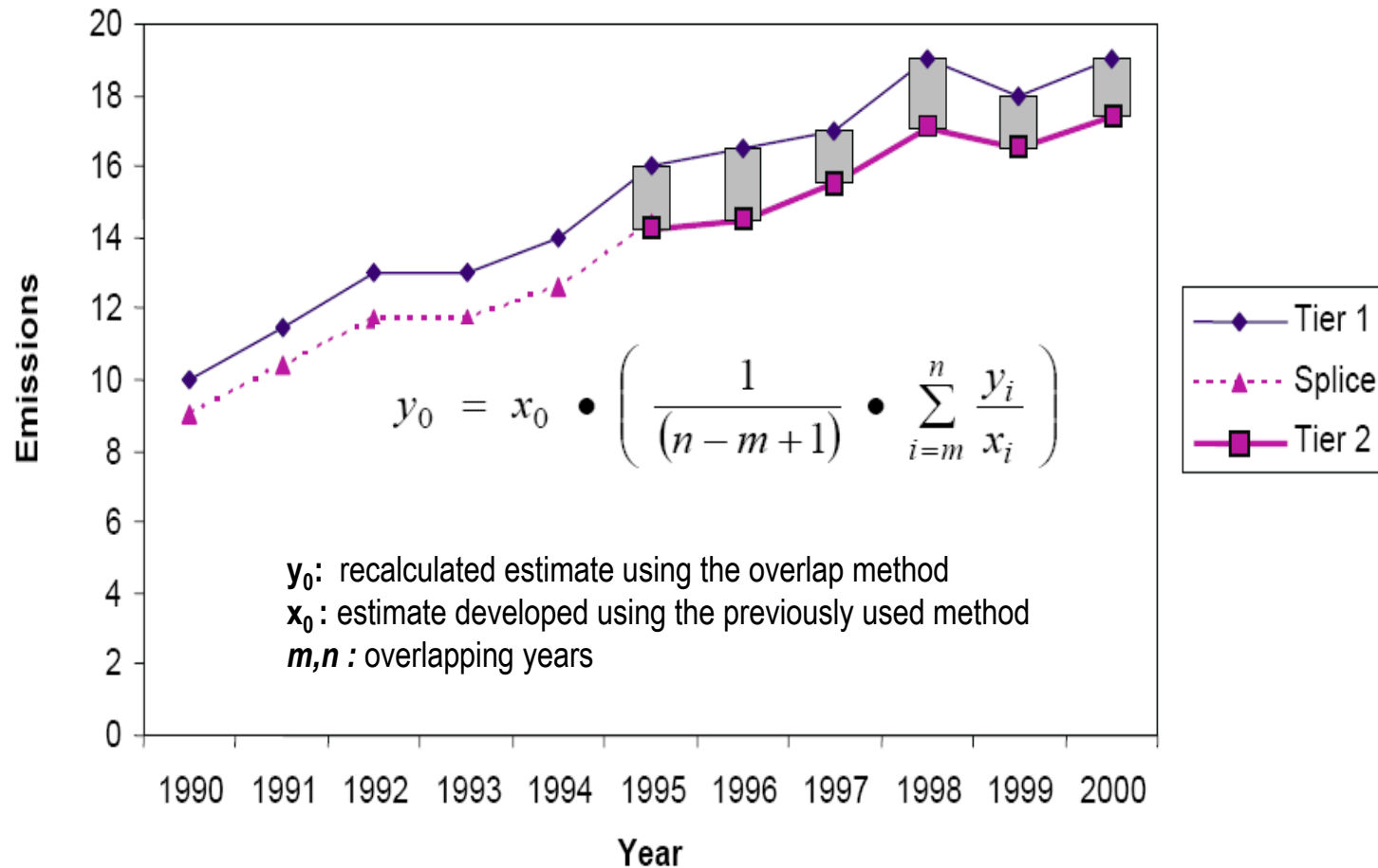
# Splicing Techniques

- Splicing: combining or joining of more than one method or data series to form a complete time series
  - Methodological change and refinement
  - Data gaps
- The 2006 IPCC Guidelines provide several splicing techniques
  - Overlap
  - Surrogate
  - Interpolation
  - Extrapolation
- Selecting a technique requires an evaluation of the specific circumstances and a determination of the best option for the particular case

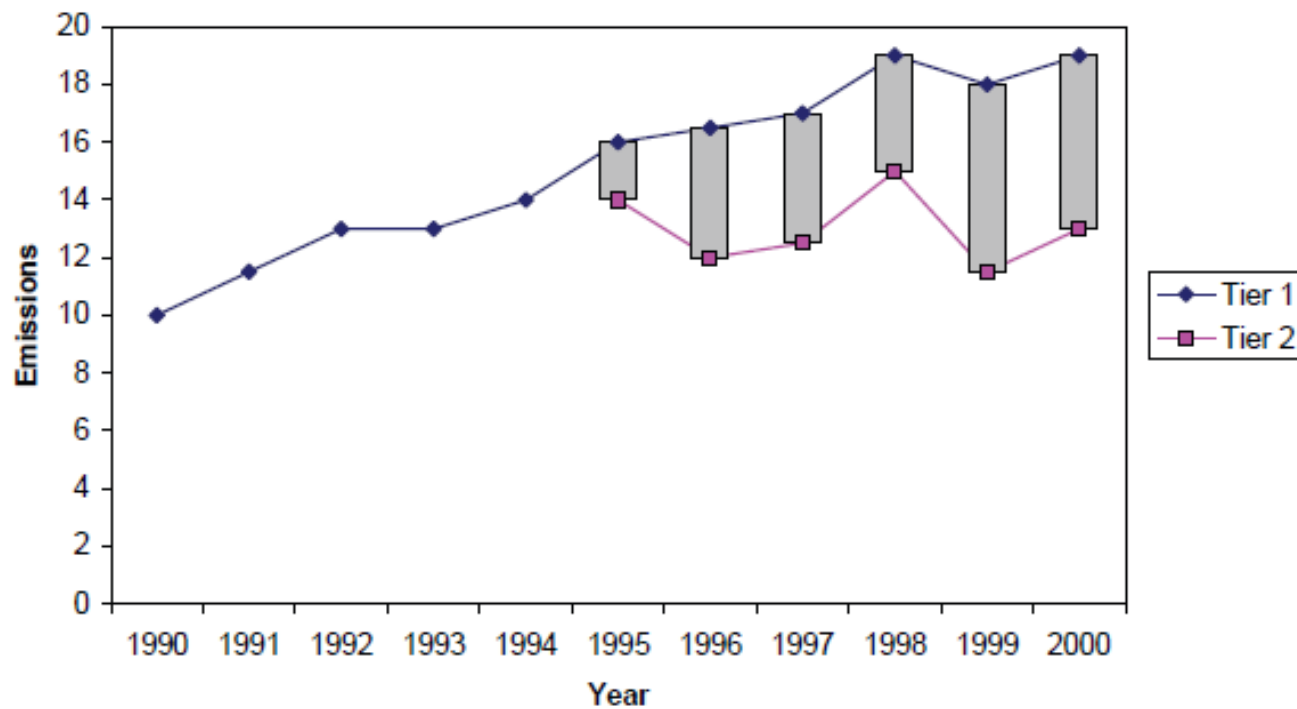
# Overlap

- When a new method is introduced but data are not available for early years in the time series (e.g. implementing a higher tier methodology)
- Develop a time series based on the relationship (or overlap) observed between the previously used and new method during the years when both can be used
- It is preferable to compare the overlap for multiple years to evaluate the relationship between the two methods
- If there is no consistent overlap between methods and it is not good practice to use the overlap technique

# Overlap: Consistent Relationship



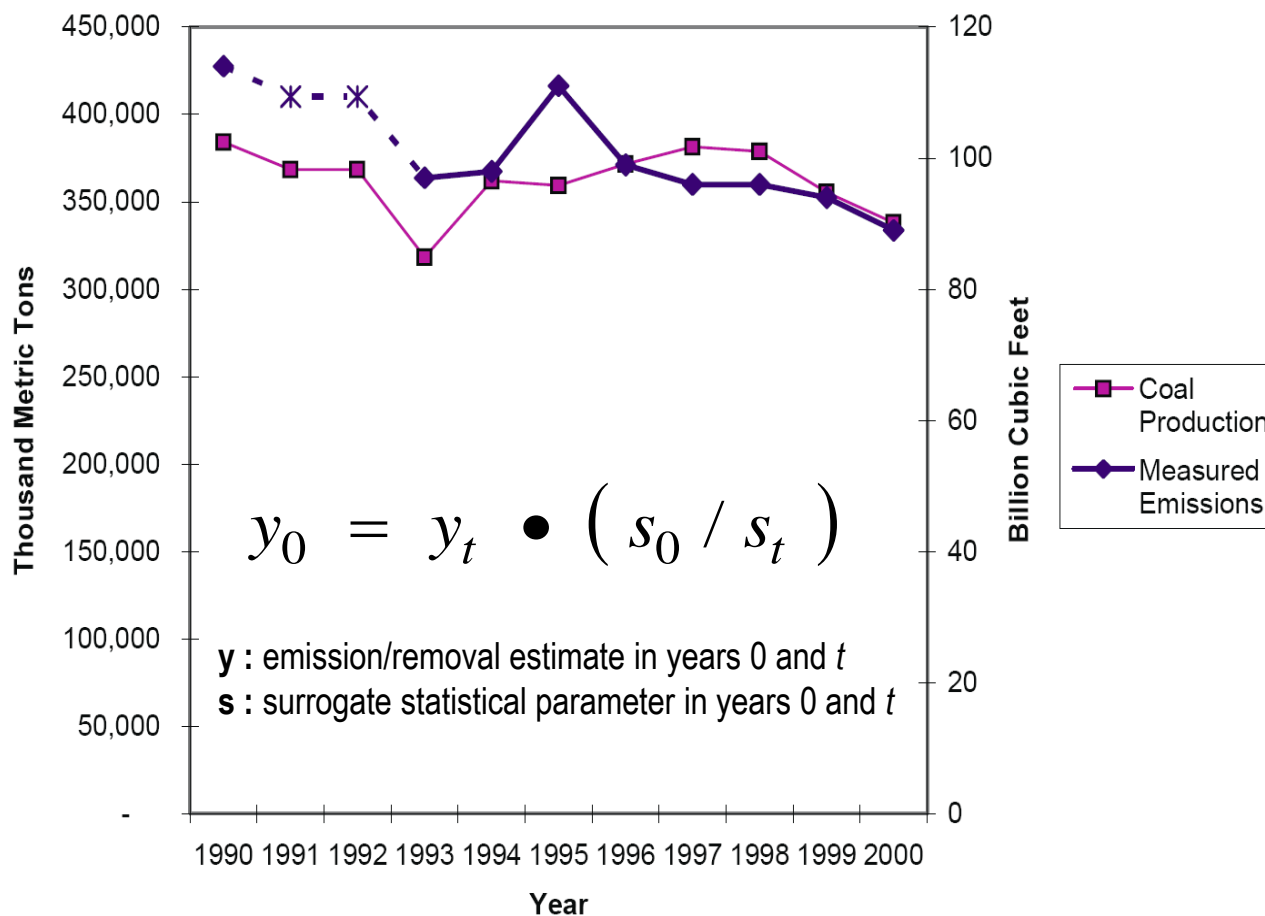
# Overlap: Inconsistent Relationship



# Surrogate Data

- The surrogate method relates emissions or removals to underlying activity or other indicative data
  - Data (statistical) that is related to the emission (emissions may be proportional to production, vehicle distances travelled and population etc.)
- Although the relationship between emissions/removals and surrogate can be developed on the basis of data for a single year, the use of multiple years might provide a better estimate

# Surrogate Data

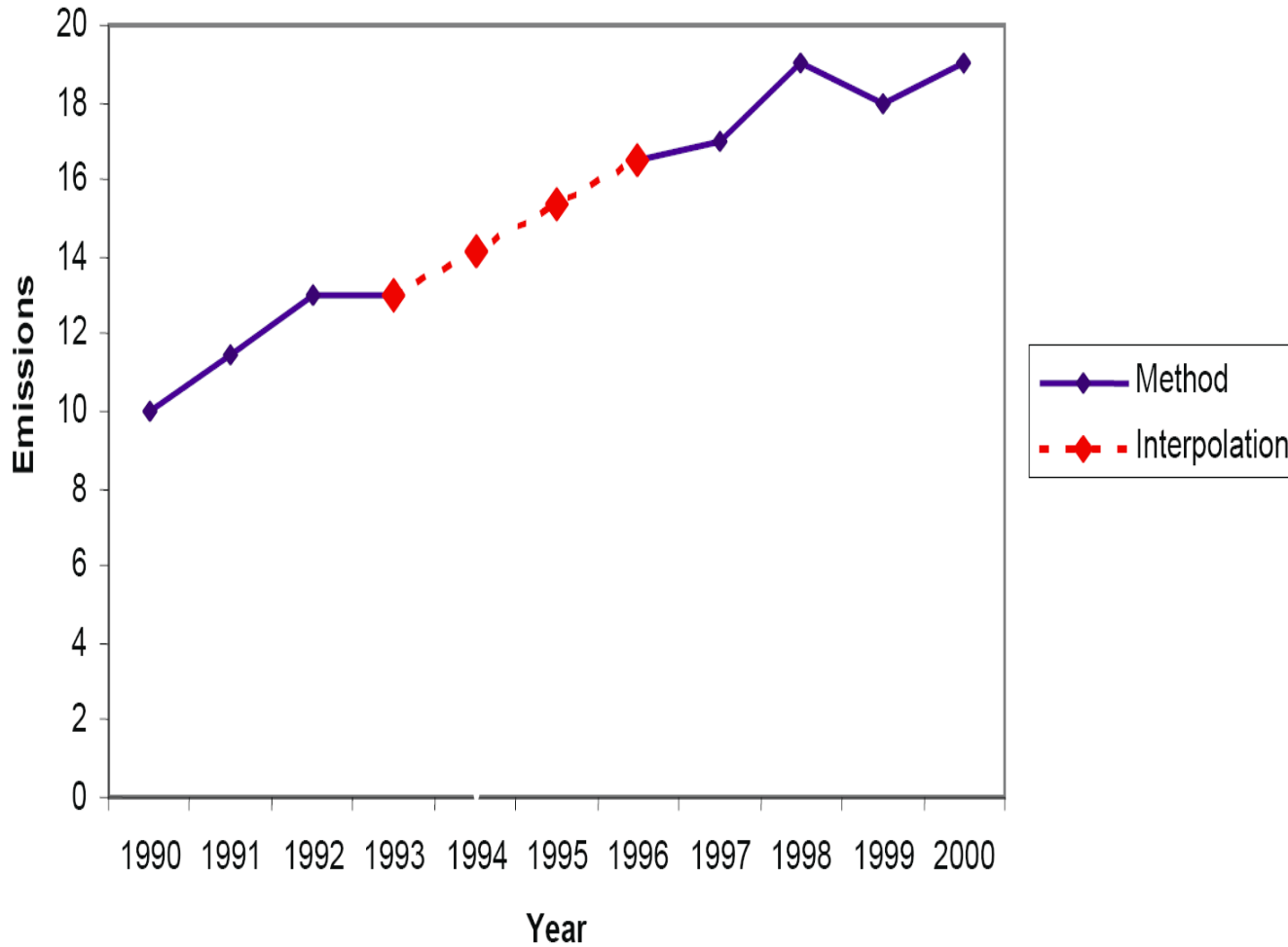




# Interpolation

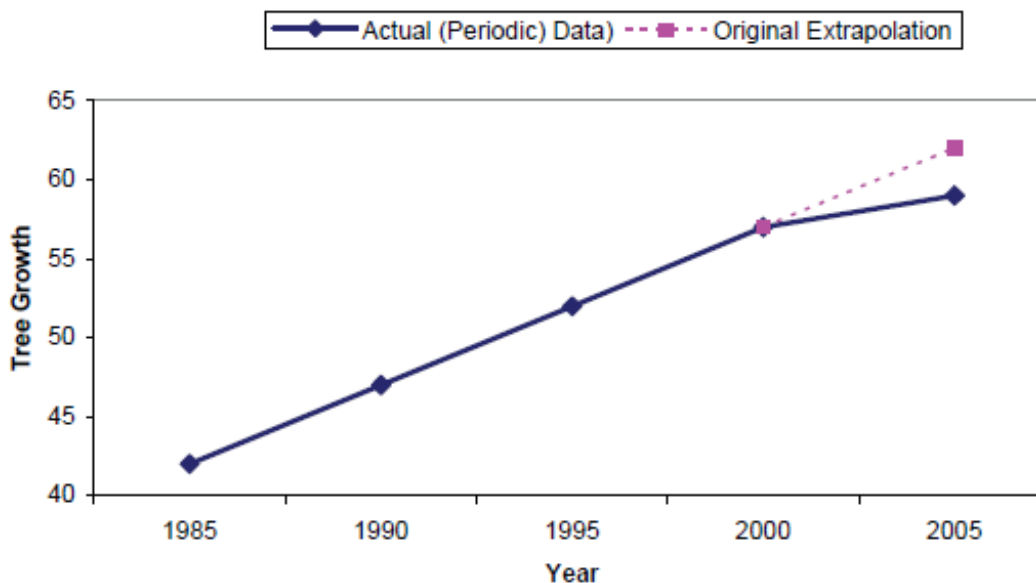
- When detailed statistics is collected every few years, or it is impractical to conduct detailed surveys on an annual basis
- Estimates for the intermediate years in the time series can be developed by interpolating between the detailed estimates when:
  - overall trend appears stable
  - actual emissions are not substantially different from the values estimated by interpolation
- If information on the general trends or underlying parameters is available, then the surrogate data can be used
  - It is good practice to compare interpolated estimates with surrogate data as a QA/QC check

# Interpolation



# Extrapolation

- When data for the base year or the most recent year are not available
- The data can be extrapolated assuming that the trend in emissions/removals remains constant over the period of extrapolation
  - Should not be used if the trend is not constant over time.
- Analyse the character of trend – e.g. linear or more complex



# Summary of Splicing Techniques

- Each technique can be appropriate in certain situation. It is *good practice* to perform the splicing using more than one technique before making a final decision

Approach	Applicability	Comments
Overlap	Data necessary to apply both the previously used and the new method must be available for at least one year, preferably more.	<ul style="list-style-type: none"> <li>• Most reliable when the overlap between two or more sets of annual estimates can be assessed.</li> <li>• If the trends observed using the previously used and new methods are inconsistent, this approach is not <i>good practice</i>.</li> </ul>
Surrogate Data	Emission factors, activity data or other estimation parameters used in the new method are strongly correlated with other well-known and more readily available indicative data.	<ul style="list-style-type: none"> <li>• Multiple indicative data sets (singly or in combination) should be tested in order to determine the most strongly correlated.</li> <li>• Should not be done for long periods.</li> </ul>
Interpolation	Data needed for recalculation using the new method are available for intermittent years during the time series.	<ul style="list-style-type: none"> <li>• Estimates can be linearly interpolated for the periods when the new method cannot be applied.</li> <li>• The method is not applicable in the case of large annual fluctuations.</li> </ul>
Trend Extrapolation	Data for the new method are not collected annually and are not available at the beginning or the end of the time series.	<ul style="list-style-type: none"> <li>• Most reliable if the trend over time is constant.</li> <li>• Should not be used if the trend is changing (in this case, the surrogate method may be more appropriate).</li> <li>• Should not be done for long periods.</li> </ul>
Other Techniques	The standard alternatives are not valid when technical conditions are changing throughout the time series (e.g., due to the introduction of mitigation technology).	<ul style="list-style-type: none"> <li>• Document customised approaches thoroughly.</li> <li>• Compare results with standard techniques.</li> </ul>

# Quality of Time Series

- Comparison of the results of multiple approaches where it is possible to use more than one approach
  - Plotting and comparing the results of splicing techniques on a graph is useful
  - If alternative splicing methods produce different results, should consider which result is most realistic
- Comparison of recalculated estimates with previous estimates can be a useful check on the quality of a recalculation
  - However, higher tier methods may produce different trends than lower tier methods because they more accurately reflect actual conditions

# Reporting and Documentation

- All recalculations and measures taken to improve time series consistency should be documented and reported
  - The effect of the recalculation of the level and trend of the estimate
  - The reason for recalculation
  - A description of the changed or refined methods
  - Justification for the changes
  - The approach previously used
  - The rationale for selecting the new approach
  - If the new method cannot be applied to the whole time series the splicing method used should be documented
    - years in which data for the method were not available
    - splicing technique used
    - graphical plots can be useful tools for documenting and explaining the application of splicing techniques

# Summary

- **We need consistent estimates of emissions/ removals for all years**
  - Same method and data sources should be applied to all years, if possible
- **Where this is not possible, inventory compilers should follow the time series consistency guidance to provide consistent estimates for all years**
  - Overlap/ Surrogate / Interpolation / Extrapolation /etc
- **We need to ensure quality of time series**
  - Quality checks are applied to entire time series
- **All decisions, methods and reasons should be documented**



**Thank you**