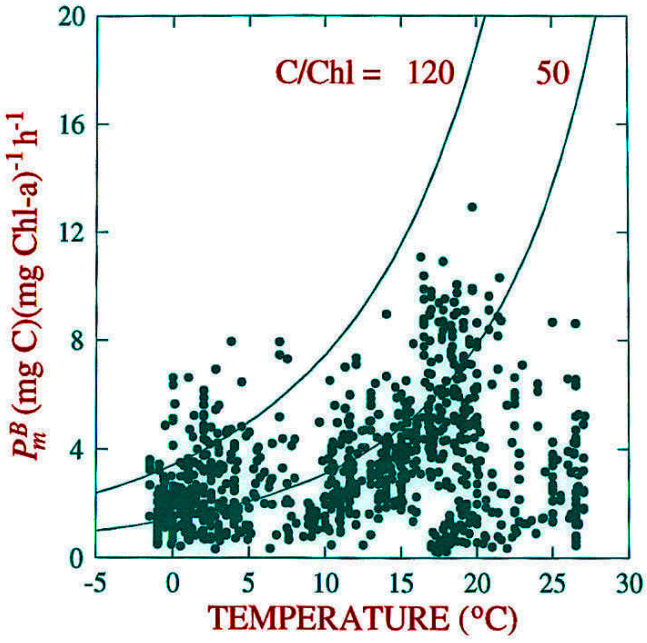
Basic Methodology

1. Compute light available at sea surface
2. Estimate biomass at surface
3. Define biomass profile
4. Estimate parameters of P-I model
5. Compute parameters of light transmission
6. Compute primary production

Note: All models follow this procedure. Differences lie in the detail.



ERRORS IN COMPUTATION OF PRIMARY PRODUCTION

Examine precision of each element of the calculation separately:

1. Surface irradiance $\sim 10\%$
2. Satellite-derived biomass $\sim 35\%$
3. Photosynthesis parameters
   a. Measurement error $\sim 5\%$ for P_m^B and $\sim 20\%$ for α^B
   b. Error arising from aggregation within domains $\sim 7\%$
4. Vertical profile shape $\leq 10\%$ at the basin scale

The local algorithm for the vertically-uniform, nonspectral model has an estimated precision of $\sim 42\%$ (compounding of errors 1, 2, and 3a).

Combining with the aggregation error (3b) gives a best-case estimate of $\sim 50\%$ for the precision of a primary-production estimate in a spatially-extrapolated calculation.

PROBLEMS WITH VALIDATION

1. No independent method available for comparison. Remote-sensing approach uses all available data, from ship as well as from satellite.

2. Comparison with bulk-property, or indirect, methods compromised by incompatibility of time scales. Further, bulk-property methods and *in vitro* incubation methods (used to derive photosynthesis parameters) address different components of primary production.

3. Validation by prediction of biomass at some future time requires information on loss terms and on flow field: these are usually unavailable.