February 16, 1940

Dear Jeffreys,

Thanks for your letter. I am not a bit clear even as to what conventions are used in dividing up a sphere into 10^{0} squares. I suppose one gets 36 such squares in a zone round the Equator, but somehow smaller numbers will have to be fitted in along the other zones.

However, this difficulty, though it somewhat obstructs my own thought, cannot be the main source of your problem, which presumably arises from a conflict between desire and performance, i.e. that if sufficiently large patches of the sphere are unobserved, many of the harmonic components will be almost arbitrary.

Sometimes in such cases I find relief in a method involving weightings and successive approximations, e.g., if you have, say, one observation for the area of the Pacific, it is quite rational to give this value to all of the 10^{0} squares within this area, but of course with an extraordinarily small weight; so that, in fact, the harmonics can do nearly what they like on the unobserved portion of the earth, and are merely guided by the observed portion. positi

You do not say so, but it may be that your main anxiety at the moment turns on the probable magnitude of the mean square residual left after, let us say, 4th or 5th harmonics had been fitted to accurate and complete data. A purely empirical approach to this aspect would be to tabulate all the most neighbouring pairs of observations and to consider the relation between mean square, discrepancy and distance, using for this simple regression methods with a confident anticipation of linearity where the observations are close enough together, and a lively interest in non-linearity when the distance is increased.

Yours sincerely,