Why are computational processes important?

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Abstract. This paper argues that in addition to mainstream theoretical, cartographic and information science traditions there remains a fundamental need to investigate the principal affects of computational processes on digital-related geographical research. From an examination of past and present geographical computation the accumulated evidence suggests that on-going developments in computer processing [hardware, software, algorithms and heuristics] must be treated as part and parcel of the geographical research agenda. It must be stressed that this is not an argument for an investigation of computers. Modern science is not about tools and techniques; it concerns the method and manner of their application, plus the discoveries that can be made, under different modes of operation and in different areas or domains of established research. There is a strong relationship between [i] computational processes – in particular those made possible through the power of modern computers; [ii] the type of questions that can be asked; and [iii] the kind of results that can be obtained. Yet the enticement of push-button solutions means that the influence of computation on the nature of the products is often overlooked and sometimes ignored. Better questions, together with a full appreciation of results, demands a greater understanding of the processes involved and this concept is applicable throughout all stages of the digital processing scenario. The first geographical computations were applied to small data sets and computer science quandaries were not considered to be a relevant issue. However, such indifference can no longer be accepted, in the case of modern geographical investigations that cover ever-larger areas or regions and use ever-higher resolution data sets. The same argument applies as more and more data are being aggregated for modelling and analysis purposes and also to temporal forecasting operations that require extended runs in excess of several decades or encompass centuries of global processing activities. The four principal elements that are recognised for inclusion in a research agenda are: · algorithms, including formal and mathematical properties, plus the behaviour of such algorithms in terms of correctness and efficiencies with regard to spatial applications e.g. raster-to-vector conversion procedures · processor designs related to the implementation of such algorithms e.g. parallel machines, internal components, and chip developments that permit faster processing speeds, more efficacious rendering, or greater numerical accuracies, · programming languages that can exploit fresh concepts in algorithm design and hardware configuration e.g. use of pattern matching or list processing languages for smart analysis and use of object orientated languages for representing spatial entities. · application development to build state-of-the-art software and thus limit the cumulative detrimental impact of structures, algorithms and processes on the broad range of computational activities that can be performed e.g. damaging affect on translated data when a switchyard model is used as compared to direct translation.