Based upon my publication record it is safe to say that I cannot be classified as a geoscientist or a computational scientist. For that reason I limit my commentary narrowly to geoscience related to ocean sciences, and computational techniques in the service of this type of geoscience problem. Naturally, one can see how these musings could be extended to other geoscience fields.

It is algorithms, rather than raw computational power, which is largely responsible for dramatic improvements in computational efficiency ({\it e.g.}, compare conjugate gradient to direct Gauss solvers). Nothing this dramatic has happened recently, however, in the very recent past multi-core/distributed computing has gotten significantly cheaper and easier to use. The significance of this is that it is bringing more geoscientists to learn computation and vice versa. This is
important because the next new computational framework will combine higher resolution with resolution-appropriate physics.

Models in geomechanics, oceans/atmospheric sciences will see a greater reliance on stochastic parametrization of processes that are under-resolved or poorly understood. This enables us to work on "multi-physics" and "multi-scale" problems, being that neither the Group Renomalization problem or the Fast Marginalization problem are going to be solved in the near futre. Stochasticity, accompanied by mixed model/data simulations are natural in this context.

As a geoscientist interested in geophysical fluid dynamics the most significant breakthroughs in recent years concern the physics modeling itself: there are
considerably better parametrizations of subscale processes, such as diffusipative dynamics and dispersion.

In the above disciplines, with models that are fairly informative (compared to models in biology, social sciences, etc), and high dimensional state spaces (10^8 degrees of freedom per time step), it is safe to say we have not entered the "Big Data" realm. Hence, improvements on models is essential.

Specific {\it recent} computational tools that have the potential for impact on geoscience:
\begin{itemize}
\item {\bf Compressed Sensing.} Do more with about the right amount of data.
\item {\bf More General Data classifiers:} Permits scientists to consider a wider range of information and how it can be parsed.
\item {\bf Improvements on sampling:} Most improvements, such as the Riemann Metric Hybrid Monte Carlo, and Iterative Monte Carlo have extended considerably the range of problems amenable to sampling, not by increasing the sample dimension as much as the intricacy of the sample space.
\item {\bf Stochastic parametrization:} It has enabled modeling physics at different scales. It has lead naturally to consideration of model/data
simulations.
\item {\bf Nonlinear/Non-Gaussian estimation} consideration of non-stationary problems, and blending of data and models along with their uncertainties.
\end{itemize}

Computational wish list (these are inter-related}
\begin{itemize}
\item Faster samplers (beat $1/\sqrt{N}$ convergence using more intelligent sampling campaigns, {\it i.e.}, a smarter way to traverse high dimensional

sample space.
\item Marked improvements on experimental design: if we were to pick a few samples from the sample space, a smart way to pick these with the most impact.
\end{itemize}