

Innovation without permission
HPC and Research Computing @ AWS



- 📦 AWS for Research Computing
- 📦 The AWS Global Infrastructure
- 📦 Example use cases for HPC on AWS
- 📦 The AWS building blocks
- 📦 Demo



Questions Welcome!

Research Computing



Science is one of the greatest areas of computation and can benefit from a democratization in cost and global accessibility that the cloud brings.

It's also where we think **Amazon** can make a **huge, really disruptive, impact** on the world by participating - which is, at the most basic level, **what we are about** as a company.

How is Cloud Helping HPC?



Faster Time to Results

Access computing infrastructure in minutes



Lower Total Cost

Pay-as-you-go pricing



Elastic and Powerful

Easily add or remove capacity



Globally Accessible

Easily collaborate with teams around the world



Secure

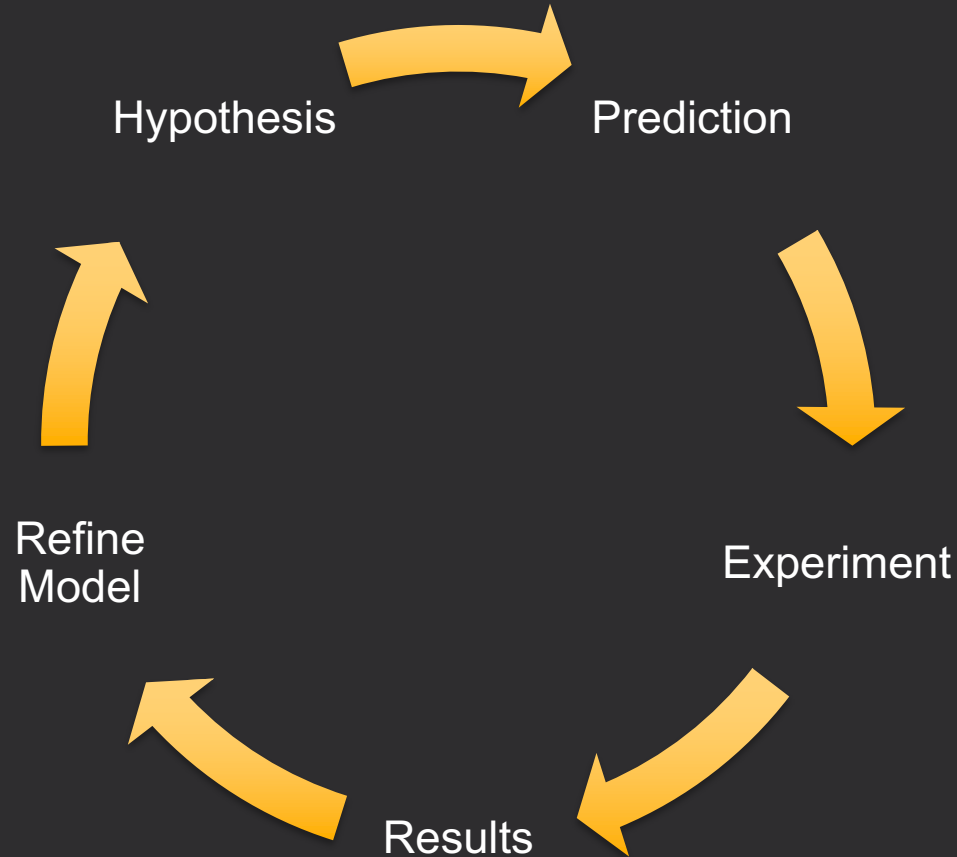
A collection of tools to protect data and privacy



Scalable

Access to effectively limitless capacity

The Scientific Method



The Scientific **Computing** Method





AWS Data Centers

<https://aws.amazon.com/compliance/data-center>

Take a virtual
tour of an AWS
data center



Take a virtual tour of an AWS data center
and learn more about how we secure AWS
Data Centers by design at:

aws.amazon.com/compliance/data-center

Learn how we
secure AWS Data
Centers by design.

Improving your security with AWS...

“Based on our experience, I believe that we can be even more secure in the AWS cloud than in our own datacenters.”



-Tom Soderstrom, CTO, NASA JPL

For more details, see Re:Invent 2013 presentations by NASA JPL cyber security engineer Matt Derenski (<http://awsps.com/videos/SEC205E-640px.mp4>)

Pricing Models

Free Tier

Get started on AWS with free usage and no commitment

For POCs and getting started



On-Demand

Pay for compute capacity by the hour with no long-term commitments

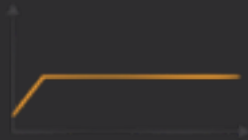
For spiky workloads, or to define needs



Reserved

Make a low, one-time payment and receive a significant discount on the hourly charge

For committed utilization



Spot

Spare capacity available at a deep discount.

For time-insensitive or transient workloads



High Throughput Computing at Scale

High Energy Physics

- Discovery of the Higgs Boson Particle
- Added 58,000 Spot Cores Elastically
- Monte Carlo Simulations Searching for Particles
- Reduced workload from 6 weeks to 10 days



Jan 22, 2016 03:37:38 to Jan 29, 2016 03:32:38 Refresh every 1m

AWS VM Status GCloud VM Status HEP Cloud HTCondor Status HEP Cloud Slots

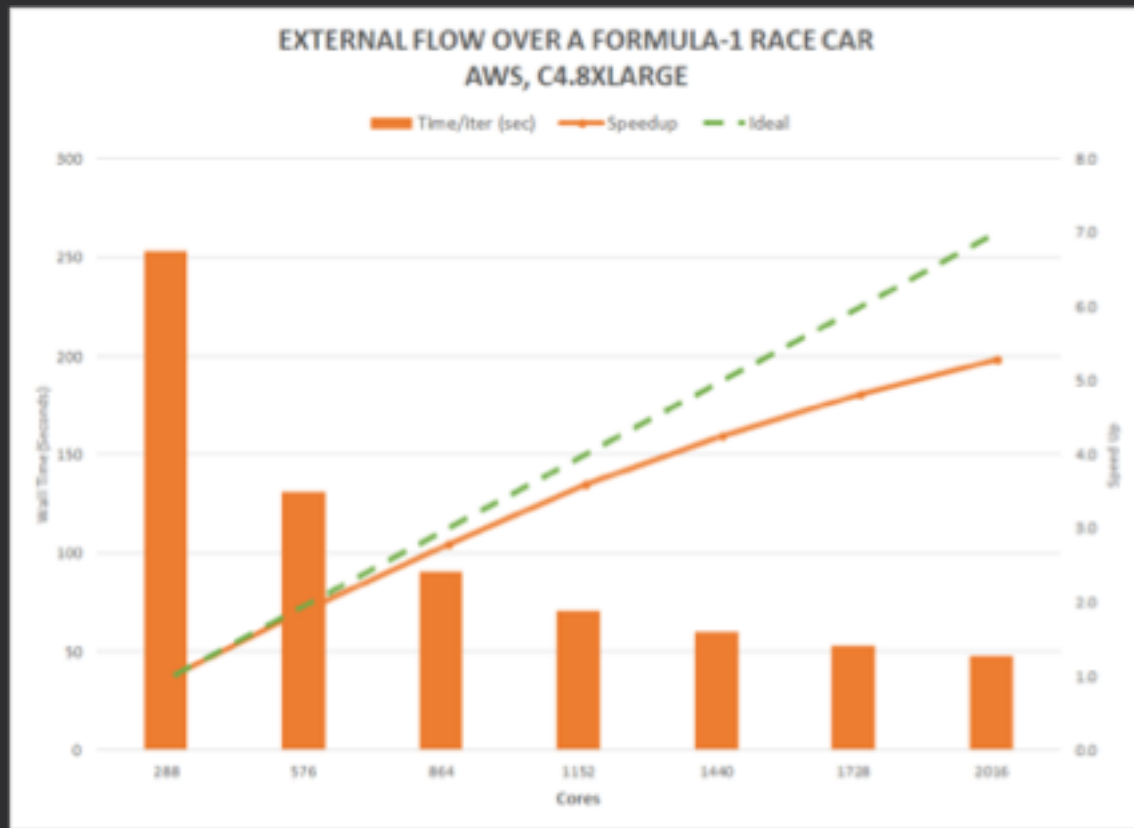
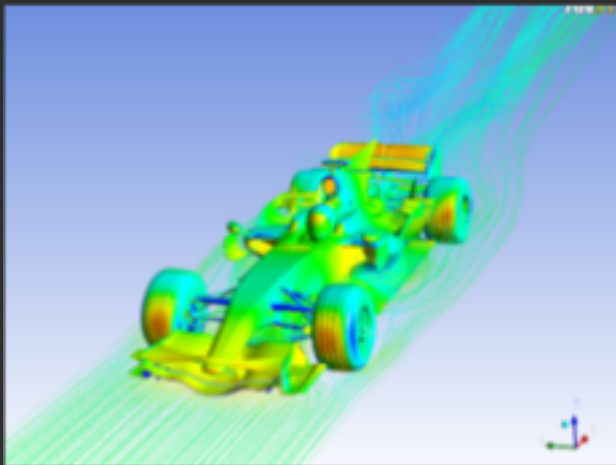
Job Status



Slots Summary



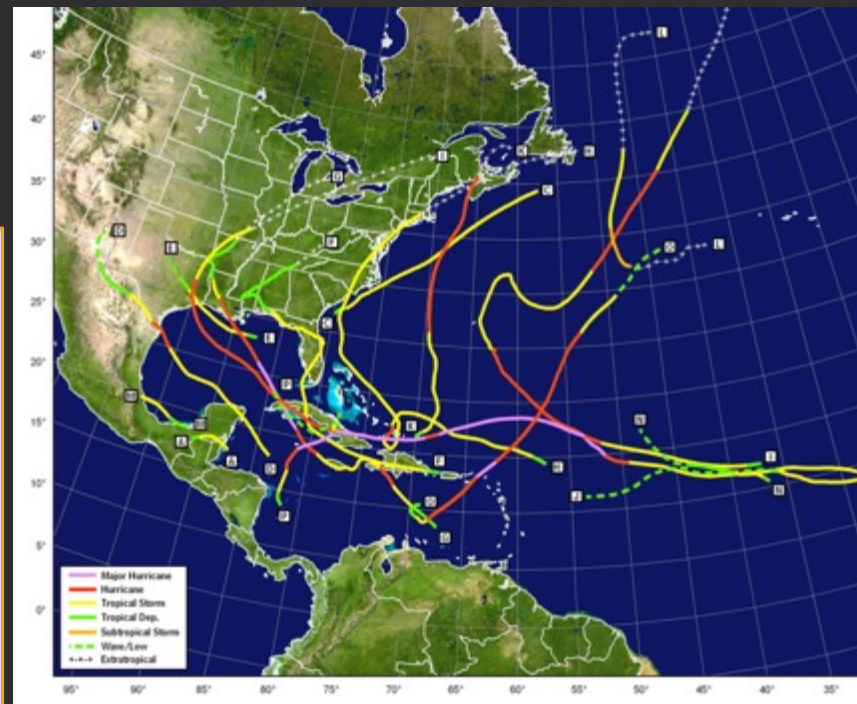
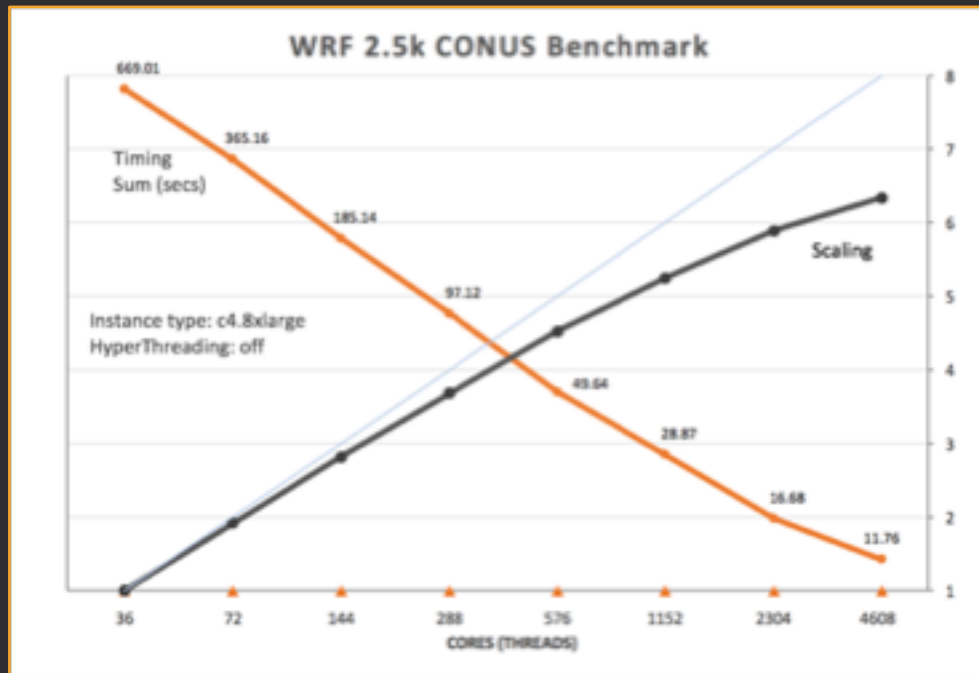
ANSYS Fluent: Getting Faster, Cost-effective Simulation on the Cloud



<http://www.ansys-blog.com/simulation-on-the-cloud/>



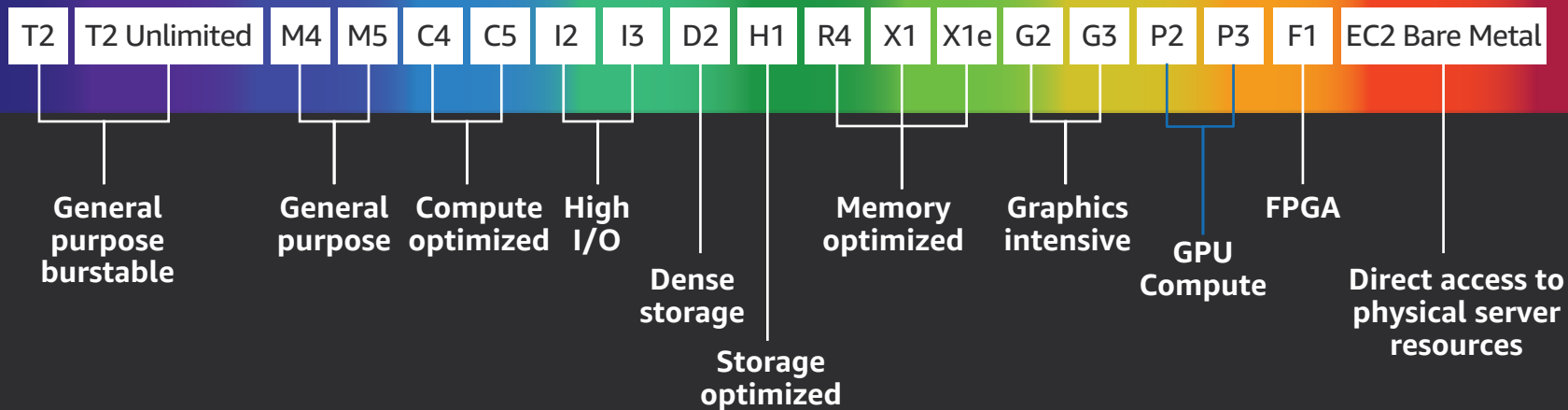
Weather Prediction on AWS



WRF Scaling and Performance on AWS

Amazon EC2 Instances

Optimize the price/performance of your HPC Workloads with the widest range of compute instances



Broad Set of Compute Instance Types

General
purpose



M5



M4

Compute
optimized



C5



C4

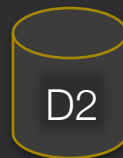


C3

Storage and I/O
optimized



I3



D2

Memory
optimized

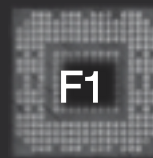


X1

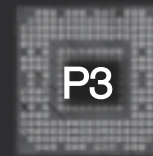


R4

GPU or FPGA
enabled



F1

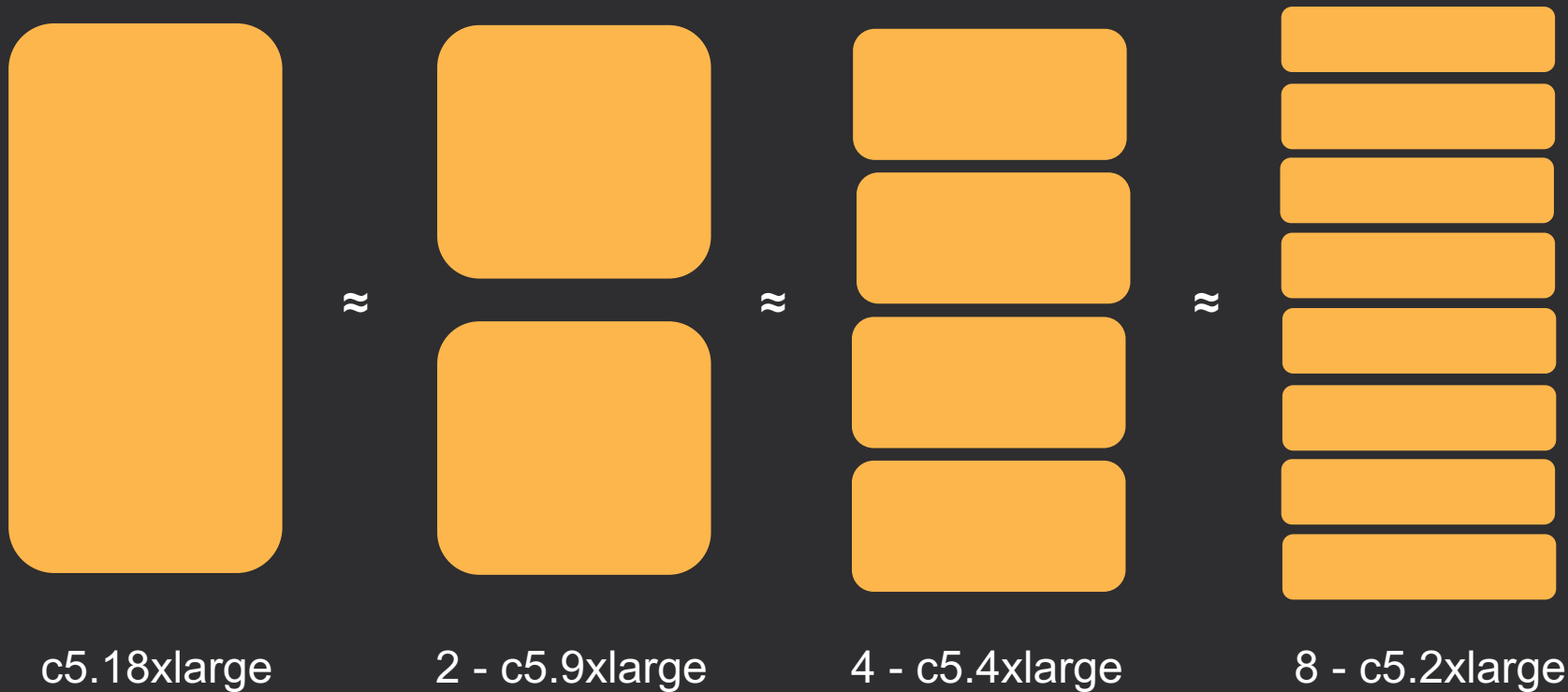


P3



G3

Instance sizing



AWS Storage Options

EFS (new!)

Highly available, multi-AZ, fully managed network-attached Elastic File System.

For near-line, highly-available storage of files in a traditional NFS format.

EC2+EBS

Create a single-AZ shared file system using EC2 and EBS, with third-party or open source software.

For near-line storage of files optimized for high I/O performance.

Amazon S3

Secure, durable, highly-scalable object storage. Fast access, low cost.

For long-term durable storage of data, in a readily accessible get/put access format.

Glacier

Secure, durable, long term, highly cost-effective object storage.

For long-term storage and archival of data that is infrequently accessed.

The screenshot shows the AWS 'Getting Started' page. At the top, the AWS logo is on the left, and navigation links for 'Contact Sales', 'Support', 'English', 'My Account', and a 'Sign Up' button are on the right. Below this is a horizontal menu with links: 'Products', 'Solutions', 'Pricing', 'Learn', 'Partner Network', 'AWS Marketplace', 'Explore More', and a search icon. The main header area is orange and features the text '10-Minute Tutorials' and 'Get started with a simple "Hello, World!" tutorial to get hands-on with an AWS product'. Below the header, there's a section 'View tutorials for:' with a dropdown menu currently set to 'All Use Cases'. The page displays a grid of tutorial cards. Each card has a title, a brief description, and a '10 Minutes' indicator. The visible cards include: 'Control your AWS Costs' (Learn how to control your AWS costs using the AWS Free Tier and AWS Budgets.), 'Launch a Linux Virtual Machine' (Launch then connect to a Linux instance in the cloud.), 'Deploy Code to a Virtual Machine' (Learn how to easily deploy code to virtual machines in the cloud.), and others under categories like 'WEBSITES & WEB APPS', 'DATABASES', and 'STORAGE'. The AWS logo is also present in the bottom right corner of the page.

<https://aws.amazon.com/free/>

<https://aws.amazon.com/getting-started/tutorials>



Pop-Up Compute Clusters – Research Tech

Introducing **Alces Flight** - self-scaling HPC-style clusters instantly ready to compute, billed by the hour and using the AWS Spot market by default to achieve supercomputing for ~1c per core per hour.



- 1,500+ popular scientific applications
 - Pre-installed & ready to run.
- Available via **AWS Marketplace** (the cloud's "App Store") and launched within minutes.
- Exploits Amazon **EC2 Spot market** by default.
- Deployable anywhere on Earth ... **immediately**.

Elastic HPC Cluster



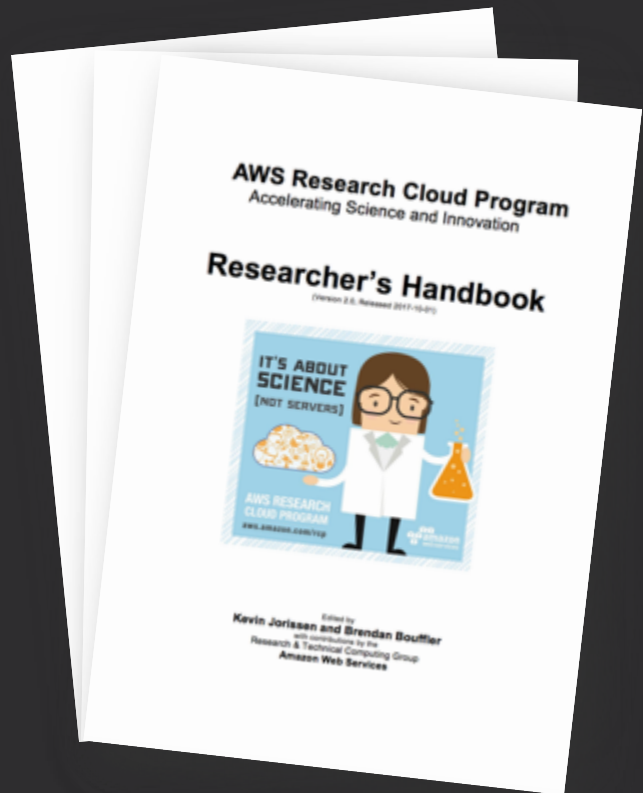
Cloud Credits for Research

- Software or tools to facilitate future research
- Perform proof of concepts for migrating research workloads
- Train the broader community on cloud computing



AWS Researcher's Handbook

The 200-page “**missing manual**” for science in the cloud.



Written by Amazon's Research Computing community **for scientists**.

- **Explains** foundational concepts about how AWS can accelerate time-to-science in the cloud.
- **Step-by-step best practices** for securing your environment to ensure your research data is safe and your privacy is protected.
- **Tools for budget management** that will help you control your spending and limit costs (and preventing any over-runs).
- **Catalogue of scientific solutions** from partners chosen for their outstanding work with scientists.

aws.amazon.com/rcp





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Thank you
谢谢
Dank je wel
고맙습니다
Gracias
Merci

