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Moving GeoInformatics Workloads into the Cloud: Real-World Examples of Enabling Collaborative Research

- **Raoul Miller**
- Oracle for Research

- **Samuel Xavier-de-Souza**
- UFRN, Brazil

- **Manjula Ranagalage**
- Rajarata University, Sri Lanka

- **H.K.S. de Zoysa**
- University of Naples, Italy

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What is Cloud Computing?

"On-demand delivery of computing resources on the internet"

- Compute (CPU and GPU)
- Storage
- Networking
- Security
- Data Services (database, reporting)

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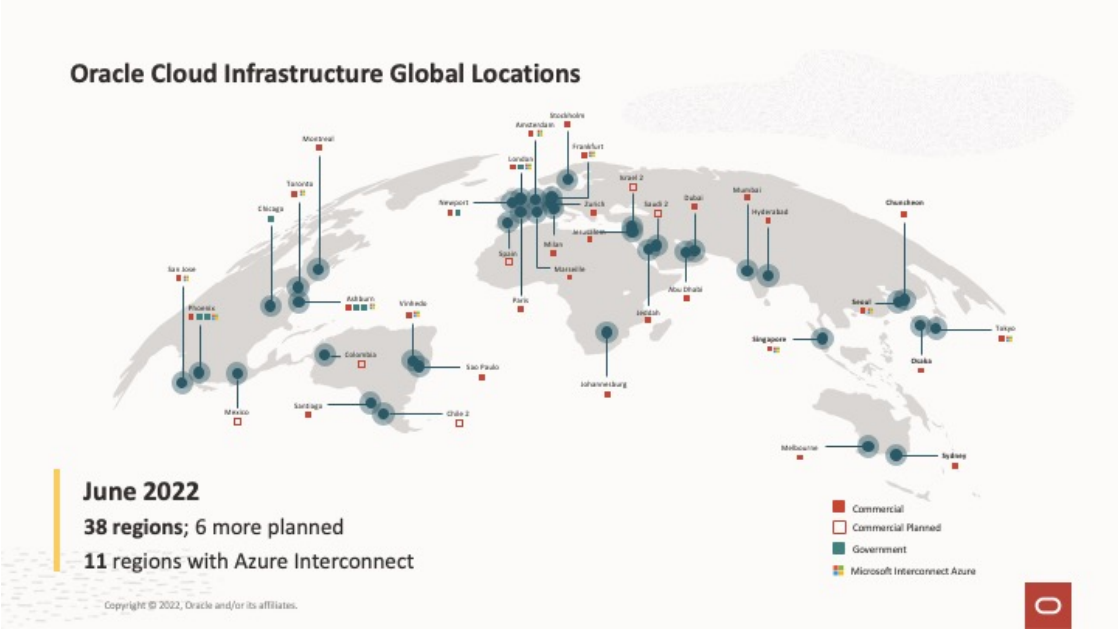
Why Move your Analytical Workloads to the Cloud?

- Flexibility
- Agility
- Worldwide Deployments
- Cost Effectiveness
- Sustainability



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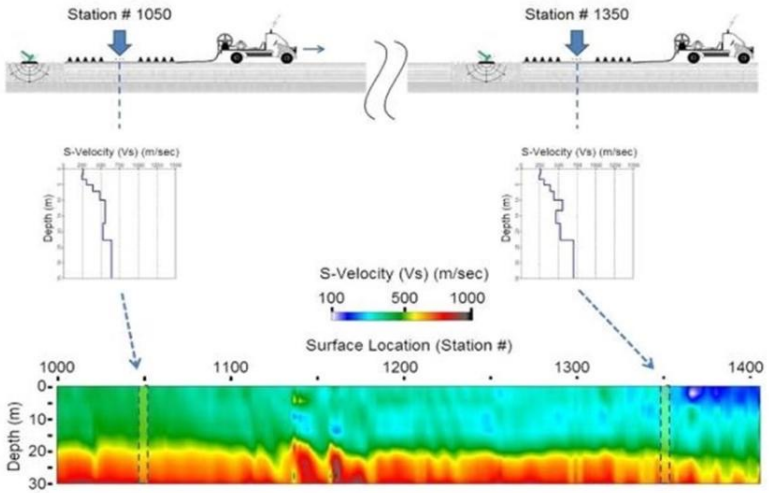
Example 1: Optimizing Wave Modelling in Exploration Geophysics

- Work conducted by Samuel Xavier-de-Souza and his team at UFRN in Brazil
- Very computationally complex modelling of wave propagation to develop models of sub-surface structure based on reflectivity.
- This project's goal is to determine the optimal mix of GPU and CPU in a cluster to most effectively (and quickly) process the seismic data.



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Advantages of Using Cloud Resources for this Project

- Flexibility – the availability of different cloud computing shapes offering a mix of CPU, GPU, and RAM with high I/O storage.
- Agility – the research team is able to deploy complex architectures quickly and easily, measure their effectiveness, and then modify them as needed.
- Cost effectiveness – purchasing on-premises hardware and storage would be very expensive, and migrating data onto and off multiple platforms is slow and complex.

Enabled multi-CPU and multi-GPU execution: Grid size 301^3

VM GPU 3.2			
Time (seconds)			
Grid size	GPU-only	CPU and single GPU automatic load balancing	CPU and multi GPU static workload distribution*
101^3	14.48	12.96	12.68
201^3	54.60	46.60	43.67
301^3	162.60	139.20	138.50
401^3	388.40	326.80	322.00

*Static workload distribution: GPU0 33.3%; GPU1 33.3%; CPUs 33.4%

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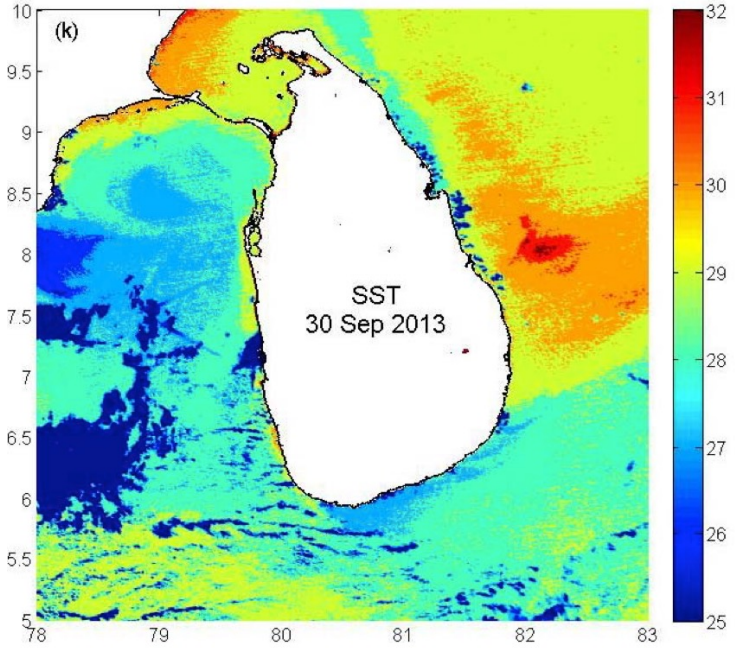
Example 2: Modelling the Effects of Anthropogenic Climate Change on Marine Ecosystems in Sri Lanka

- Worked conducted by Professor Manjula Ranagalage at Rajarata University in Sri Lanka and Dr. H.K.S de Zoysa at University of Naples Federico II in Italy.
- Taking MODIS satellite data of SST and fisheries data from the Sri Lanka Ministry of Fisheries and Aquatic Resources Development.
- Using cloud resources to store data, manage ETL, and run analyses.
- Ability for researchers in different parts of world to work together on same data set and analytical platform.



de Vos, *et al.* (2014)

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Advantages of Using Cloud Resources for this Project

- Distributed systems - Ability for collaborators around the world to work together on single data set and analytic tools on cloud VM
- Reliability - Access to reliable storage and compute even when local systems are unavailable.
- Cost Effective – institutions with low levels of funding have access to powerful computing and storage, allowing them to undertake valuable analyses.

Image: © worldbank.org

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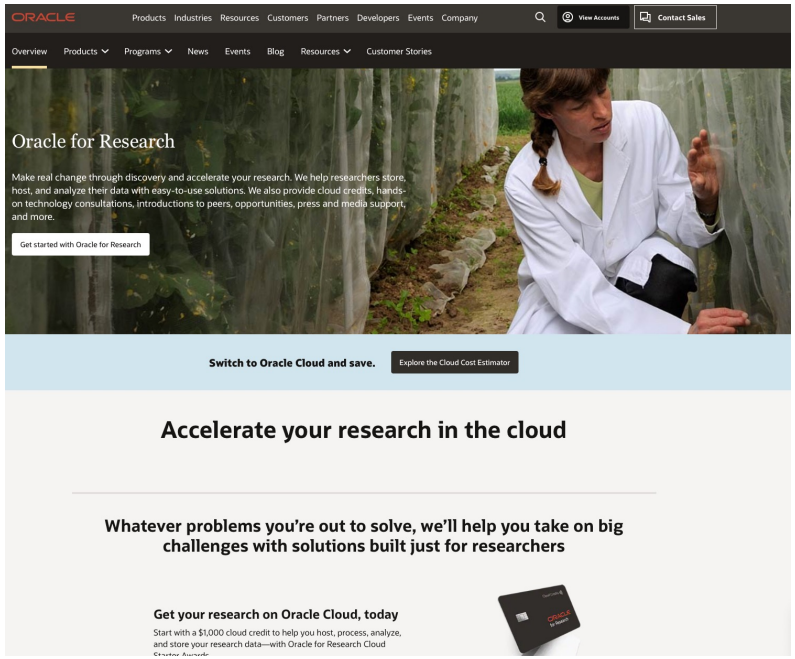
www.oracle.com/research

raoul.j.miller@oracle.com



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