WICSCC AWS challenge 2025 Team Matador

In this challenge, team Matador of Texas Tech university took on the challenge of optimizing the Conus 12km weather simulation model with WRF. Despite various challenges, our team was able to produce results that improved the price-performance of the simulation and reduce runtime.

Infrastructure as Code

Included this the YAML file that was used to build our cluster for our best price-performance run.

To build a cluster using this configuration file, one must navigate to the Parallel Cluster UI provided by AWS. Here, click “Build Cluster” then “create from template”. When the File Explorer pops up, select the given YAML file and continue. Every window should already have the right configurations. On the first page, you will need to make a selection from the VCP dropdown menu, in which there is only one option. Also, on the “step 2” page, ensure to choose the “az2” option from the subnet ID dropdown.

When at the last page, click “dry run” to test the setup, then build the node.

Setting Up Cluster

Once the cluster is done building, open up the cluster shell. Change to the ec2-user and navigate to the home directory.

```
sudo su ec2-user

cd ~
```

Given are the cluster-setup.sh and wrf-setup.sh files, which configure the cluster and configure, WRF, and the conus 12 km model to run. Copy these into your home directory and run them using the source command:

```
source cluster-setup.sh

cd ~
```

source wrf-setup.sh

This step also creates your best-run.sh file, which can now be used to simulate the conus 12k model. The batch script as well as the output for this run is also included with this submission.

cd /fsx/conus_12km

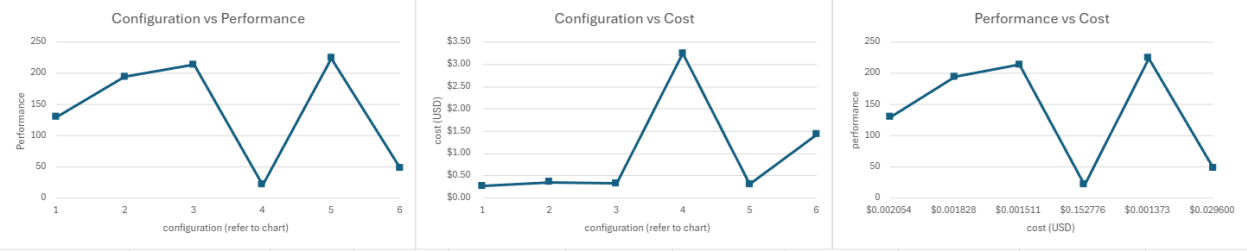
sbatch best-run.sh

Price and Performance

The table recording our performance and cost for various configurations is given below. It is also included in the excel sheet with the submission file.

config. number	instance type	# instances	tasks per node	OMP threads	Compute Time (s	Forecast Time (h)	EC2 Pricing / Hour	Cost Per Simulation	Simulation Time	Price to Performance
1	hpc6a.48xlarge	1	48	2	333	12	$2.88	$0.27	129.7297297	$0.002054
2	hpc6a.48xlarge	2	96	1	222.151	12	$2.88	$0.36	194.4623252	$0.001828
3	hpc6a.48xlarge	2	48	2	202	12	$2.88	$0.32	213.8613861	$0.001511
4	hpc6a.48xlarge	2	24	4	2031	12	$2.88	$3.25	21.27031019	$0.152776
5	hpc6a.48xlarge	2	12	8	192.539	12	$2.88	$0.31	224.3701276	$0.001373
6	hpc6a.48xlarge	2	6	16	893.982	12	$2.88	$1.43	48.3231206	$0.029600

Three graphs, the configuration vs performance (simulation time), the configuration vs the simulation cost, and the price to performance are included below.

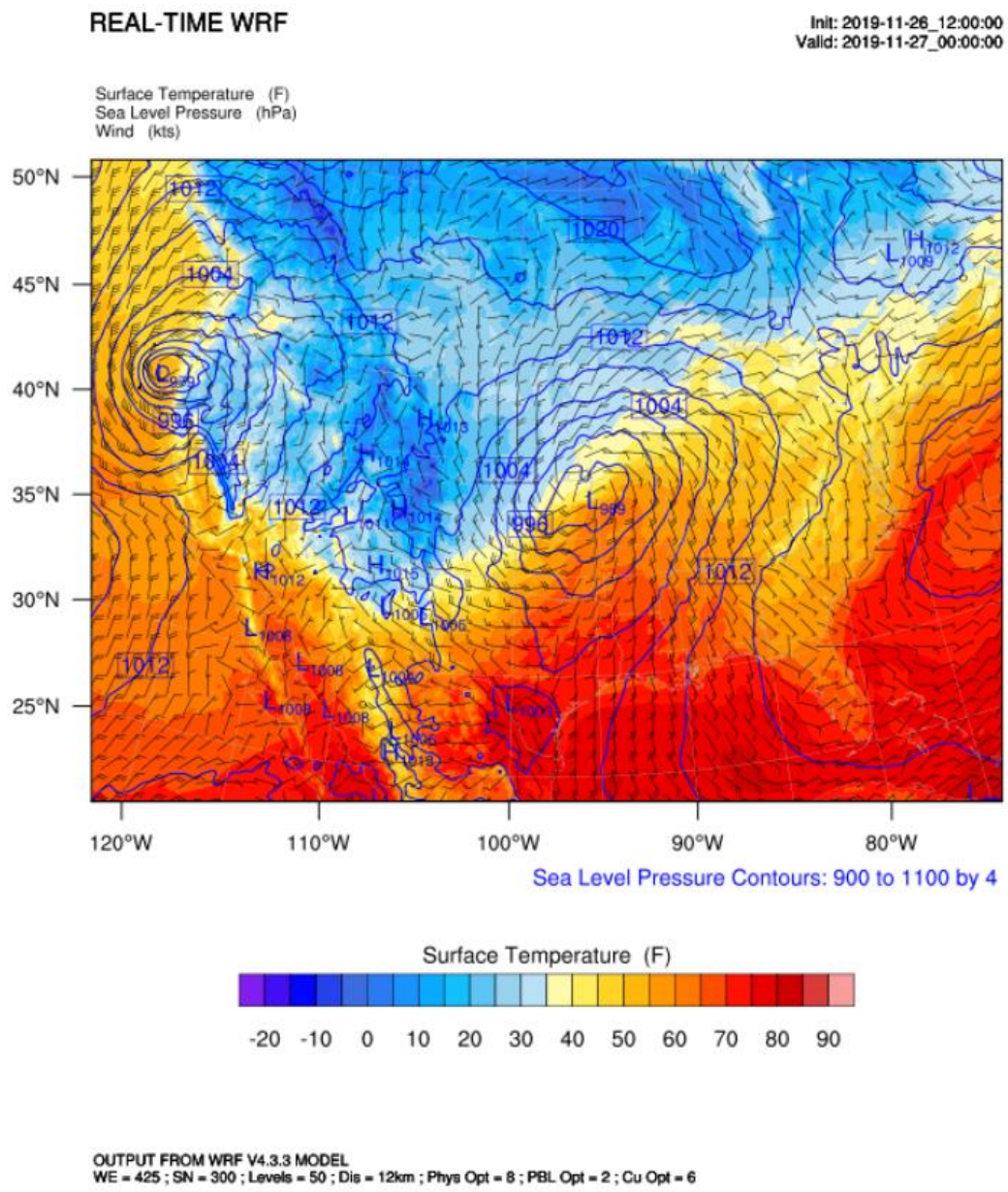


Overall, our best configuration was configuration 3, which gave us our best price to performance as well as our best runtime. This gave us a simulation cost of $0.31 and a price to performance of $0.001511.

Due to failing nodes and quota limitations, we were unable to test many different hardware configurations. Instead, we tuned the number of instances, the tasks per node, and the OMP number of threads used for the simulation to get our best result.

Renderings

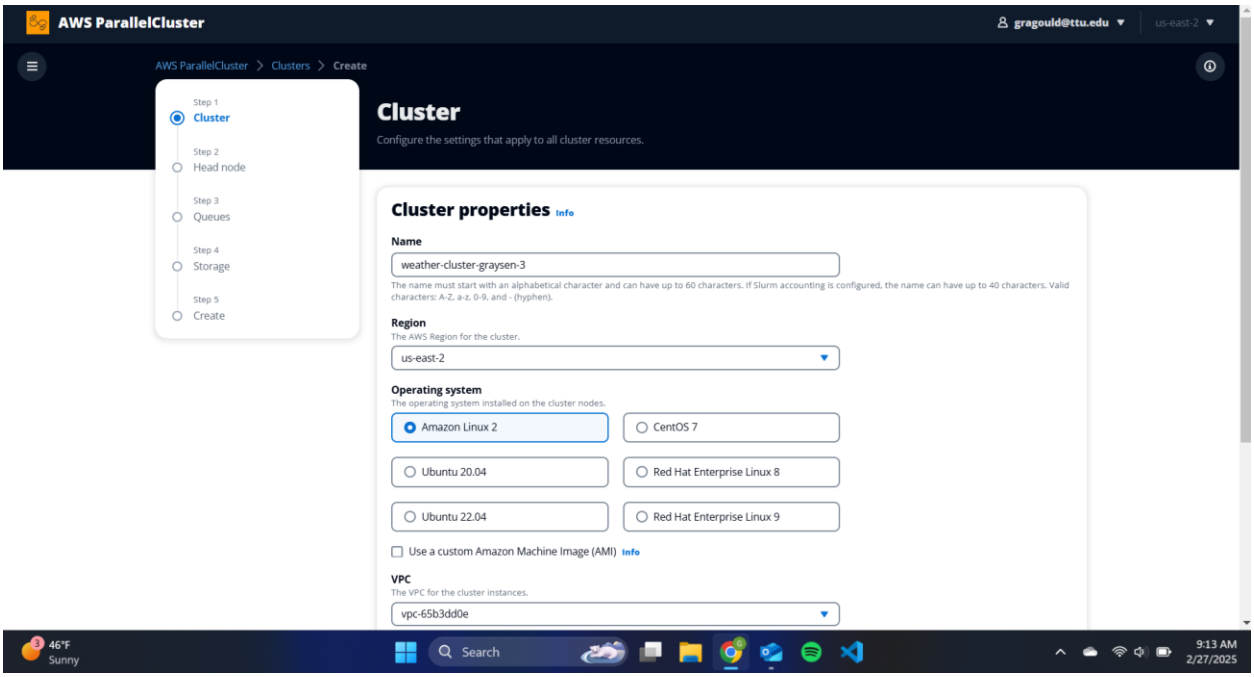
The output renderings from the conus 12km are included below:



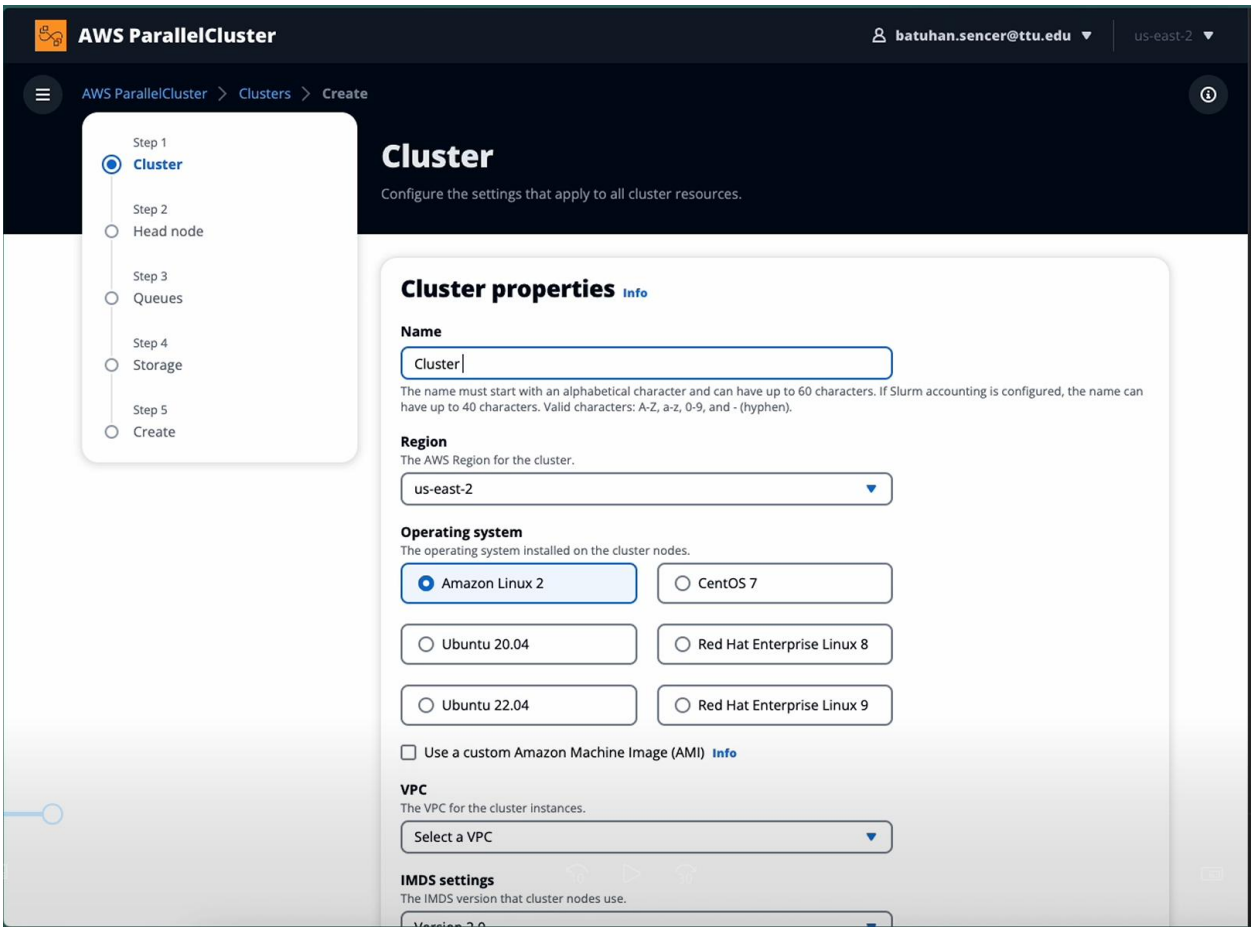
Proof of Cluster Building

Below is proof that clusters were built by two team members, Graysen Gould and Batuhan Senser, on 2-26-25 and 3-1-25 respectively. More screenshots and videos are included in the submission file.

Proof of Graysen building cluster on 2-26-25:



Proof of Batuhan building a cluster on 3-1-25:


AWS ParallelCluster
batuhan.sencer@ttu.edu
us-east-2
AWS ParallelCluster > Clusters > Create
Step 1
Cluster
Step 2
Head node
Step 3
Queues
Step 4
Storage
Step 5
Create
Cluster
Configure the settings that apply to all cluster resources.
Cluster properties Info
Name
Cluster
The name must start with an alphabetical character and can have up to 60 characters. If Slurm accounting is configured, the name can have up to 40 characters. Valid characters: A-Z, a-z, 0-9, and - (hyphen).
Region
The AWS Region for the cluster.
us-east-2
Operating system
The operating system installed on the cluster nodes.
Amazon Linux 2
CentOS 7
Ubuntu 20.04
Red Hat Enterprise Linux 8
Ubuntu 22.04
Red Hat Enterprise Linux 9
Use a custom Amazon Machine Image (AMI) Info
VPC
The VPC for the cluster instances.
Select a VPC
IMDS settings
The IMDS version that cluster nodes use.