Technology Company

Lenovo

Unlocking the secrets of the ocean

Oceanbox.io

How Oceanbox built a powerful HPC environment using Lenovo ThinkSystem servers powered by AMD EPYC™ processors to increase knowledge about how things travel with the ocean currents.

AMD
EPYC

Who is Oceanbox.io?

Oceanbox.io is a start-up based in Tromsø in northern Norway that aims to redefine oceanography through the simulation and visualization of the near-shore ocean. The internal team has more than 20 years of experience in oceanography, marine ecology, software development, scientific computing, and parallel programming.

Using high-resolution models of ocean currents close to the shore, online services from Oceanbox enable fish-farming companies to predict and analyze environmental impacts and the spread of parasites and pathogens. This initial use case for the technology is expected to deliver millions of dollars in efficiency savings to Norway's large fish-farming industry.

The Oceanbox visualization tools can also be used for other purposes, from modeling of waste and sedimentation, to assisting search and rescue teams in locating missing persons, and more general-purpose services like helping water sports enthusiasts make good decisions and improving route planning.
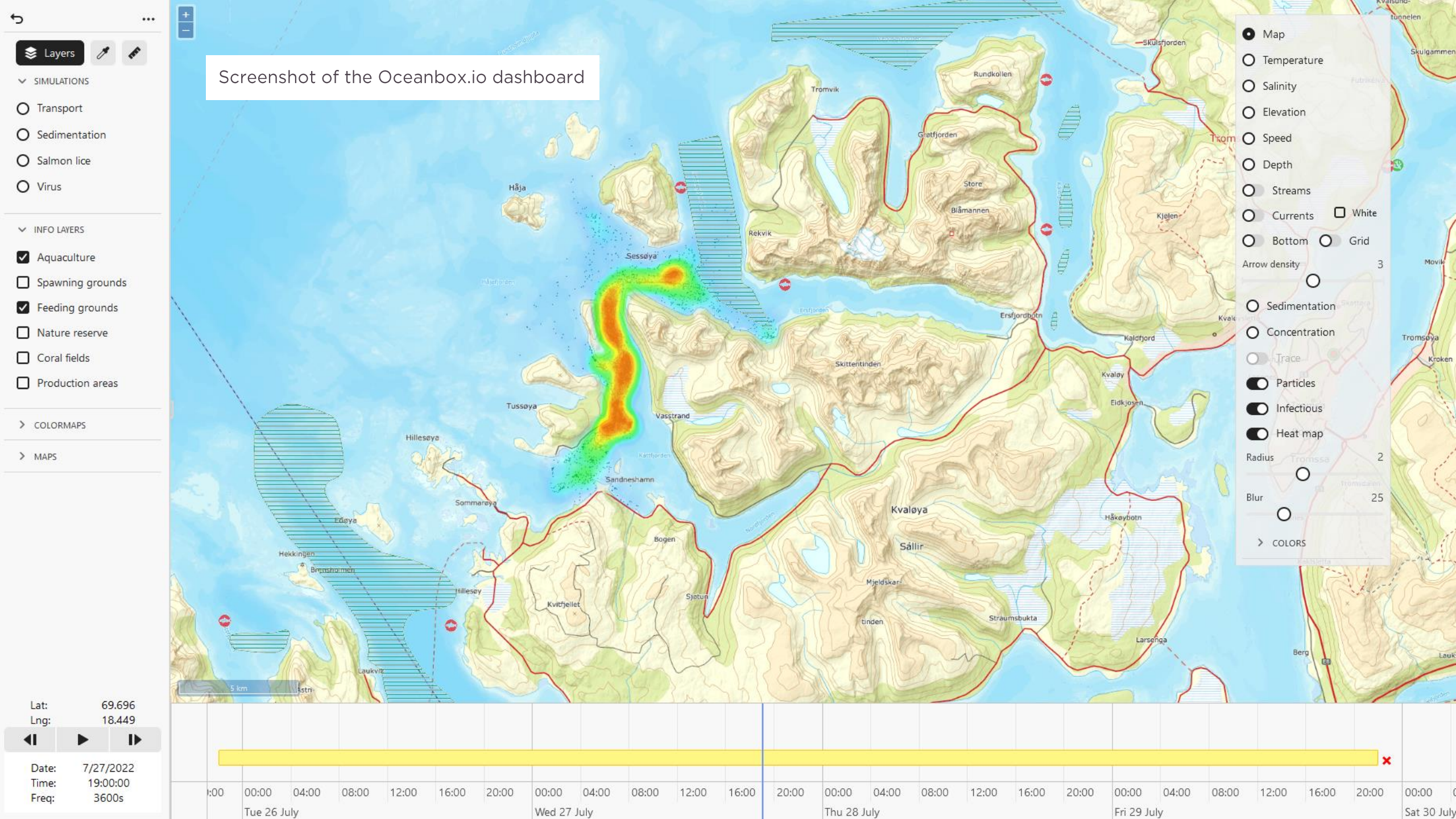
Layers

SIMULATIONS

- ○ Transport
- ○ Sedimentation
- ○ Salmon lice
- ○ Virus

INFO LAYERS

- ☑ Aquaculture
- ☐ Spawning grounds
- ☑ Feeding grounds
- ☐ Nature reserve
- ☐ Coral fields
- ☐ Production areas

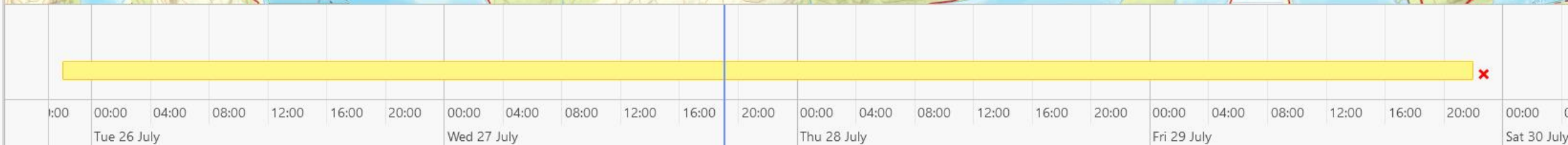> COLORMAPS

> MAPS

Lat: 69.696
Lng: 18.449

Date: 7/27/2022
Time: 19:00:00
Freq: 3600s

- ● Map
- ○ Temperature
- ○ Salinity
- ○ Elevation
- ○ Speed
- ○ Depth
- ○ Streams
- ○ Currents   ☐ White
- ○ Bottom   ○ Grid

Arrow density   3

- ○ Sedimentation
- ○ Concentration
- ○ Trace
- ⬤ Particles
- ⬤ Infectious
- ⬤ Heat map

Radius   2

Blur   25

> COLORS

Tue 26 July   Wed 27 July   Thu 28 July   Fri 29 July   Sat 30 July

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The
Challenge

A key challenge in the commercial farming of salmon in Norway is to protect fish in their near-shore pens from lice—both to maximize yields and to comply with government regulations to limit the spread of parasites to wild salmon populations. It is also important to consider impact on valuable areas like spawning and feeding grounds, and vulnerable areas like nature reserves and coral reefs.

The cost of one salmon de-licing treatment is about US$100,000. In Norway about 3,500 treatments are performed annually along the coastline. But de-licing is often not the end of the story: During treatments the salmon are pushed together, releasing some of the lice which are then caught by the ocean currents. Later, the currents can push these freshly removed lice back into the pens and reinfest the same fish, and sometimes the currents move the lice to a neighboring location which then gets infected. Timing these operations based on current forecasts can save both time and a lot of headaches for the industry.

As commercial fish farming is a US$20 billion industry in Norway, Oceanbox identified a big opportunity to build and sell a predictive visualization tool that would empower fish farms to optimize their investments and yields.

Modeling ocean currents at the level of detail required is a mathematical challenge involving extremely complex thermodynamics and fluid dynamics. As a startup, Oceanbox wanted to quickly ramp up its modeling, simulation, and visualization tools, turning them from prototypes into fully fledged solutions on a stable high-performance computing (HPC) platform, ready for commercial use.

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"You can use observations and measurements to see what the ocean is doing today, but that tells you nothing about tomorrow's conditions. To estimate what's likely to happen, you need extremely powerful HPC to solve complex nonlinear equations at very high resolution."

Svenn Hanssen
CEO, Serit Tromsø (partner and key investor in Oceanbox.io)

Simulating oceans of data

Oceanbox deployed 16 Lenovo ThinkSystem SR645 servers, each with two 64-core AMD EPYC™ processors, as the basis for its new HPC environment.

Jonas Juselius, CTO at Oceanbox.io, comments: "At Oceanbox, we needed the best HPC technology available to handle the huge computations involved in modeling ocean currents. For a typical near-shore model, we have up to two million grid cells; simulating a year of currents takes three or four weeks on 1,000 cores, and we produce about 40 GB of data a day."

Hardware
Lenovo ThinkSystem SR645 servers powered by AMD EPYC™ 7713 Series Processors
Lenovo ThinkSystem storage

The Oceanbox solution enables customers to choose an area and time period, simulate the release of pathogens, then visualize how they are predicted to spread in an intuitive color model that shows the speed, direction, and depth of ocean currents. In addition to salmon lice, the service can predict the movement of algae and a variety of other pathogens, taking into account wind, precipitation, temperature, salinity, oxygenation, and more besides.

> "The AMD-powered HPC solution from Lenovo is an excellent fit for Oceanbox, providing 2,048 computational cores in a very compact 16U system. When you want to maximize the density of cores, the price/performance advantages of AMD are very compelling."

Jonas Juselius
Head of Innovation, CTO, Oceanbox.io

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Results

Having completed a successful proof-of-concept exercise, Oceanbox has launched its solution and is working with pilot customers to refine its models based on real-world data. When the company finishes modeling the Norwegian coast, it plans to model other important near-shore locations for fish farming in areas like Canada and the Faroes.

"Our solution takes around 15 minutes to produce a result that would previously have taken a specialist aquaculture consultancy four to five weeks," says Svenn Hanssen. "And of course, this information is significantly more valuable as we approach real-time delivery."

Using the intuitive visual tools provided by Oceanbox, fish farms can find the optimal times to invest in de-licing, potentially saving hundreds of millions of dollars a year across the entire industry in Norway. Keeping salmon free from lice increases the health of the fish and enables higher yields that deliver greater profitability.
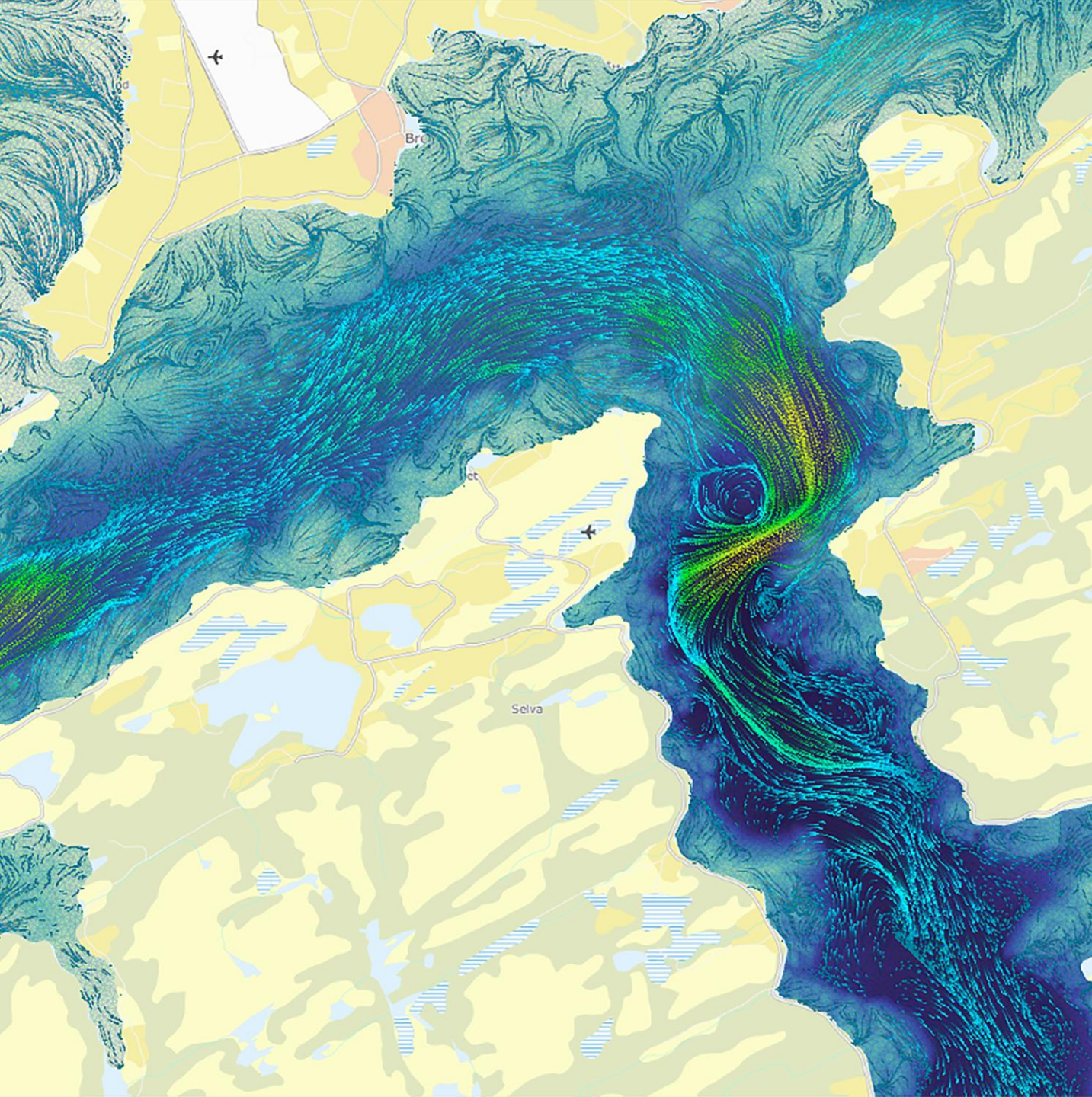
✓ Rapid visualization of predicted ocean currents

✓ Ability to predict the likely movement of parasites and pathogens

✓ Potential for hundreds of millions of dollars in efficiency savings

"Our Lenovo HPC solution combined with our advanced predictive model helps us to reveal the ocean's secrets, enabling our customers to maximize the return on their investments and reduce the impact on the environment."

Svenn Hanssen
CEO, Serit Tromsø (partner and key investor in Oceanbox.io)

Why **Lenovo**?

A key investor in Oceanbox.io is Serit Tromsø—a 45-person IT consultancy and Lenovo Gold Partner. Based on previous experience with the technology, Serit advised Oceanbox to build its HPC cluster using Lenovo ThinkSystem SR645 dual-socket servers equipped with two 64-core AMD EPYC 7713 Series Processors.

"Our technical team collaborated very closely with the Lenovo HPC specialists during the design phase," recalls Juselius.

Working with Lenovo and Serit, Oceanbox deployed 16 SR645 compute nodes running Red Hat Enterprise Linux, each with 256 GB of memory, in a high-speed Infiniband network.

Two further SR645 nodes in the same configuration are attached to Lenovo disk storage devices to provide both a high-speed BeeGFS parallel file system to support live computations and an NFS-based capacity tier for bulk storage. The parallel file system uses 120 TB of small, ultra-fast disks in a mirrored RAID 10 array, while the bulk storage uses a smaller number of 16 TB disks in a RAID 6 array.

How can you predict the speed, direction, and depth of ocean currents?

Enabling the modeling of ocean currents with a
HPC platform based on Lenovo and AMD technology.

Explore Lenovo HPC Solutions