Rio Olympics from space

The Opening Ceremony of the 2016 Summer Olympics takes place on Friday and so we've decided to revive our highly infrequent blog series 'Can you see sporting venues from space?' Previously we've looked for the Singapore and Abu Dhabi Formula One Grand Prix Circuits, but this week we're focussing on the Rio Olympic venues.

Rio de Janeiro

The Games of the XXXI Olympiad will take place from the 5th to the 21st August in the Brazilian city of Rio de Janeiro. It is expected that more than ten thousand athletes will be competing for the 306 Olympic titles across 37 venues, 7 of which are temporary venues and 5 are outside Rio. The remaining twenty-five are permanent venues within the city, and 11 have been newly built for the Olympics and Paralympics. It is these permanent venues that we'll see if we can spot from space!

The image at the top of the blog shows the Rio area, and you'll notice the dark green area in the centre of the image which is the Tijuca National Park containing one of the world's largest urban rainforest. It covers an area of 32 km².

Spatial Resolution

Spatial resolution is the key characteristic in whether sporting venues can be seen from space, and in simplistic terms it refers to the smallest object that can be seen on Earth from that sensor. For example, an instrument with a 10 m spatial resolution means that each pixel on its image represents 10 m, and therefore for something to be distinguishable on that image it needs to be larger than 10 m in size. There are exceptions to this rule, such as gas flares, which are so bright that they can dominate a much larger pixel.

We used the phrase 'simplistic terms' above because technically, the sensor in the satellite doesn't actually see a square pixel, instead it sees an ellipse due to the angle through which it receives the signal. The ellipses are turned into square pixels by data processing to create the image. Spatial resolution is generally considered to have four categories:

- Low spatial resolution: tend to have pixels between 50 m and 1 km.
- Medium spatial resolution: tend to have pixels between 4 m and 50 m.
- High spatial resolution: tend to have pixels between 1 m and 4 m.
- Very high spatial resolution: tend to have pixels between 0.25 m to 1 m

Clearly with very high resolution imagery, such as that provided by commercial Worldview satellites owned by DigitalGlobe, can provide great images of the Olympic venues. However, as you know we like to work with data that is free-to-access, rather than paid for data. We've used Sentinel-2 data for this blog, which has a 10 m spatial resolution for its visible and near infra-red bands via the multispectral imager it carries.

Can we see the Olympic venues from space?

In our earlier parts of this infrequent series we couldn't see the night race from the Singapore circuit, but we did identify the Abu Dhabi track and red roof of the Ferrari World theme park. So can we see the Olympics? Actually we can!

On the image to left, you'll notice two bright white circles, one in the middle of the image and the second to the south-east. The bright circle in the middle is the Olympic Stadium which will be hosting the athletics and stands out clearly from the buildings surrounding it, to the South East is the Maracanã Stadium which will stage the opening and closing ceremonies together with the finals of the football tournaments.

In the bottom left of the image is small triangular shape which is location for the Aquatics Stadium, Olympic Tennis Centre, the Gymnastic and Wheelchair basketball arena, and the Carioca arenas which will host basketball, judo, wrestling and boccia. The bottom of the triangle juts out into the Jacarepagua Lagoon.

In the top left of the image, you can see the runway of the military Afonsos Air Force Base and north of the air base are a number of other Olympic venues, however these are hard to spot within their surroundings – these include the Equestrian Centre, Hockey Centre, BMX Centre, Whitewater canoe slalom course and the Deodoro stadium which will host the Rugby 7s and modern pentathlon.

It is possible to see the Olympic venues from space! Good luck to all the athletics competing over the next few weeks.