

GIS9 UAV VLOS area

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Task: modeling if an UAV will be visible from an observation point

Given:

- A flight area
- a DSM
- flight parameters
- Assess observer locations



The location

Fjugstad natural reserve

See AOI_Fjugstad in GIS9.gdb



Drone regulation

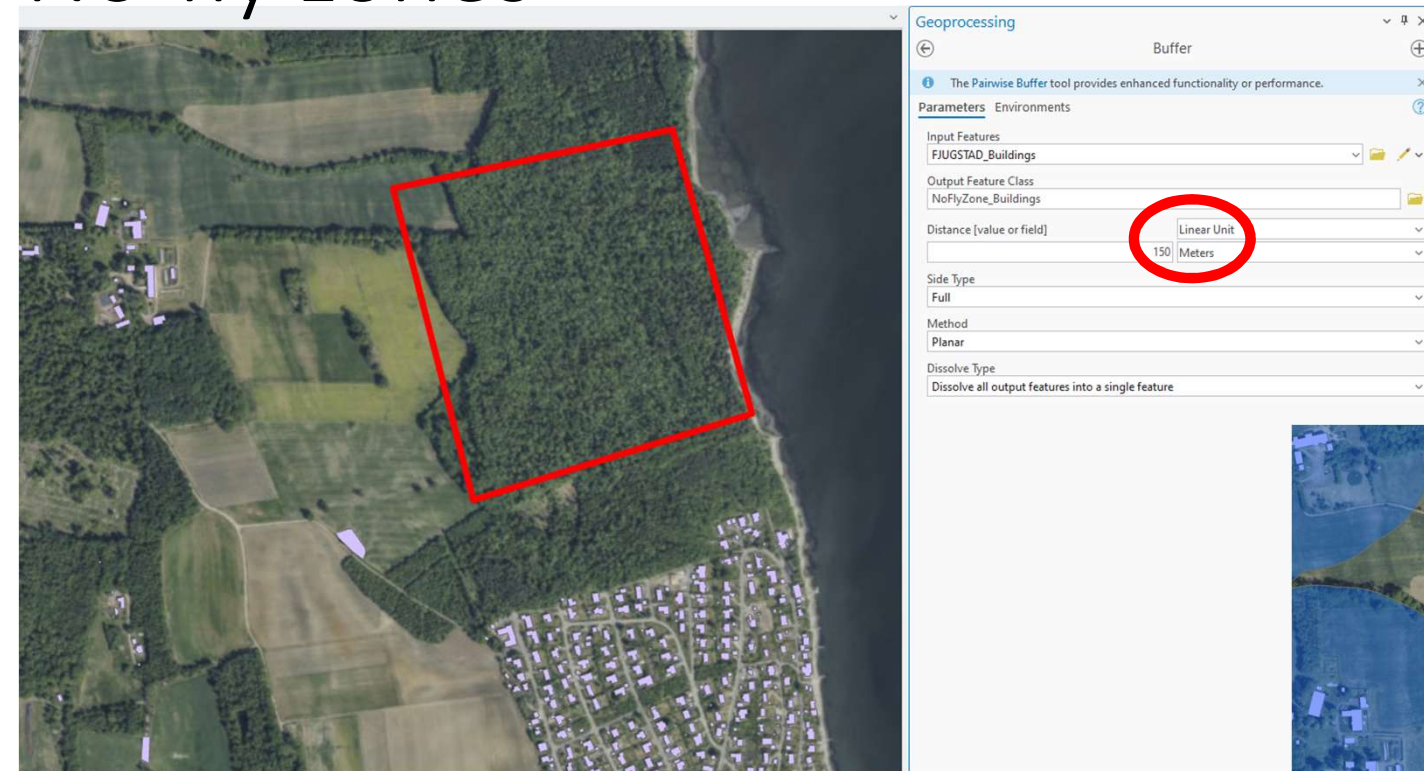
We are using a Matrice 300RTK, an UAV without a C-class certification but under 25kg, that can be flown in the A3 open category:

- Max 120m AGL
- Always within Visual Line of Sight (what we're estimating in this lab)
- Min 150 meter away from people and buildings
- We aren't allowed to take-off from the forest itself.
- We can't be more than 750m from the drone

Flight parameters – part 1

- We want to fly 75m AGL to get the data we need
 - We need a DTM to assess this (load Fjugstad_dtm1.tif)
- Do we need to restrict our flight area to stay far enough away?
 - Buffer of 150m on Fjugstad_Buildings (building data from OSM)

No-fly zones

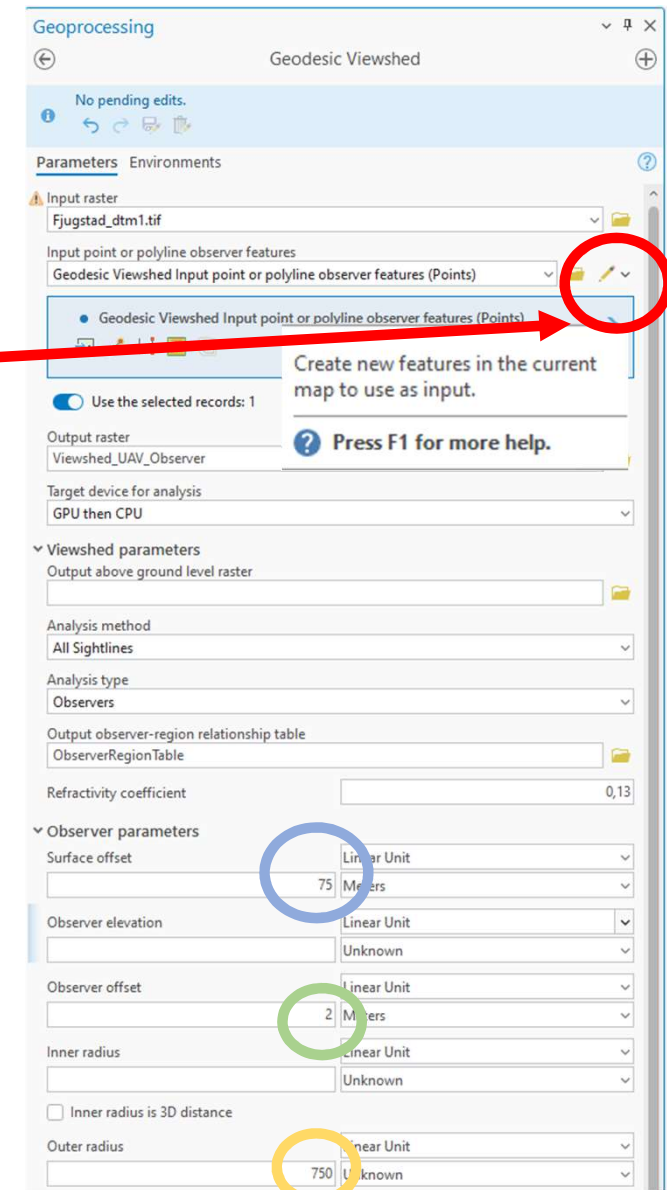


Looks like we're ok! (Maybe the person planing the flight area had thought of that ;))



Calculating viewshed

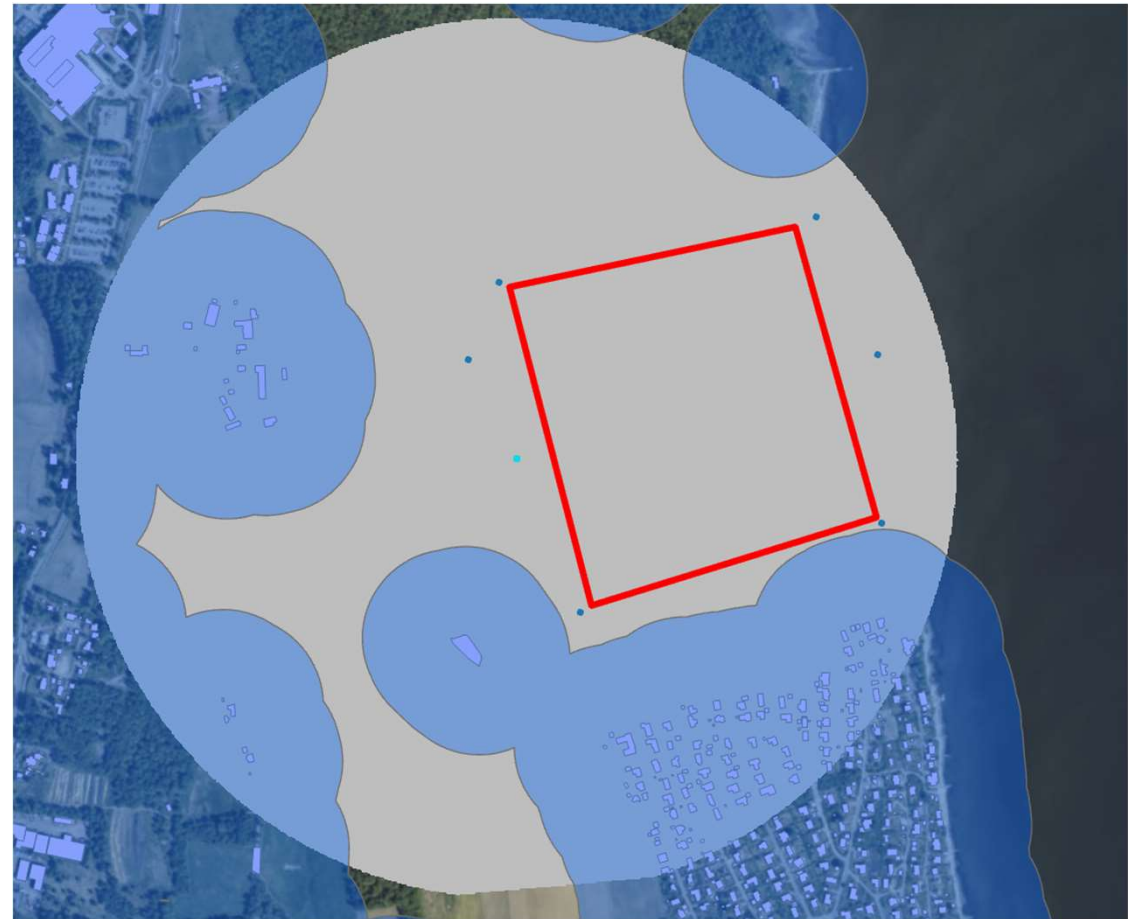
- Create a selection of potential observer locations (start with 1)
- Set Analysis type to «Observers»
- Set flight height to 75m
- Set Observer offset (eye-ground distance) to your height
- Set «outer radius» to 750m as we can't see the UAV further than that



Viewshed

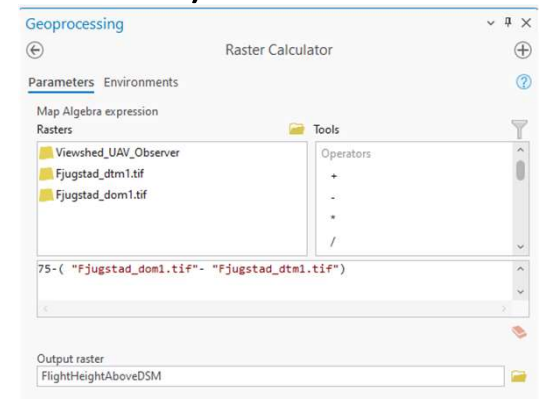
In this case, the selected observer can see the UAV in the whole area → boring!

BUT, we used a DTM, with no trees or buildings, maybe there's an impact?



Flight parameters – part 2

- We want to fly 75m AGL to get the data we need
 - We need a DTM to assess this (load Fjugstad_dtm1.tif)
- We want to calculate the vieshed using a DSM (DOM), to take trees and other structures into account
 - If we just feed the DSM to the viewshed tool, it will compute the viewshed as if we were flying 75m above the DSM (so, above the trees), which we aren't
 - The offset then needs to be $75 - \text{CanopyHeight} = 75 - (\text{DSM} - \text{DTM})$
 - Use the raster calculator to compute this



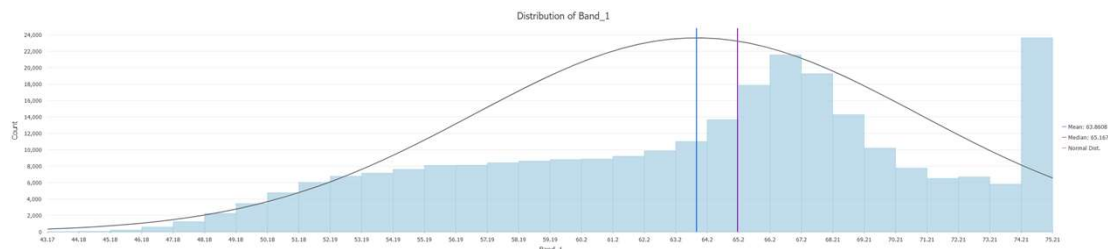
Flight parameters – part 2

- The Geodesic biewshed doesn't take a raster input for surface offset, so we'll have to approximate this :
 - Clip the FlightHeightAboveDSM to the AOI
 - Look at the statistics

Build Parameters: skipped columns: 1, rows: 1, ignored value(s):

Band Name	Minimum	Maximum	Mean	Std. Deviation
Band_1	43,17461395263672	75,2142105102539	63,86079511040251	7,08713245740606

- $\text{Mean} - 2 * \text{SD} = 49,71\text{m} \rightarrow 50\text{m}$ should cover



Geoprocessing

Clip Raster

Parameters Environments

Input Raster
FlightHeightAboveDSM

Output Extent
AOI_polygons_WithStats

Rectangle

X and Y Extent

Top 6589548,32914484

Left 241738,791610596

Right 242324,291629805

Bottom 6588938,96039545

Output Raster Dataset
FlightHeightAboveDSMinAOI

☒ Use Input Features for Clipping Geometry

NoData Value
3,4e+38

☐ Maintain Clipping Extent

Calculating viewshed (DSM)

- Select observer locations (start with 1)
- Set Analysis type to «Observers»
- Set flight height to 50m
- Set Observer offset (eye-ground distance) to your height
- Set «outer radius» to 750m as we can't see the UAV further than that

Geoprocessing

Geodesic Viewshed

Parameters Environments

Input raster
Fjugstad_dom1.tif

Input point or polyline observer features
Geodesic Viewshed Input point or polyline observer features (Points)

Use the selected records: 1

Output raster
Viewshed_UAV_1Observer_DSM

Target device for analysis
GPU then CPU

Viewshed parameters

Output above ground level raster

Analysis method
All Sightlines

Analysis type
Observers

Output observer-region relationship table
ObserverRegionTable

Refractivity coefficient
0,13

Observer parameters

Surface offset
50 Linear Unit
Meters

Observer elevation
Unknown

Observer offset
2 Linear Unit
Meters

Inner radius
Unknown

Inner radius is 3D distance

Outer radius
750 Linear Unit
Unknown

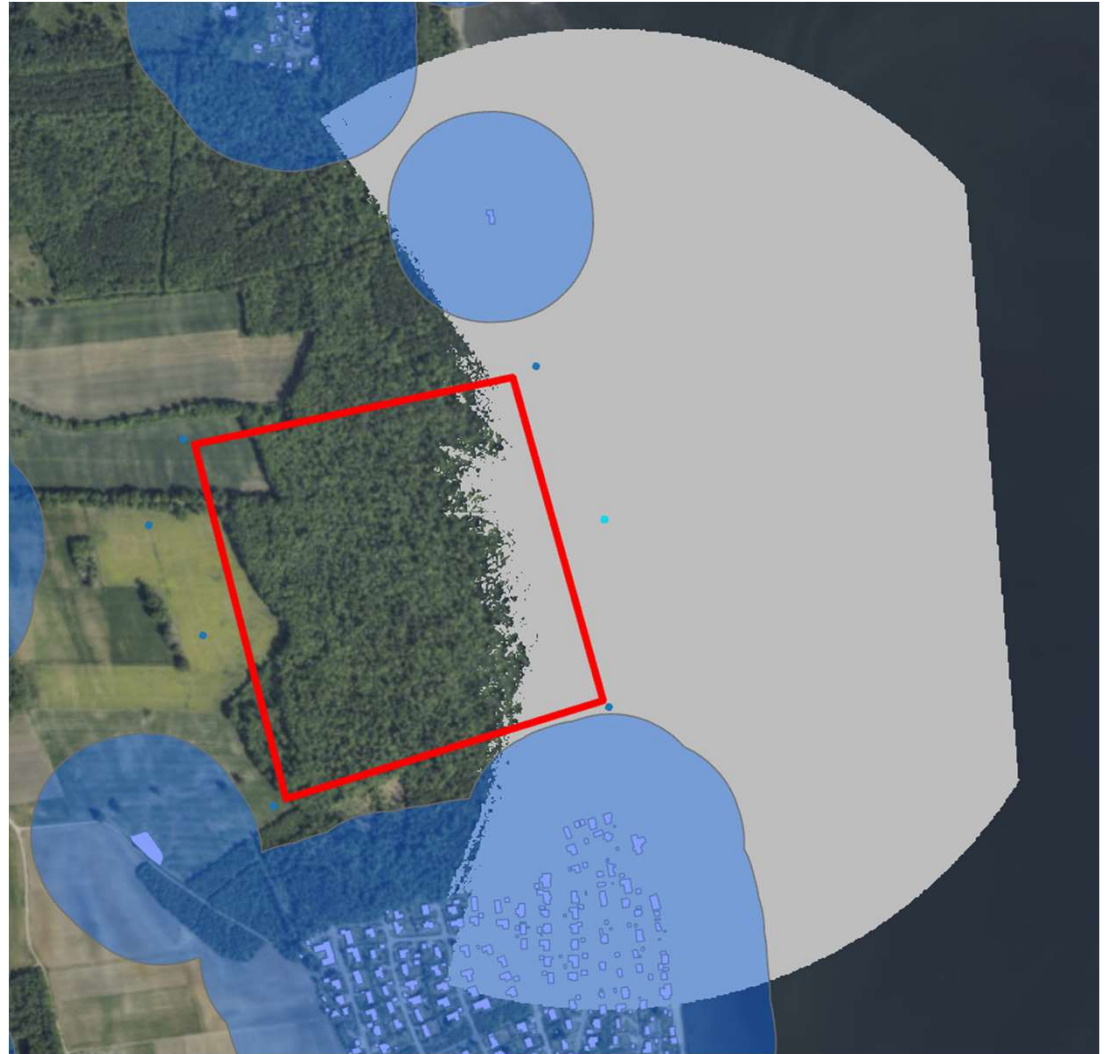
Viewshed (DSM)

- Oops!



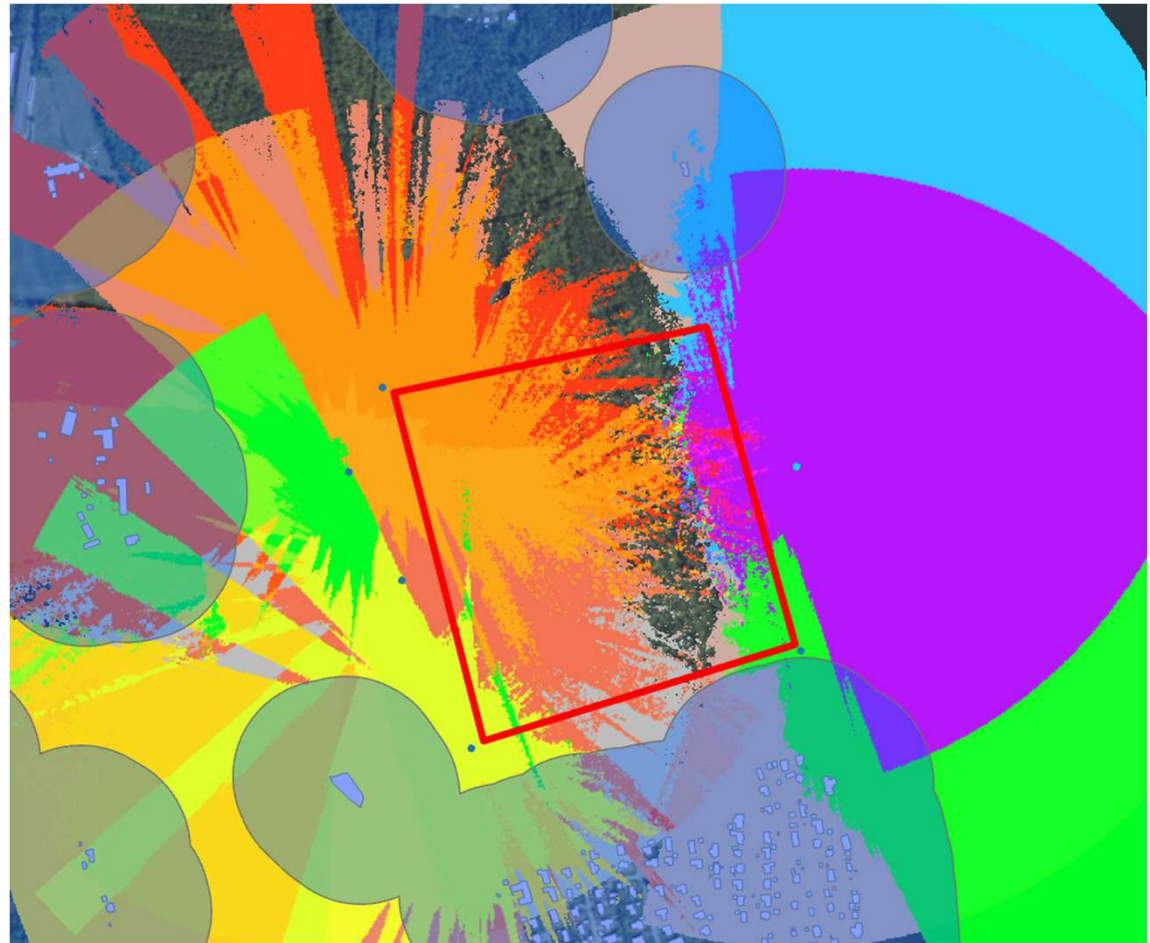
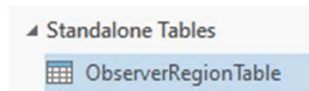
Viewshed (DSM)

- Even worse!
- Try to find a good spot!



Many observers at once

- The table tells you what areas relate to
- None of my observers are good (some areas aren't covered by any)



Lab report

- Run this in another location with
 - Buildings around
 - A DTM and DSM