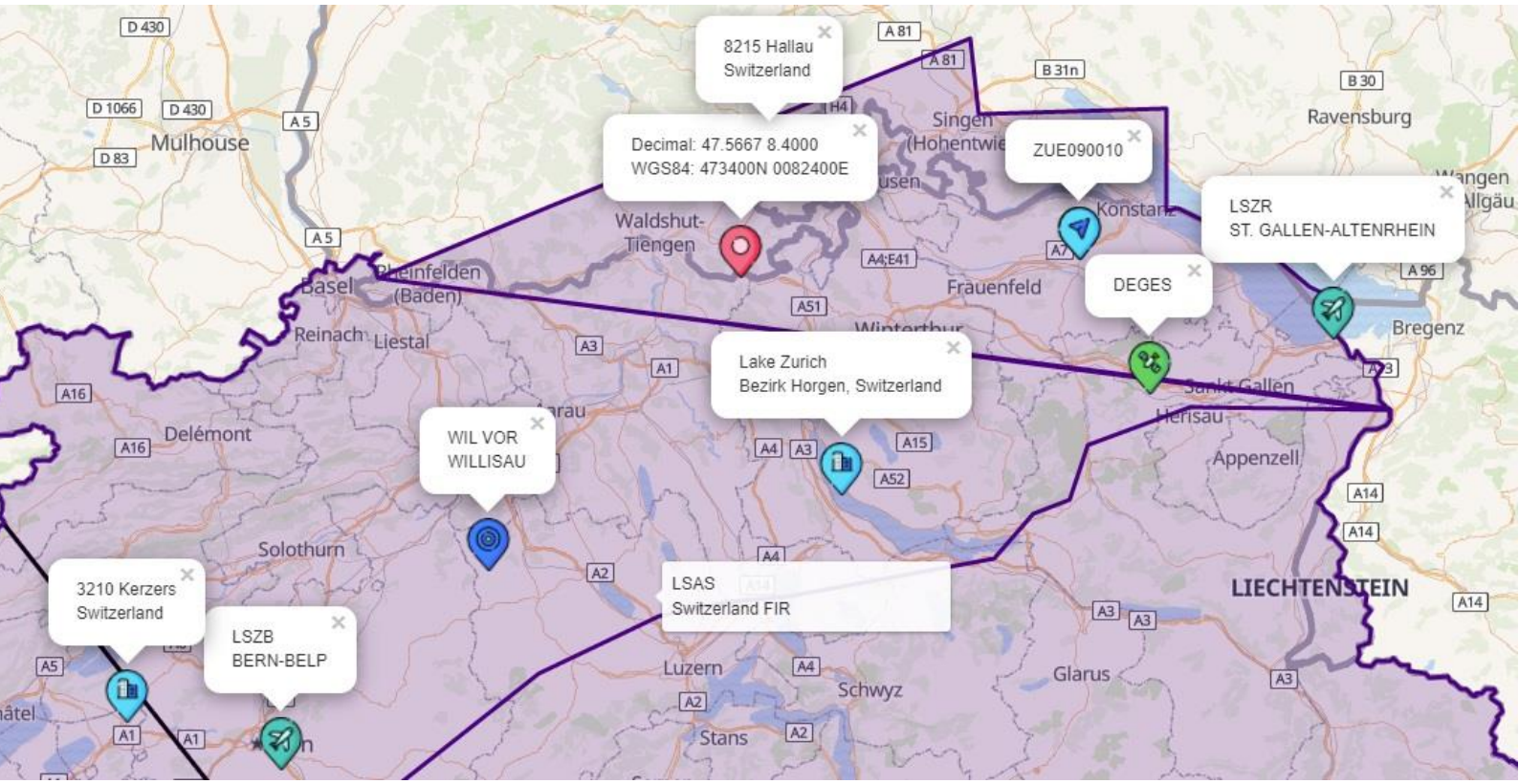
# AIM Mapping Tool

## User Manual & Guide



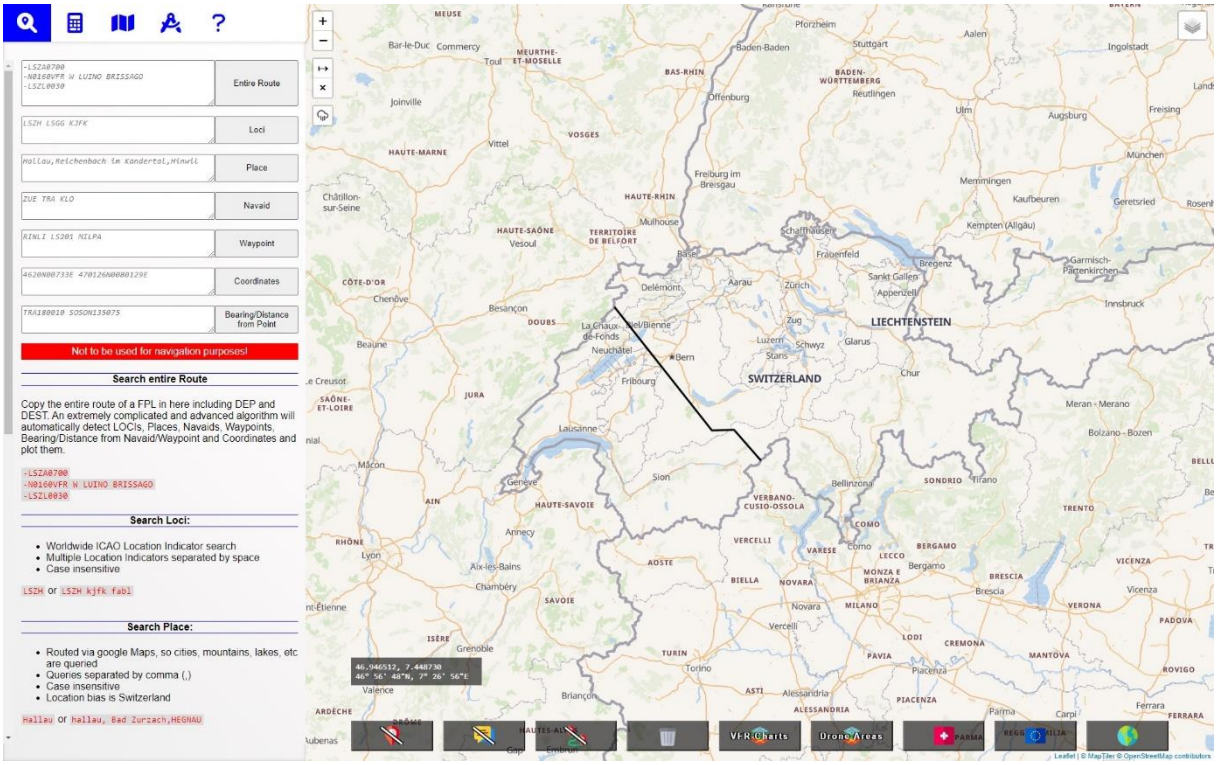

*A feature rich web application for Flight Plan Route Visualization tailored to AIM Services Switzerland.*
*Developed and maintained by Marcel Weber for AIM Services Switzerland.*

# 1 Introduction

This is a user manual/how-to of the AIM Mapping Tool web application (henceforth referred to as AMT).

# 2 Overview

The AMT is generally divided into two main sections, Map View (right) and Tool View (left), each with their respective sub-sections.




## 2.1 Map View

The map view consists of a standard map background and toolbar overlays. Markers on the map will indicate the location of a searched point of interest.

By default, the airspace layer “LS - LSAG/LSAZ Boundary” is projected onto the map as well.

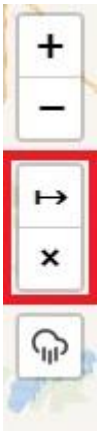
### 2.1.1 Options cluster upper left

From top to bottom, the options cluster in the upper left corner consists of:

### 2.1.1.1 Zoom

Zoom into the map with + and zoom out of the map with -. This has the same effect as using the scroll wheel to zoom.

### 2.1.1.2 Line Measurement



This control displays a line from a chosen starting point on the map to the current mouse position, indicating the distance between the starting point and the current mouse position in nautical miles as well as the line angle in 360 degrees.

To start a line, click on the →. The background will turn green indicating the line measurement is active. Then, click on the desired location on the map. When moving the mouse, a blue dashed line will connect the starting point (purple circle) with the current mouse position.


**Figure 1: Note the green background on the arrow symbol.**

With another click, an intermediate stop can be set, from which a new line will follow the mouse cursor.

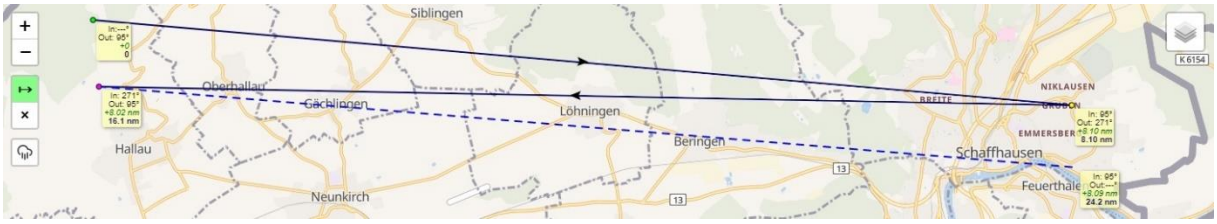
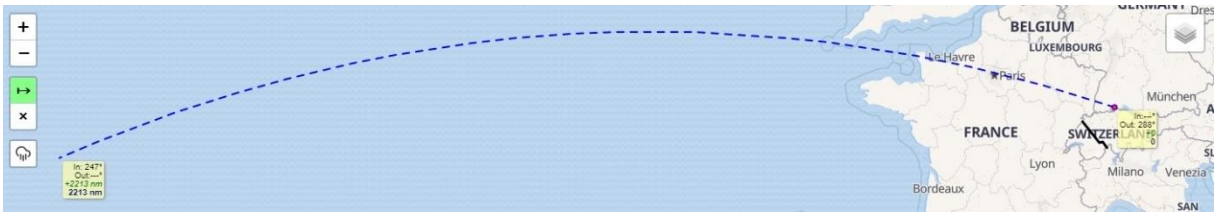



**Figure 2: Note the fixed lines with directional indicators.**

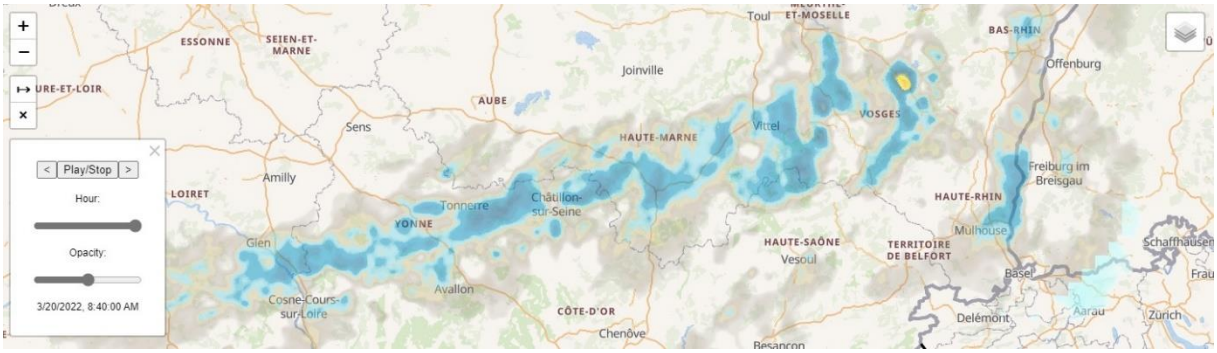
The line accounts for the curvature of the earth.




Use Esc to cancel the line drawing. Click the X to remove all the lines.

### 2.1.1.3 Rain Radar

This control creates an overlay akin to a weather radar. With the Start/Stop control, an animation can be controlled of the rain cloud movement.




## 2.1.2 Options cluster upper right

This control contains the airspace layers that can be projected onto the map. Hovering over it expands the airspace selection.

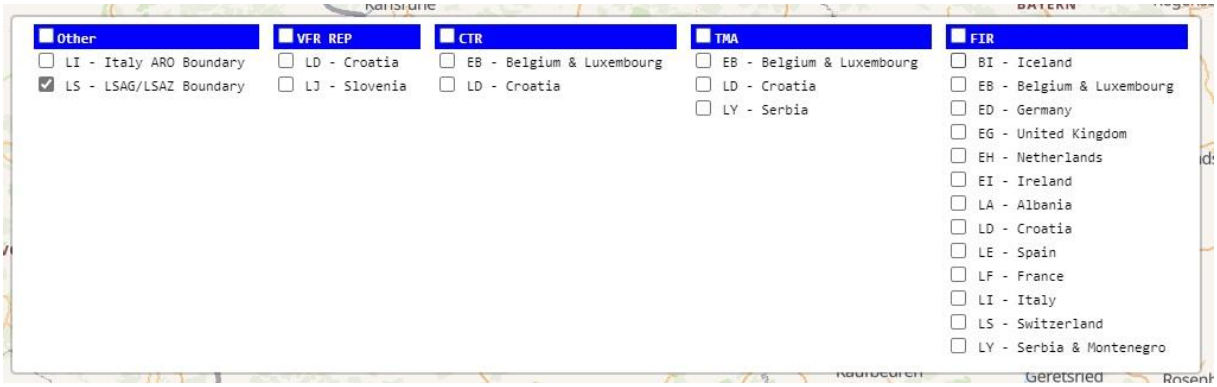



**Figure 3: Note that LS -LSAG/LSAZ Boundary is selected by default.**

Here, different airspace layers can be selected. They are grouped:

- FIR
  Flight information Region
- TMA
  Terminal Approach Area
- CTR
  Airport Control Zone
- VFR REP
  VFR Reporting Points
  Mandatory Entry/Exit Points
- Other
  Other airspace boundaries

Apart from FIRs, only airspace layers that are relevant to flight plan addressing are listed.

#### 2.1.2.1 Airspace visualization

A click on the box next to an airspace layer toggles its projection on the map. Multiple layers can be selected as well as all layers of a category at once.

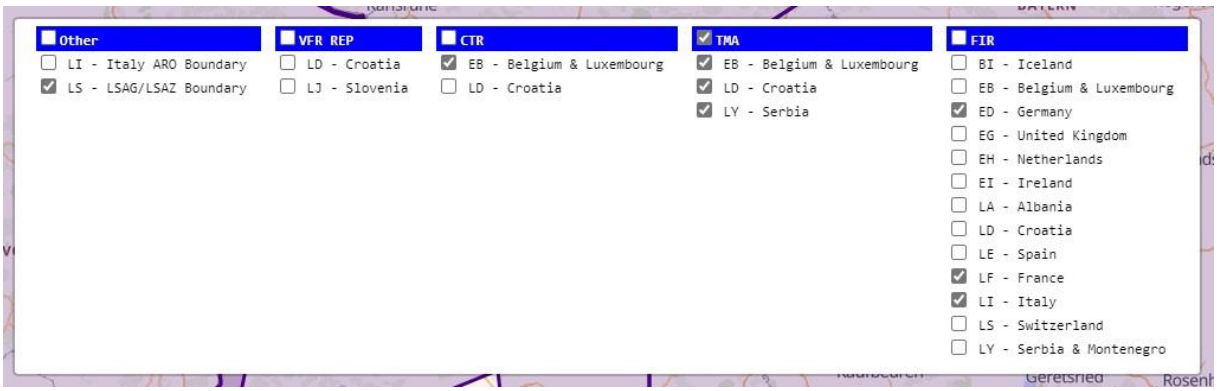



**Figure 4: Note the TMA selection to toggle all TMA layers.**

Note that the airspace layers are stacked based on the order they are selected.

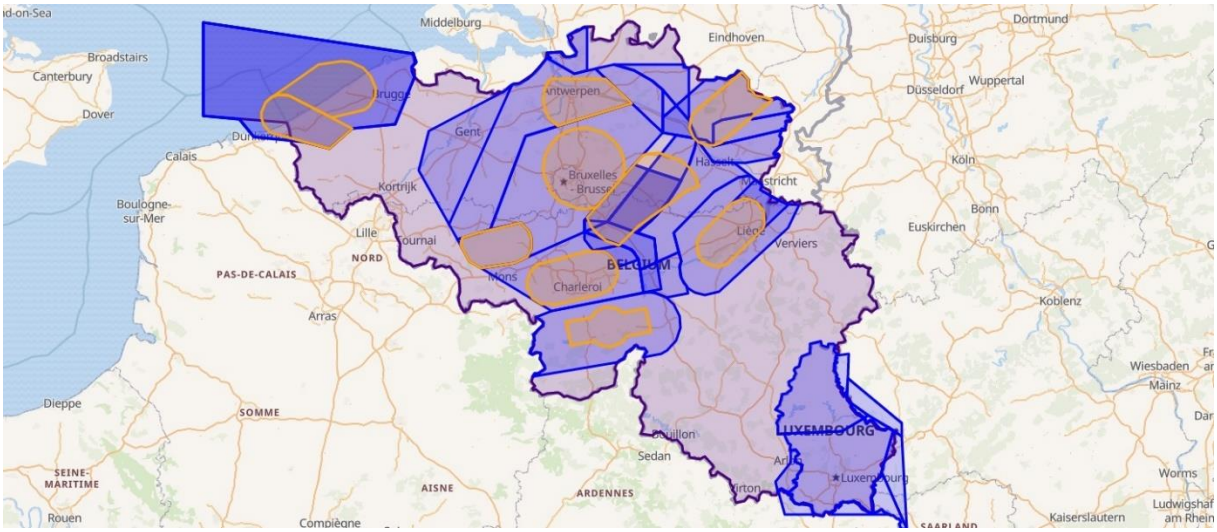
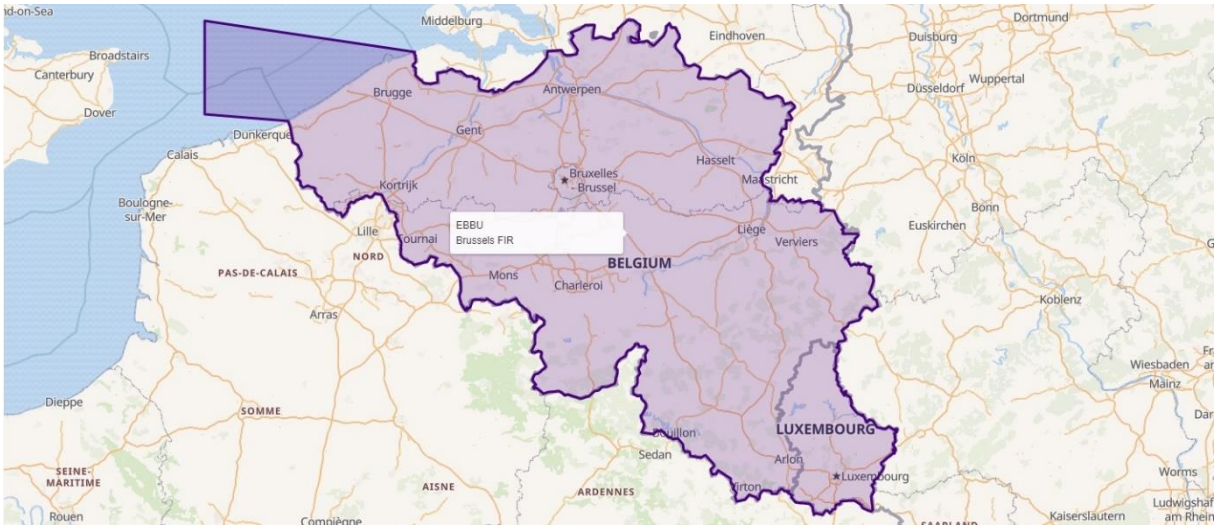



**Figure 5: Stacking of FIR, TMA and CTR layers in the order FIR > TMA > CTR.**

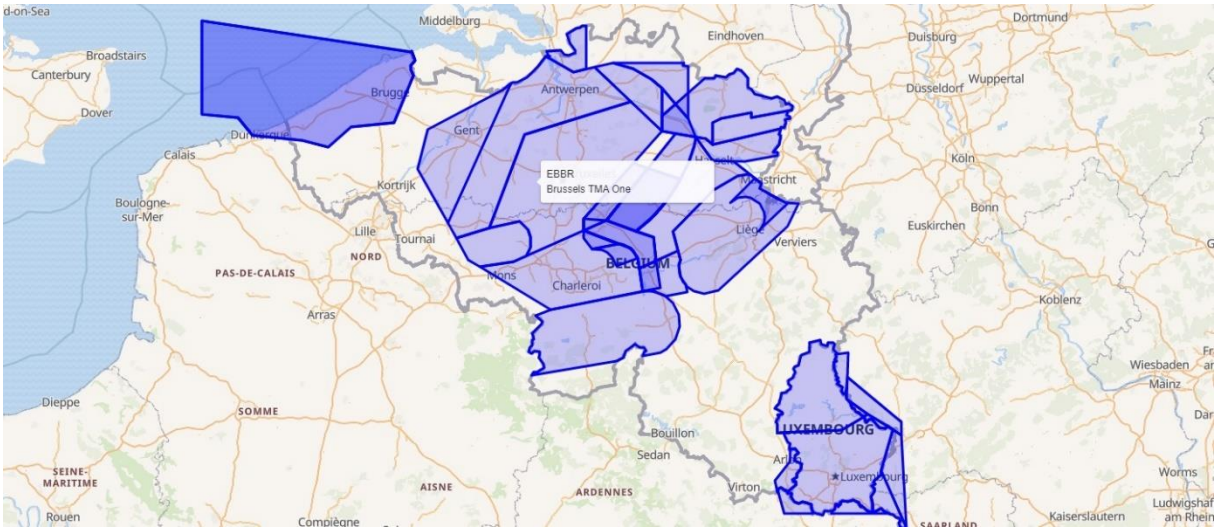
### 2.1.2.1.1 FIR

FIRs are displayed with a purple shade. Hovering over a FIR layer displays a tooltip next to the cursor with ICAO designator, name and airspace type.



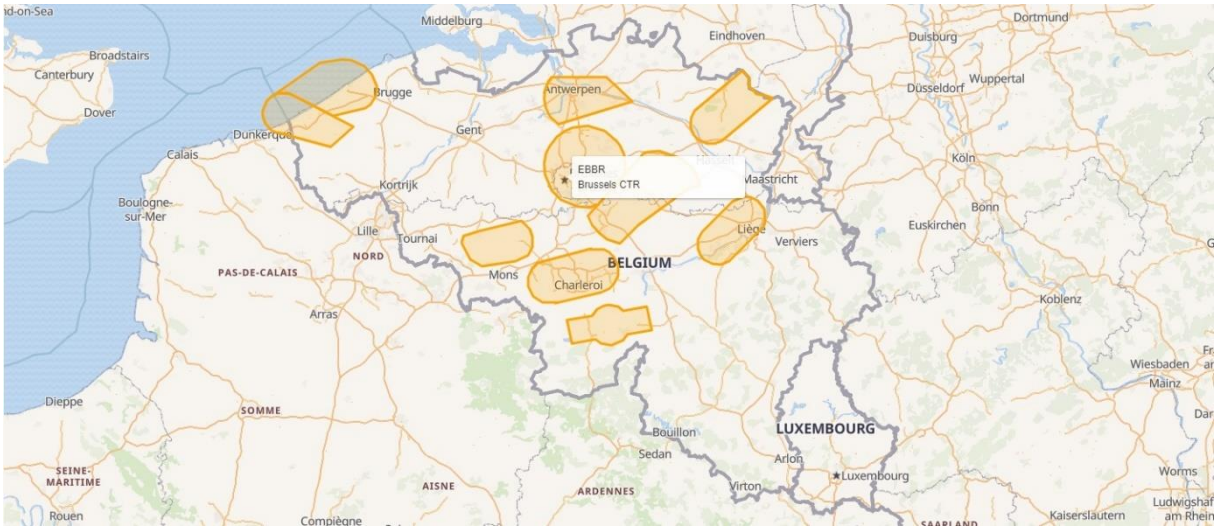
#### 2.1.2.1.2 TMA

TMAs are displayed with a blue shade. Hovering over a TMA layer displays a tooltip next to the cursor with ICAO designator, name and airspace type.



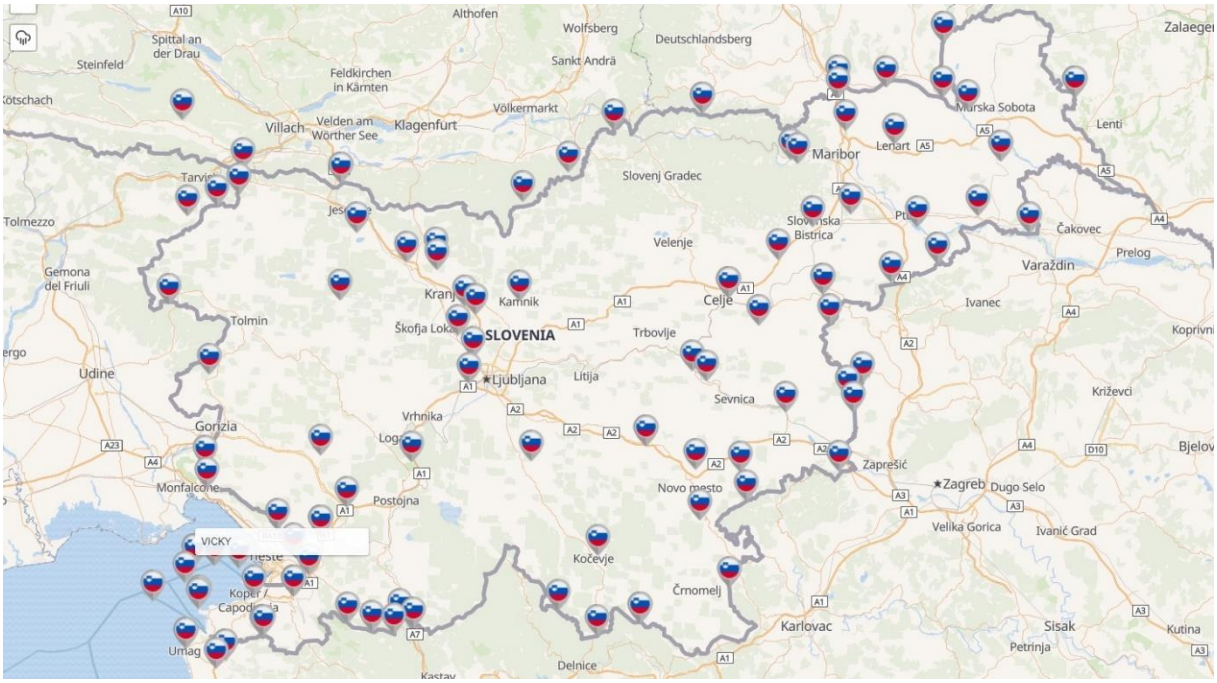

#### 2.1.2.1.3 CTR

CTRs are displayed with a yellow shade. Hovering over a CTR layer displays a tooltip next to the cursor with ICAO designator, name and airspace type.



#### 2.1.2.1.4 VFR REP

VFR Reporting Points are displayed as a marker with the respective country's flag. Hovering over a VFR Reporting Point displays a tooltip next to the cursor with the point designator.




#### 2.1.2.1.5 Other

Other airspace layers are displayed with a black shade. Hovering over an "other" airspace layer displays a tooltip next to the cursor with the layer description.

### 2.1.3 Options cluster bottom


From left to right, the options cluster bottom consists of:

#### 2.1.3.1 Cursor Coordinates


This field is visible when hovering over the map and displays the coordinates of the mouse cursor position in WGS84 coordinates, formatted as decimal degrees and degrees, minutes and seconds.

#### 2.1.3.2 Clear Markers


If markers are present on the map, clicking this button removes all of them.

#### 2.1.3.3 Clear Popups


If markers with open popups are present on the map, clicking this button closes all popups.


**Figure 6: Example of two airport markers, one with a closed and one with an open popup.**

#### 2.1.3.4 Clear Connection Lines


If marker connection lines are present on the map, clicking this button removes them while preserving the markers.


**Figure 7: Example of a marker connection line.**

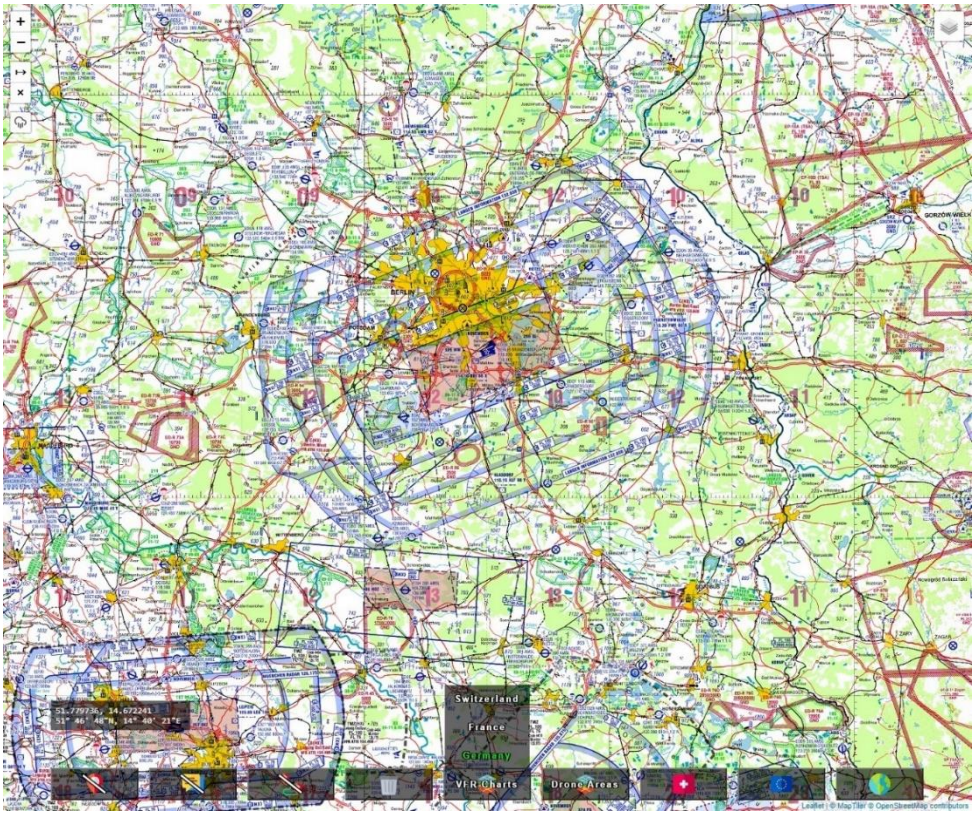
### 2.1.3.5 Clear all


Clicking this button removes all markers and lines from the map and clears all search fields.

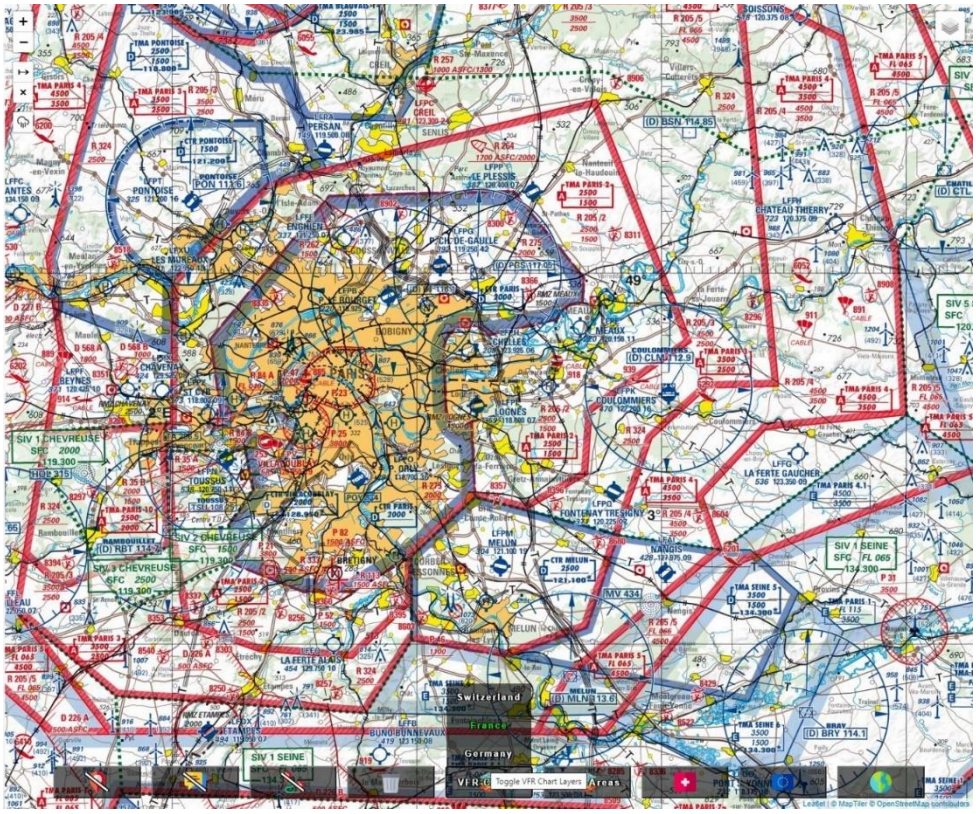
### 2.1.3.6 VFR Chart display


Clicking this button opens a context menu to choose the desired VFR chart to be projected onto the map. Active VFR maps are colored lime. Multiple VFR charts can be rendered at once. Note that they are stacked based on the order of selection.

#### 2.1.3.6.1 VFR Chart Germany




#### 2.1.3.6.2 VFR Chart France



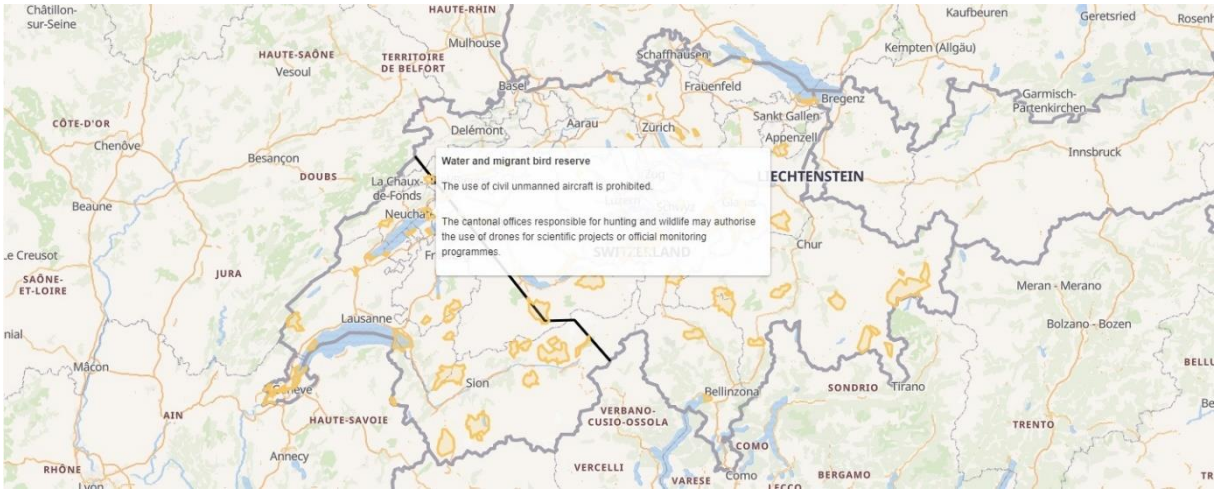
### 2.1.3.6.3 VFR Chart Switzerland


### 2.1.3.7 Drone Area Display


Clicking this button opens a context menu to choose the desired Swiss Drone Restriction area to be projected onto the map. Active Drone Areas are colored lime. Multiple Drone Areas can be rendered at once. Note that they are stacked based on the order of selection.

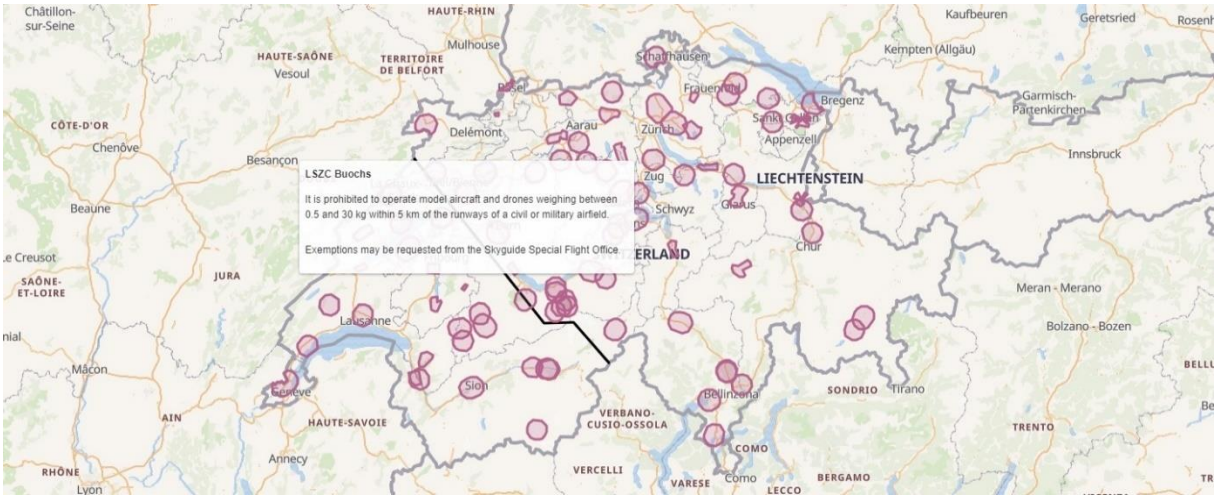
#### 2.1.3.7.1 Natural Reserve Areas

These areas consist of protected natural areas, for example game reserves, national parks or ornithological breeding grounds. They are displayed with a yellow shape. Hovering over a Natural Reserve Area displays a tooltip next to the cursor with the type of reserve area, the restriction in place and the authority to grant exceptions.




#### 2.1.3.7.2 Restricted Zones

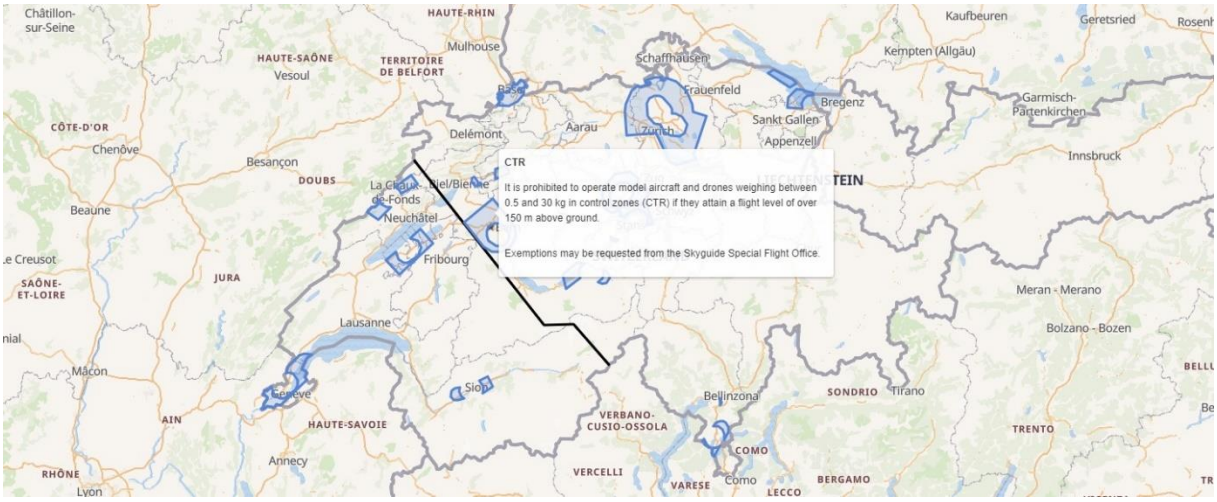
These areas depict the radius of five kilometres around an airport. They are displayed with a purple shape. Hovering over a Restricted Zone displays a tooltip next to the cursor with the ICAO Location Indicator and airport name, the restriction in place and the authority to grant exceptions.



#### 2.1.3.7.3 CTR

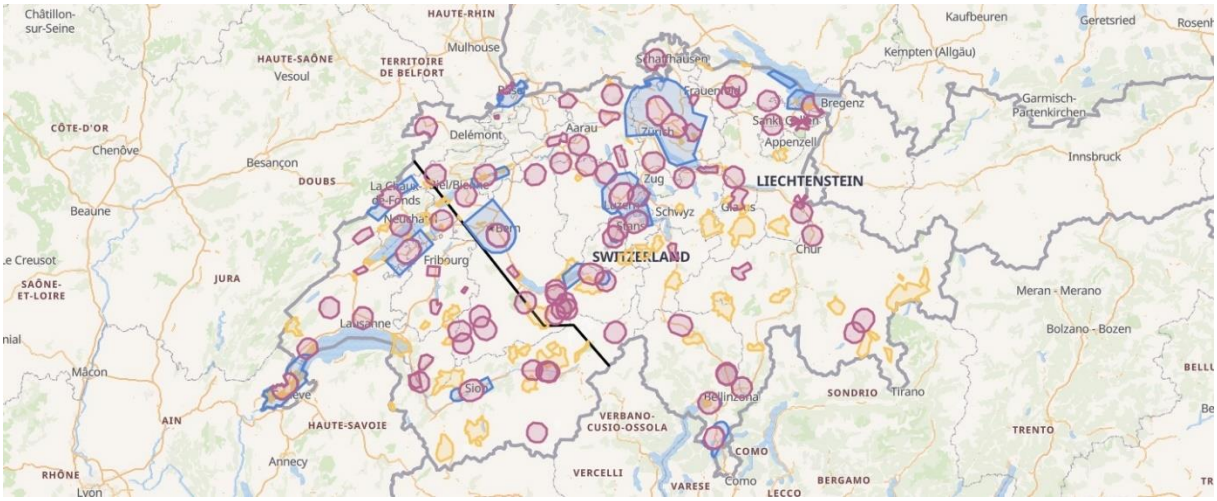
These areas depict the control zones of major airports. They are displayed with a blue shape. Hovering over a CTR displays a tooltip next to the cursor with the CTR annotation, the restriction in place and the authority to grant exceptions.

Note that due to how the data is delivered by swisstopo and FOCA, the ICAO Location Indicator and airport name are not part of the dataset.




#### 2.1.3.7.4 All Areas

This simply projects the Natural Reserve Areas, Restricted Zones and CTRs all at once.

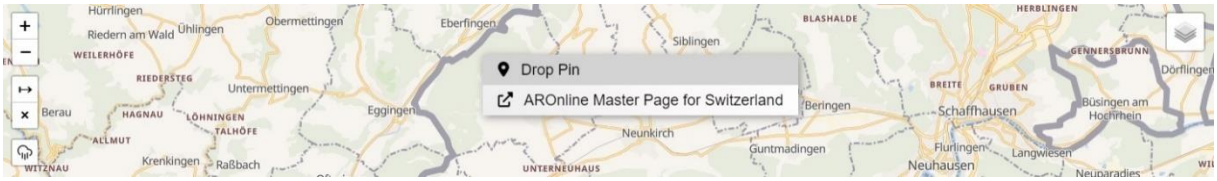



### 2.1.4 Additional Functionality

Some map functionality is not bound to the options clusters, but available from directly interacting with the map itself.

### 2.1.4.1 Drop pin

When right-clicking on the map, a context menu opens.




By choosing the option “Drop Pin”, a marker will be placed on the position where the right click occurred. By default, the marker has a closed popup. Clicking on the marker opens its popup with the designation “Custom Marker” and its coordinates in WGS84 decimal.


### 2.1.4.2 Link to AROnline

When right-clicking on a country, a context menu opens.


By choosing the option “AROnline Master Page for {country}”, the AROnline Master Page for the relevant country will be opened in a new tab.

Note that this only works over land and not water. An indication for this is, if the cursor looks like a crosshair, an AROnline link is accessible. If it looks like a hand, no AROnline link is accessible. The right click context menu will subsequently not display an “AROnline Master Page for {country}” link.

Also note that this only works within the skyguide network, as AROnline is an intranet site and not accessible from outside the skyguide network.

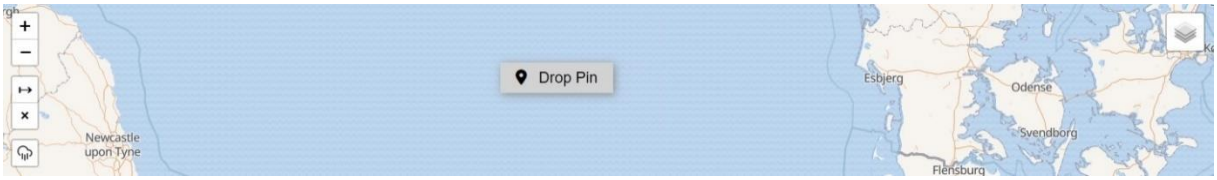



**Figure 8: Note the absence of an AROnline link when right-clicking on water.**

### 2.1.4.3 Marker Connection Line

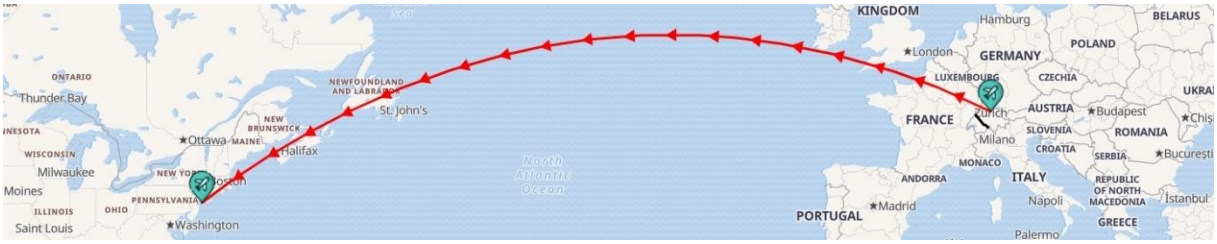
Provided there are at least two markers on the map present, the Marker Connection line functionality is enabled.

By double-clicking on one marker, and then double-clicking on another marker, a red line is drawn between them with arrows indicating the direction (i.e., from first to last double-clicked marker).


**Figure 9: Note the arrows indicating the direction.**

Chaining multiple markers together is also possible.


The line accounts for the curvature of the earth.




As soon as a line is plotted, the Time/Distance measurement dialog opens aswell:

### 2.1.4.4 Time/Distance measurements

As soon as two markers are connected with a line, the Time/Distance dialog opens at the top of the map view.

It displays, from left to right:

- DEP
  The starting marker
- DIST
  The distance in nautical miles between the connected markers. The distance takes into account the curvature of the earth
- DEST
  The endpoint of the line connection
- TIME
  Provided the input field in “Speed in Knots” has a value, displays the estimated elapsed time in hours, minutes and seconds from DEP to DEST based on the line connection and thus the distance between the markers
- TOTAL DIST
  If only two markers are chained, simply displays the distance in nautical miles between them. If more than two markers are chained, displays the sum of each marker pair distance, i.e., the distance from the very first to the very last marker in the chain
- TOTAL TIME
  Provided the input field in “Speed in Knots” has a value , same as TOTAL DIST, but with the estimated elapsed time

By default the last chain is displayed at the top.


**Figure 10: Note the 100 in the "Speed in Knots" field, yielding TIME and TOTAL TIME values**


**Figure 11: Note the individual TIME values and the TOTAL TIME value**

By clicking the arrow in the lower middle of the Time/Distance dialog, the dialog window expands downwards to allow an overview over all chained connections without the need for scrolling.

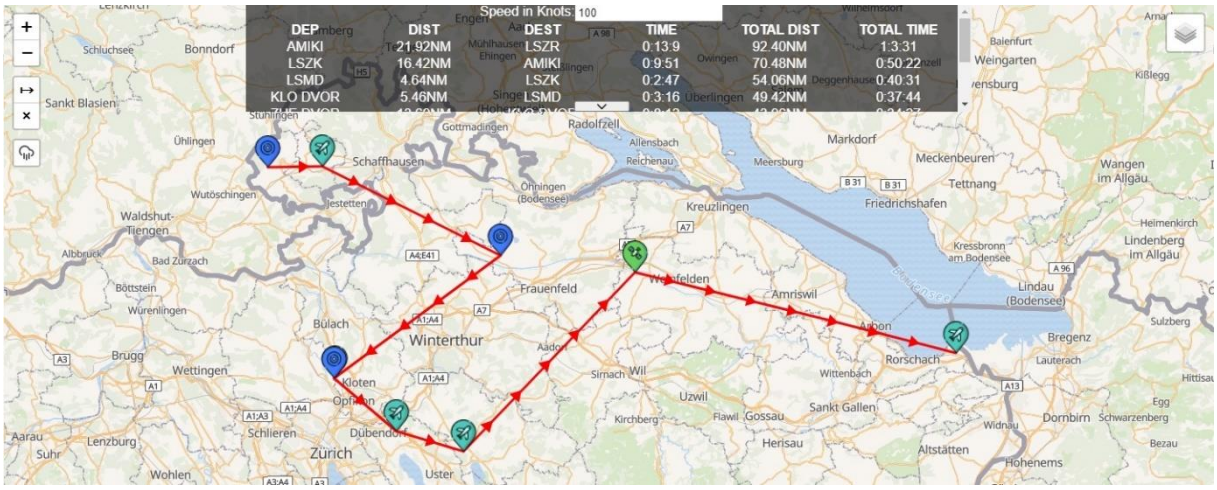
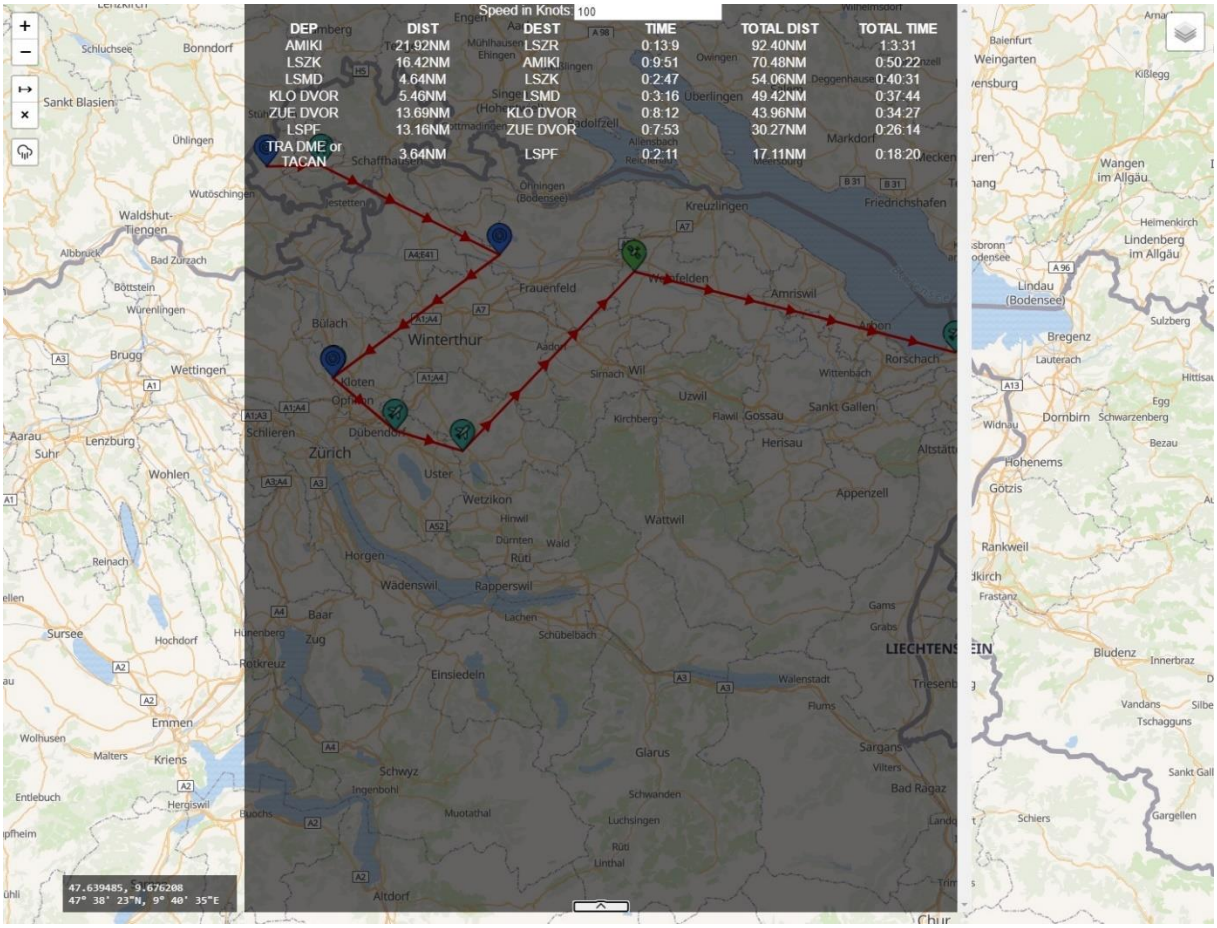



**Figure 12: Note the scrollbar indicating more markers outside the visible area.**




By clicking the “Clear all” button in the bottom options cluster, the marker lines are removed and the Time/Distance dialog disappears.

## 2.2 Tool View

The Tool View consists of a sidebar with five toggle-able sections:

### 2.2.1 Search on Map

The main and default section. This allows an operator to query different database entries and have the results plotted on the map as a marker. It consists of seven input areas, whereas six of them query different categories of database entries and the seventh queries the other six at once.

While “Entire Route” is the topmost input area, it is described last as it combines the other six together.

#### 2.2.1.1 Search Location Indicator

This input area takes an ICAO airport location indicator as an input and queries a worldwide database against it. Multiple location indicators can be queried separated by a space. The input is case insensitive.

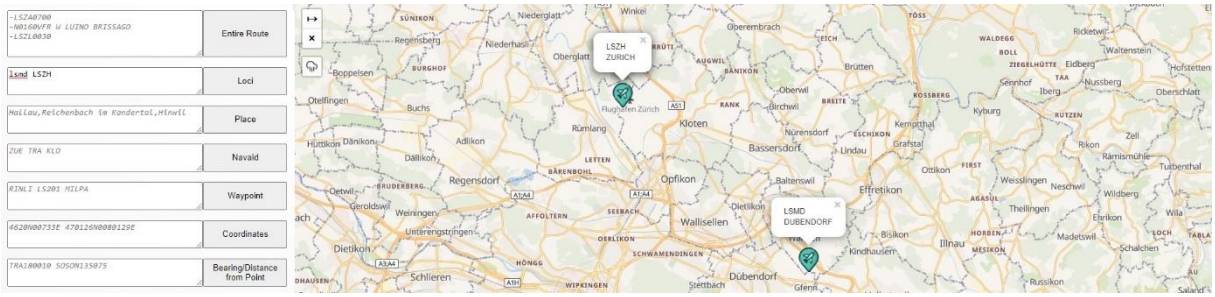



**Figure 13: Note the case insensitive input**

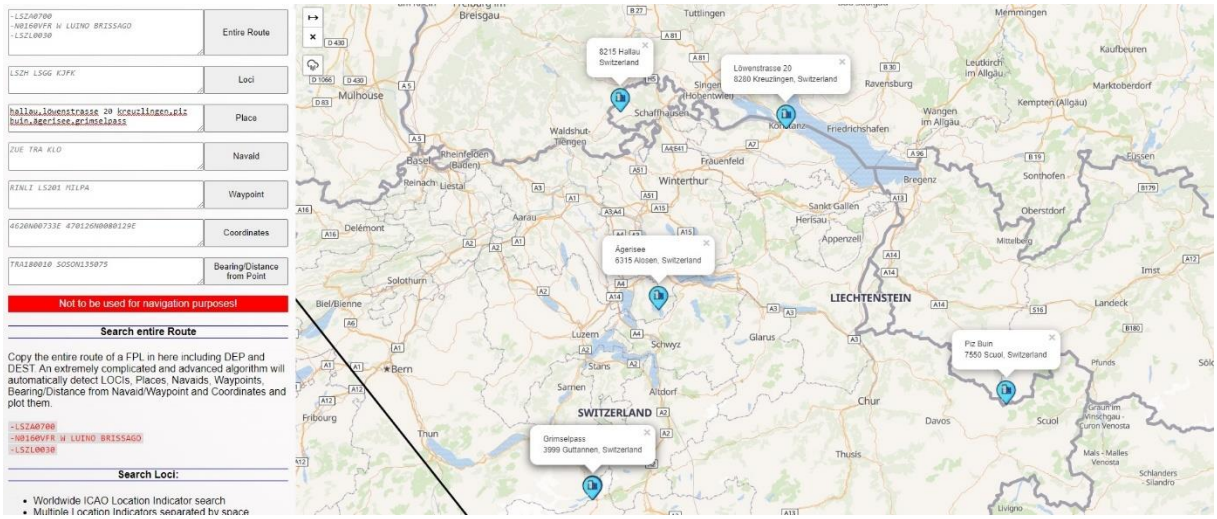
ICAO Location Indicator markers feature a popup displaying the location indicator and airport name.

### 2.2.1.2 Search geographical location

The input area takes a geographical location as an input and forms a request to an API provider, whose response will be plotted on the map.

Geographical locations consist of cities, towns, villages, lakes, rivers, mountains, street addresses, mountain passes and some points of interest and are worldwide.

Multiple geographical locations can be queried separated by comma (this is because geographical locations can have spaces in their name, e.g., “Bad Zurzach”). The input is case insensitive.




The query is biased towards Switzerland, meaning it will primarily return results concerning Switzerland. However, the ATM cannot comprehend context, so if multiple results match a query, they will all be plotted on the map.


**Figure 14: Note the world wide results for the query "Matterhorn".**

Geographical location markers feature a popup displaying the name of the location and additional information depending on the type, such as zip codes, county codes or country names.

### 2.2.1.3 Search Navigation Aid

The input takes a three-letter navigation aid indicator as an input and queries a worldwide database against it. Multiple navigation aids can be queried separated by a space. The input is case insensitive.

Two or one letter navigation aids are omitted to prevent overplotting, see Search Entire Route.

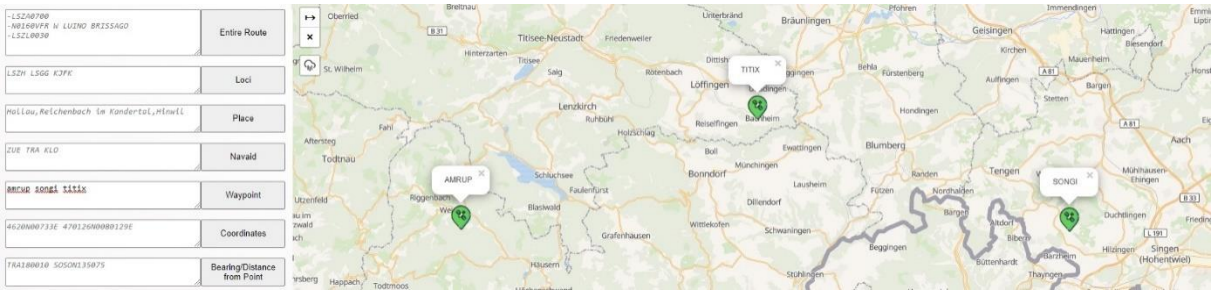
Navigation aids consist of VOR, DME, VORTAC and TACAN. Since NDBs are not part of the dataset, they cannot be queried.


Navigation Aid markers feature a popup displaying the three-letter designation and the navigation aid name.

### 2.2.1.4 Search Waypoint/Reporting Point

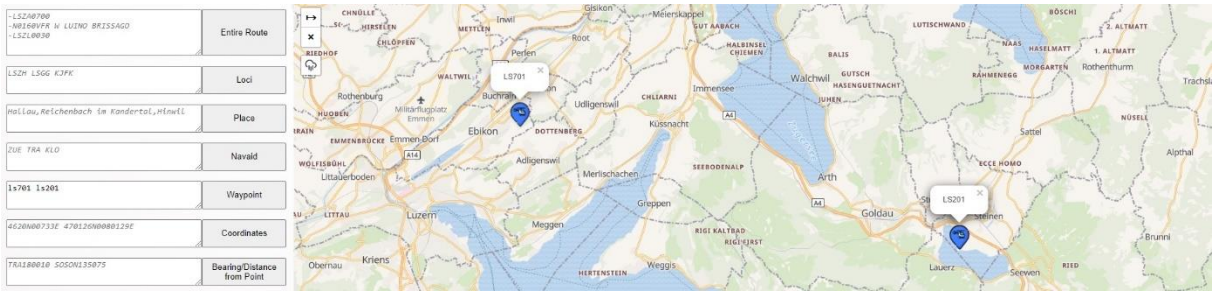
The input takes a five-letter Waypoint/Reporting Point indicator as an input and queries a worldwide database against it. Multiple Waypoints/Reporting Points can be queried separated by a space. The input is case insensitive.

Due to limitations in the dataset, no Waypoints/Reporting Points in the southwestern hemisphere are available. This means that almost the entirety of South America south of the equator is not part of the dataset and cannot be queried.




Waypoint/Reporting Point markers feature a popup displaying the five-letter designation.

Included in the dataset are also Swiss LFN Waypoints:




LFN Waypoint markers feature a popup displaying the two-letter/triple digit designation.

### 2.2.1.5 Search Coordinates

The input takes a WGS84 coordinate as an input and directly plots it on the map. Multiple coordinates can be queried separated by a space. The input is case insensitive.

The format is either in Degrees Minutes or Degrees Minutes Seconds, as {nnnn}N|S{nnnnn}E|W or {nnnnnn}N|S{nnnnnnn}E|W, so for example 4701N00728E or 541322S0182714W. Borth formats can be queried together.


Coordinate markers feature a popup displaying the coordinate in WGS84 decimal degrees and degrees minutes seconds as per input format but separated by a space for readability.

### 2.2.1.6 Search Bearing/Distance from point

The input takes a five-letter Waypoint/Reporting Point indicator or a three-letter navigation aid indicator as an input combined with an azimuth in 360 degrees and a distance in nautical miles. Query is dependent on the Navigation Aid and Waypoint/Reporting Point databases. Multiple bearing/distance pairs can be queried separated by a space. The input is case insensitive.

The format is in Waypoint/Reporting Point or Navigation Aid indicator followed by azimuth followed by distance in one string, as {aaaaa}{nnn}{nnn} or {aaa}{nnn}{nnn} so for example AMIKI123050 meaning the marker will be set 123 degrees and 50 nautical miles from the coordinates of AMIKI itself.

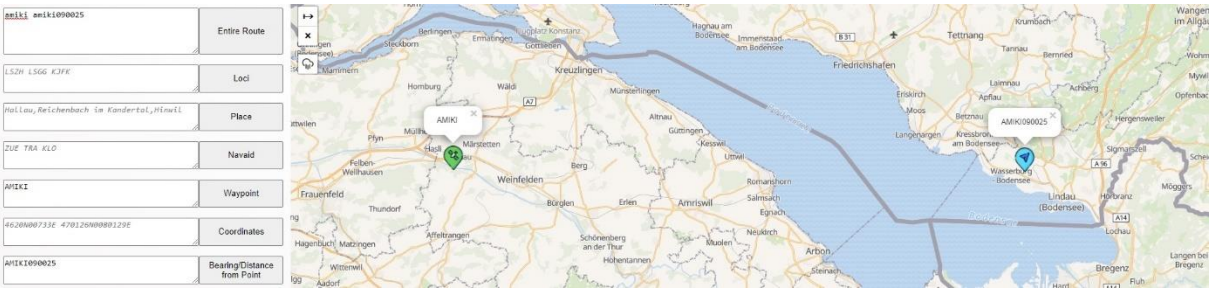



**Figure 15: Example: AMIKI and 25 Nautical Miles, 90 degrees distance from AMIKI**

Bearing/Distance markers feature a popup displaying the result the same as the input query.

### 2.2.1.7 Search Entire Route

This input takes in anything but is primarily meant to paste in complete flight plan routes. It is able to parse the input according to the six different input categories and plot everything together on the map. Meaning an operator can search a flight in FlightSearch, copy the flight plan route and paste it in without any formatting and having it plotted on the map.

Message state:Closed
AIM3901 152008
FF LSZMZPZX
152008 KBLIHAEX

(FPL-HBKPN-VG
-TB20/L-SDGY/SB1
-LSZM0900
-N0146VFR DCT OLNAV DCT UVULA DCT RONAG DCT 4650N01031E DCT TISAX DCT PBW1 DCT
-LIPB0047 LOWI
-EET/LIMM0030 RMK/PILOT DINO FIORI +41793353627, CREATED BY SKYDEMON,
SUPP INFO RQS KBLIHAEX DOF/220316)

**Figure 16: Step 1: Copy the route of the flight plan including DEP and DEST**

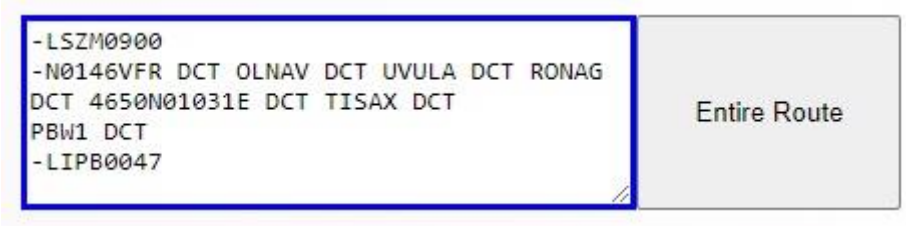



**Figure 17: Step 2: Paste it directly to the "Entire Route" input**

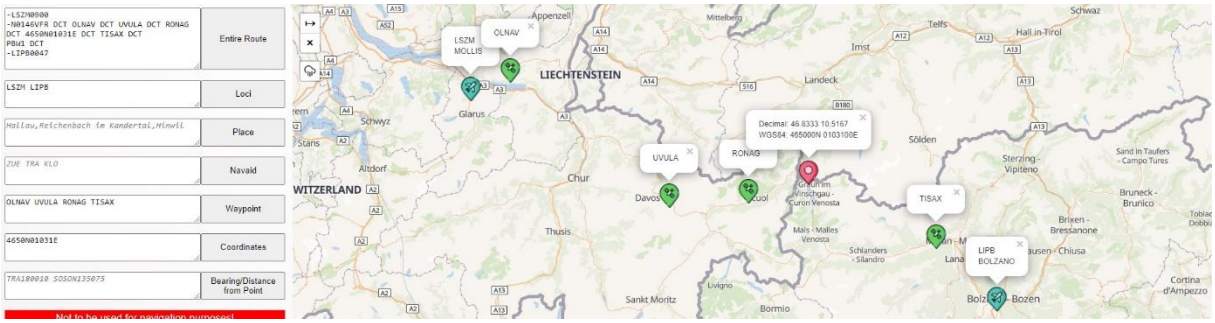


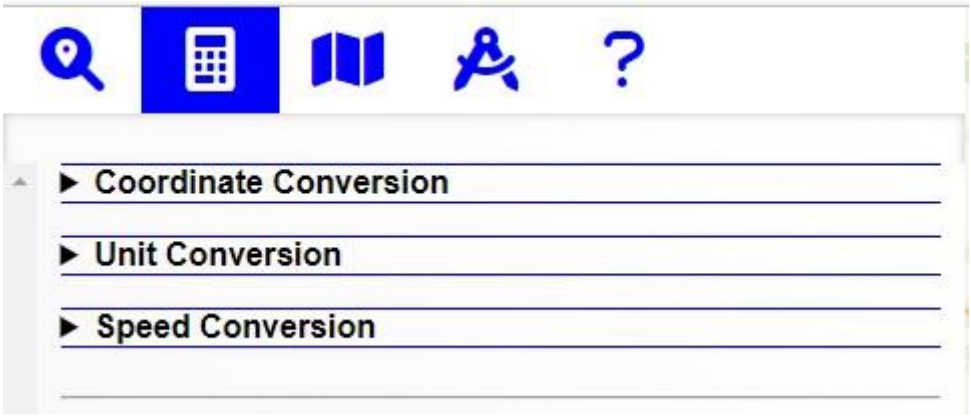

**Figure 18: The AMT will break down the route into categories and plot them. Note how the other input fields are populated with the detected values.**

This has some limitations, so sometimes manual adjustment is necessary, which is why the route gets broken up into the six categories and their respective input fields are populated. So, adjustments can be made in the respective field and the result plotted in addition to what is already on the map, without deleting everything.

For geopgraphical locations with spaces in their name (like “Bad Zurzach”), it is not advised to use the “Entire Route” input. Use “Place” instead. “Place” can also be used to fix broken geographical locations in a flight plan route without losing the other markers.

### 2.2.2 Unit Conversions

This section features unit conversions from and to coordinates, length and speed units. Each topic is accessible by clicking its title.




#### 2.2.2.1 Coordinate Conversions

This allows conversion from and to:

- WGS84 Degrees Minutes
- WGS84 Degrees Minutes Seconds
- WGS84 Decimal Degrees
- Swissgrid LV95

Input coordinate format can be chosen by dropdown. Default is WGS84 Degrees Minutes.
The format must be according to the placeholder coordinate in the input field. This is especially relevant if multiple coordinates are to be converted at once.

With the “Convert” button, the input coordinate(s) will be converted to all other formats in the same order as the input coordinate(s).

With the “Plot” button, the coordinates can be plotted to the map if desired.

The conversion tool can handle multiple coordinates at once, theoretically an infinite number. However, because the Swissgrid conversion uses an API, converting a high number of coordinates can take a lot of time.

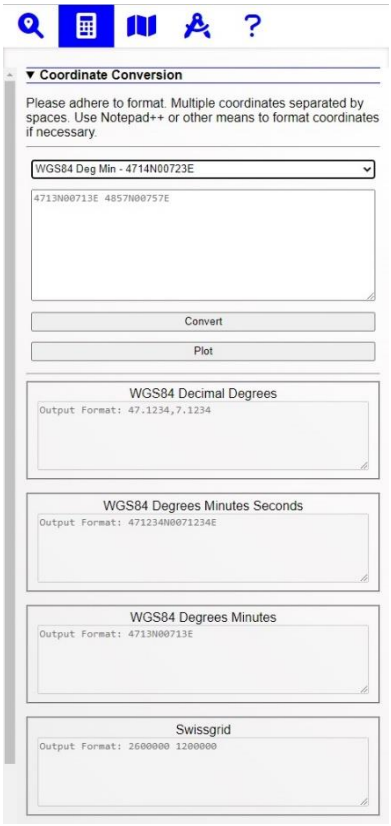



**Figure 19: Default view. Not the placeholder format and the output formats.**

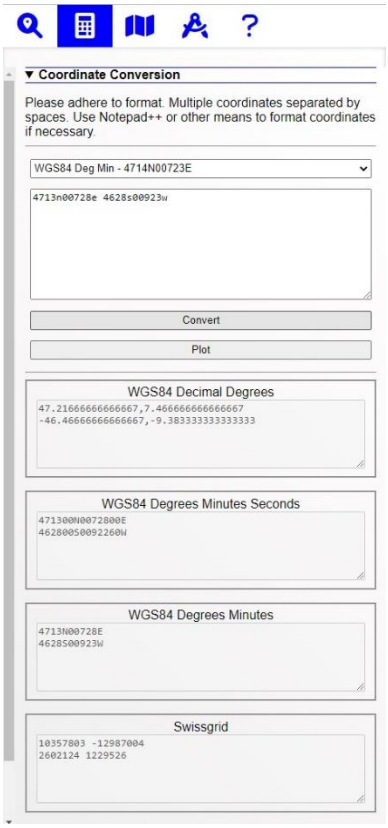



**Figure 20: Converted coordinates**

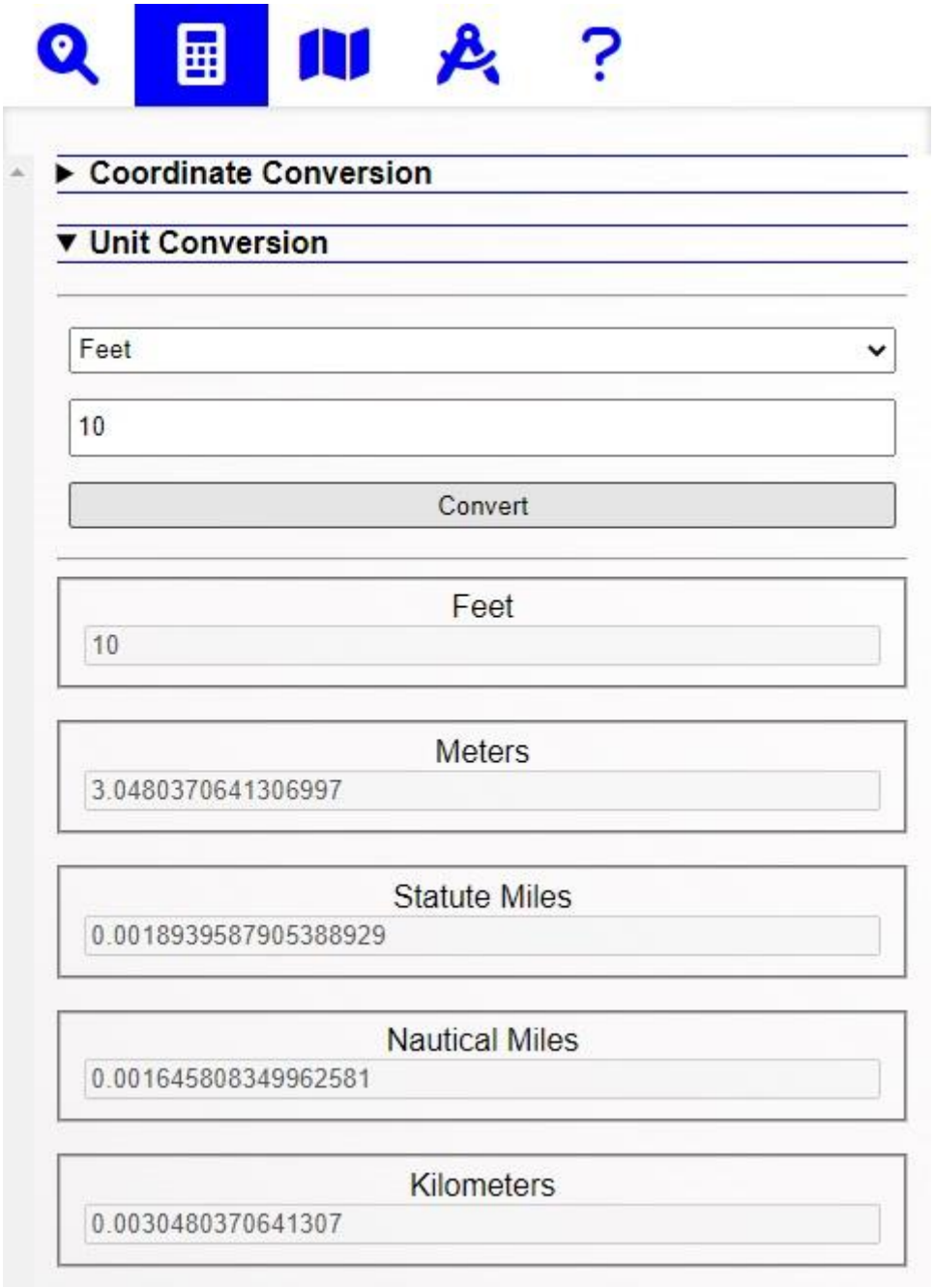
#### 2.2.2.2 Unit Conversions

This allows conversion from/to:

- Feet
- Meters
- Statute Miles
- Nautical Miles
- Kilometers

Input unit format can be chosen by dropdown. Default is Feet.

Input takes a number (integer or floating point).
With the “Convert” button, the input unit will be converted to all other units.



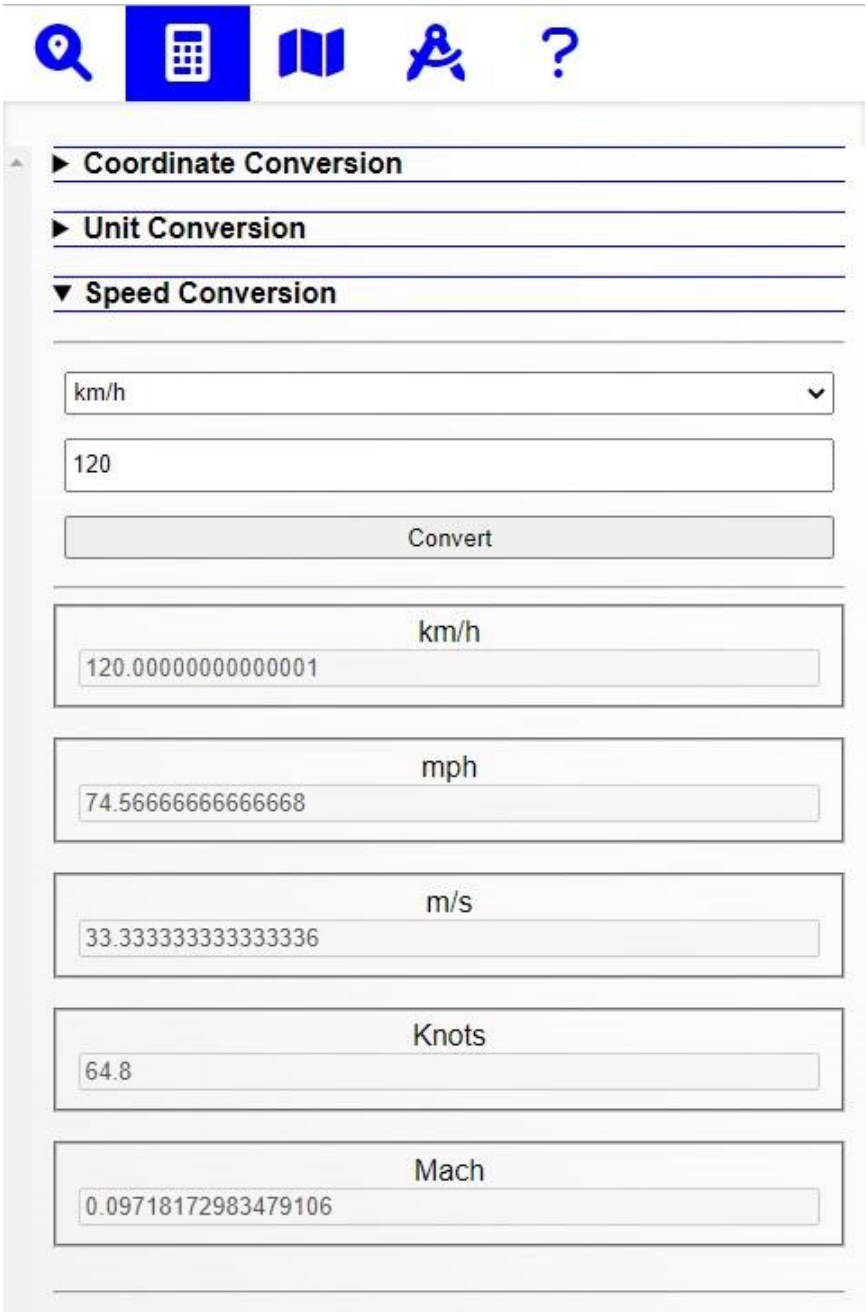
#### 2.2.2.3 Speed Conversions

This allows conversion from/to:

- Kilometres per Hours
- Statute Miles per Hour
- Meters per Second
- Knots
- Mach Number

Input unit format can be chosen by dropdown. Default is Kilometres per Hour.

Input takes a number (integer or floating point).
With the “Convert” button, the input unit will be converted to all other units.



### 2.2.3 Map Styles

This allows for a choice of map styles according to user preference.
Currently, these map styles are supported:

- Basic
  Stylistic street map with clear administrative borders
- Satellite
  Aerial photography map with borders and labels
- Open Street Maps
  Stylistic street map provided by the OSM Project
- Swisstopo
  Stylistic map provided by the Swiss Federal Office of Topography
- National Geographic
  Highly stylized political border map
- NASA/ESRI
  High resolution aerial photography map without borders and labels

Default is “Basic”.

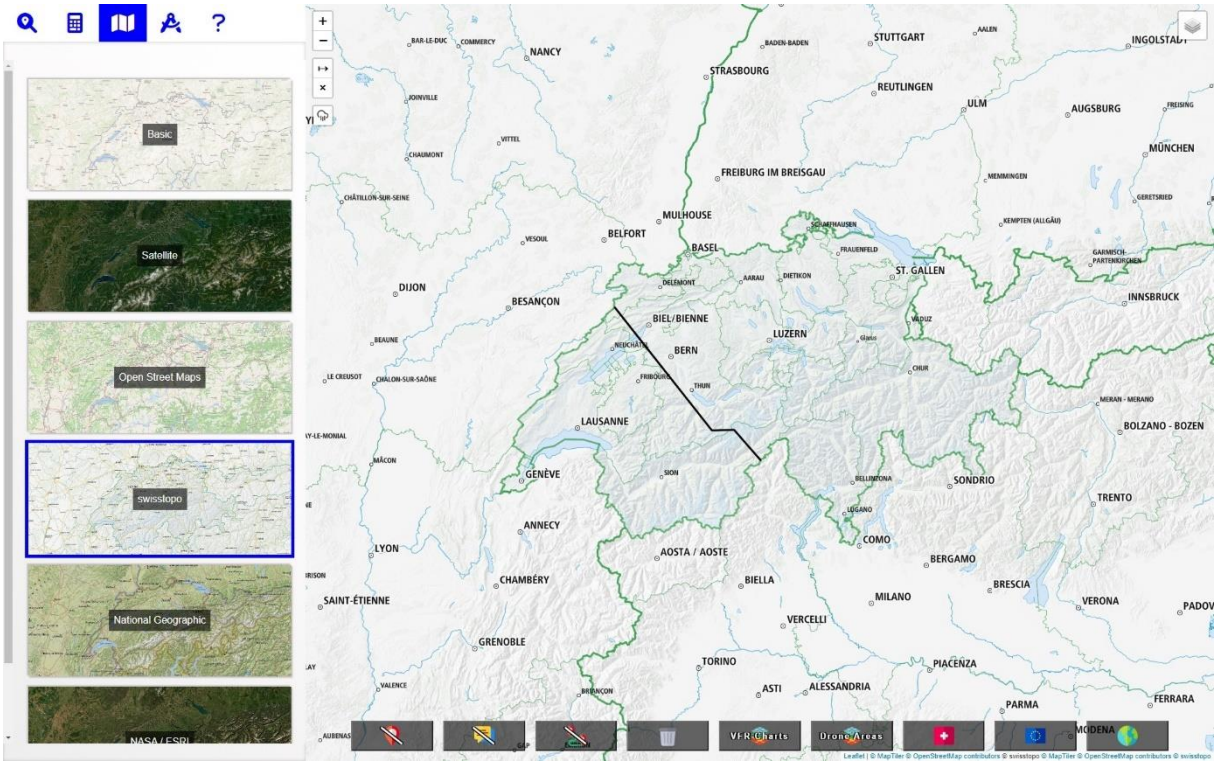
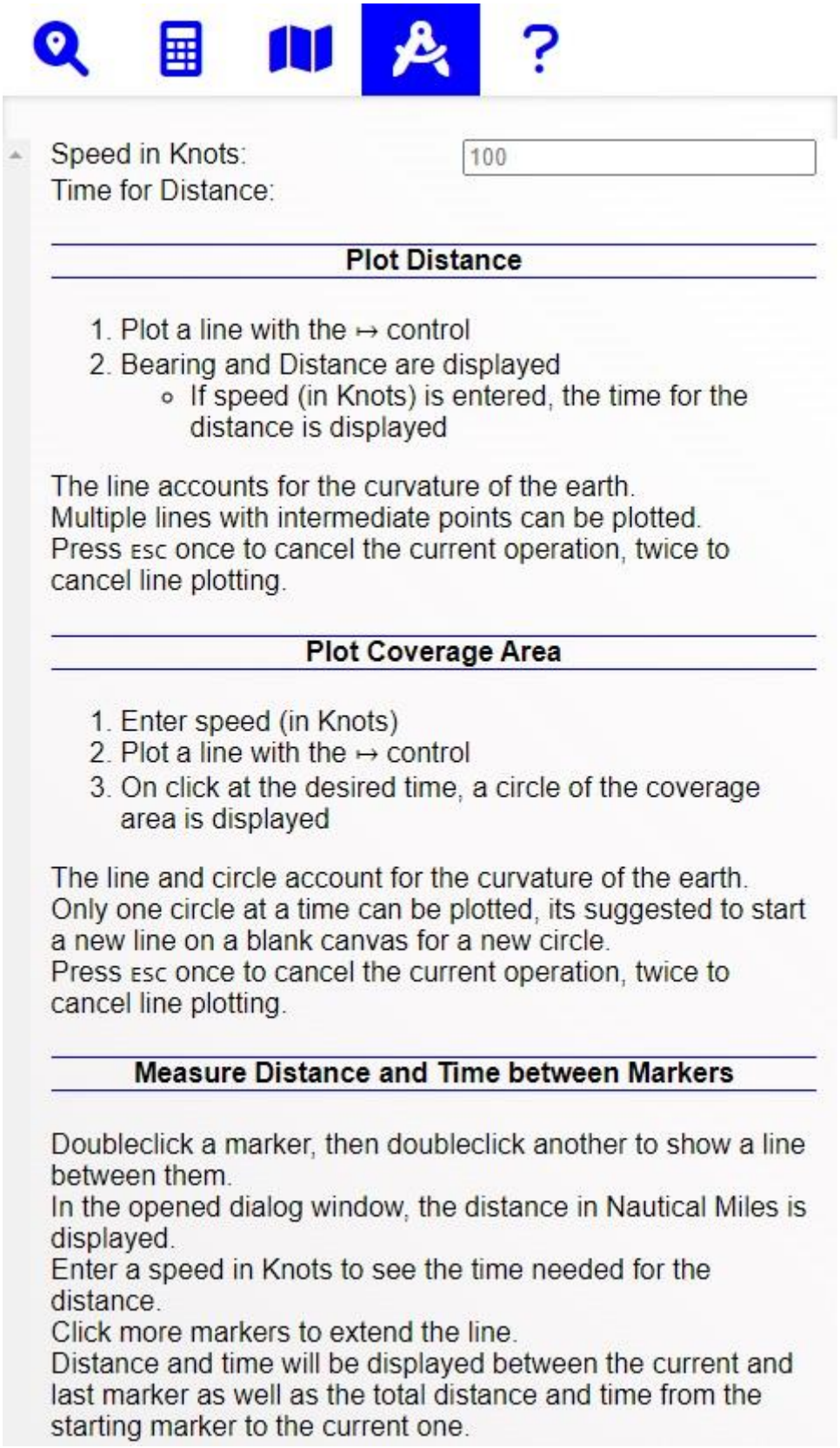



**Figure 21: AMT map in the "swisstopo" style**

### 2.2.4 Measurements

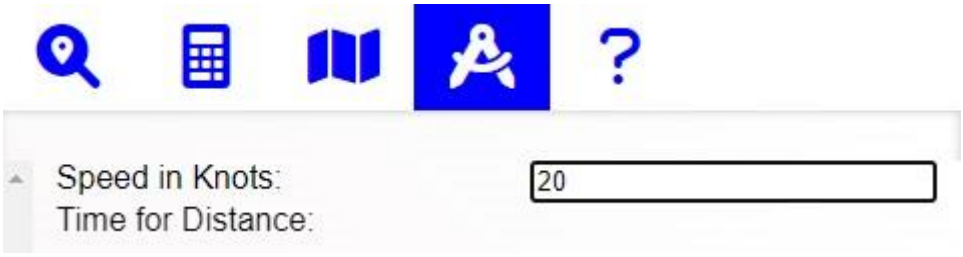
This works in conjunction with the Line Measurement function described in chapter 2.1.1.2. It is mainly geared towards estimating the penetrated airspaces of balloon flights.



### 2.2.4.1 Plot Coverage Area

To expand the Line Measurement function with a coverage area, meaning to visualize the total area an aircraft can reach in a given time based on its speed and its total EET (or the endurance), these steps must be followed:

1. Enter the speed of the aircraft in knots




2. Activate Line Measurement function and click at the desired starting point


3. When moving the cursor, note the calculated time displayed under the speed input. Draw the line until the desired time is reached

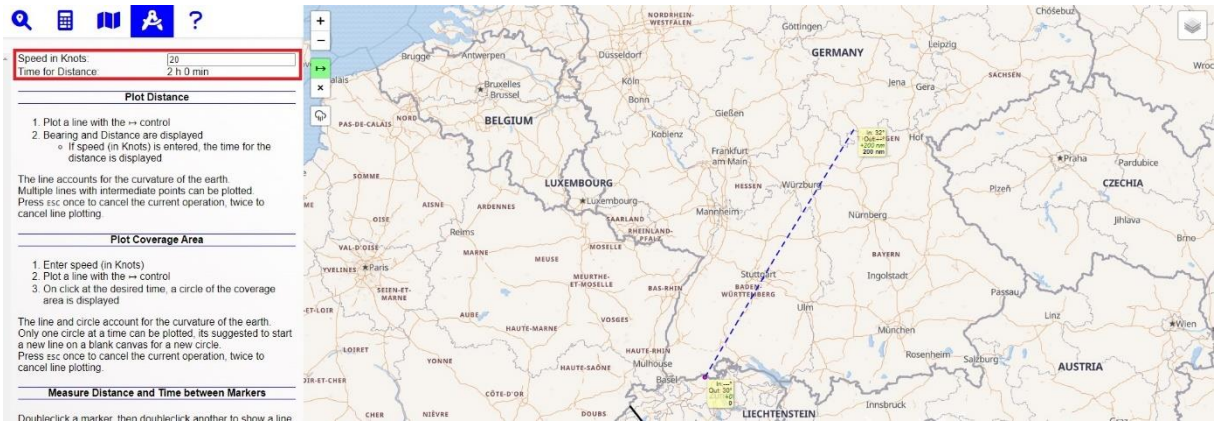
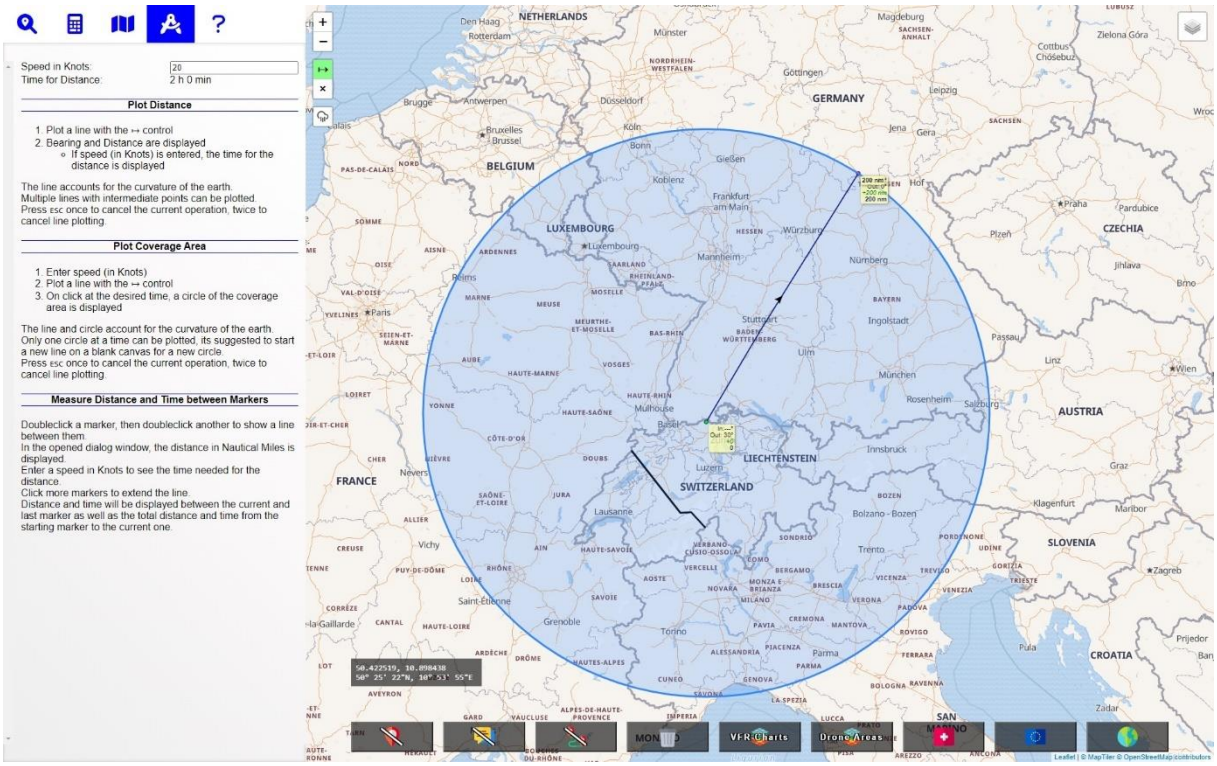



**Figure 22: Note the 2 hour estimate below the speed input**

4. By clicking at the desired end point, a circle will be displayed with the radius of the distance




5. Press ESC once to cancel the line drawing and retaining the circle, allowing for additional layers to be displayed, e.g., airspaces.

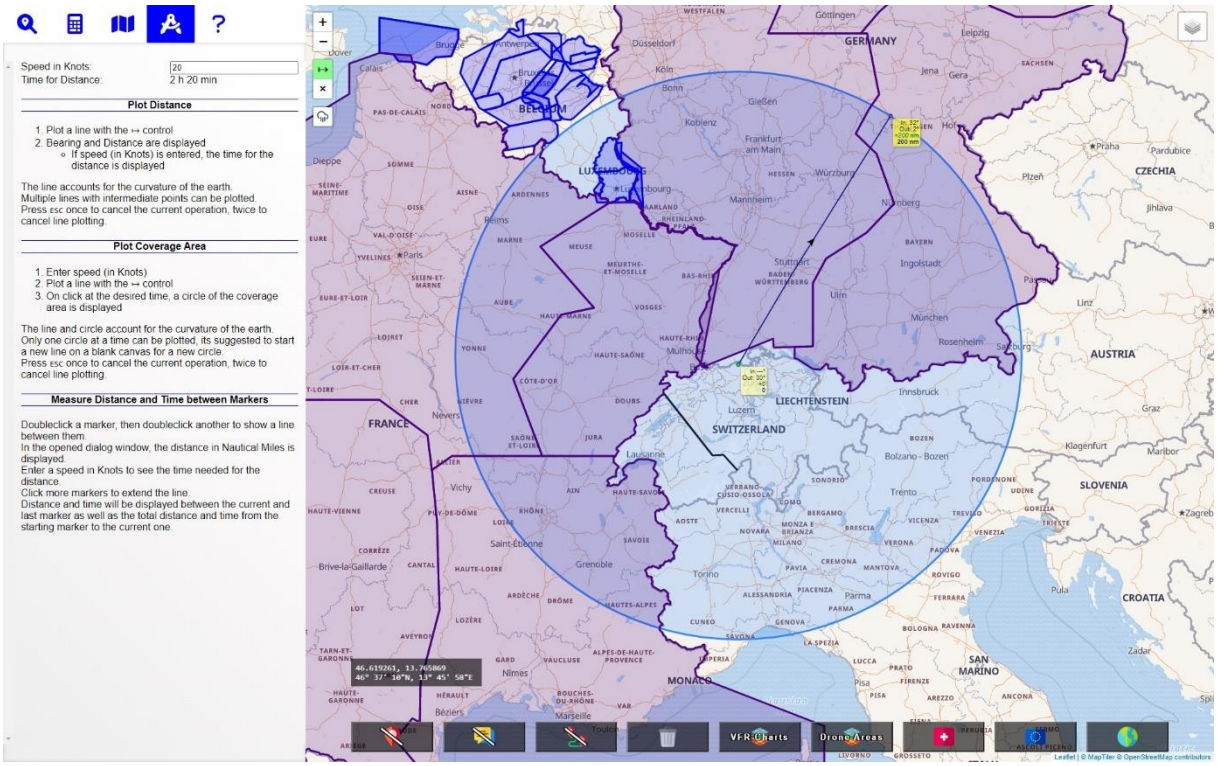



**Figure 23: Example of additionally displayed FIR and TMA**

6. Press ESC again to clear the circle.

Notes:

The circle is always drawn from the original starting point to the last set end point. Meaning that if after Step 4, ESC is not pressed and instead, a further line is drawn, the circle will adapt to the size dictated by the new end point.

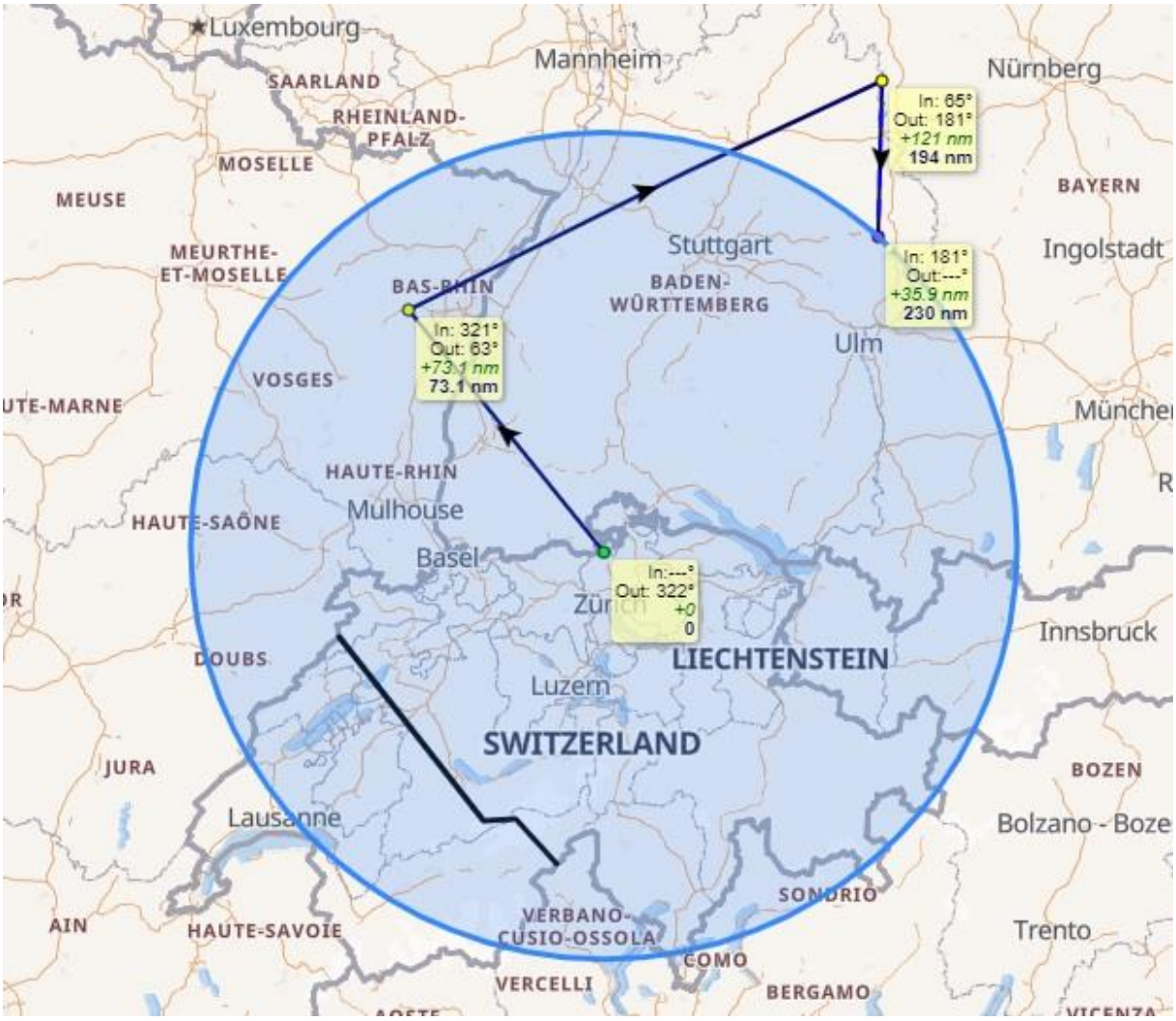



**Figure 24: Note the circle being drawn to the last set endpoint and the intermediate points being ignored**

### 2.2.5 Information

This section features various bits of information about the AMT, providing github & Trello links, citing sources and attributions and holds the copyright information.

## 3 About

The AMT has its roots in the inherit frustration of needing to use a multitude of different tools to achieve one goal, which is as annoying as it is inefficient.

Kickstarted by Jaqueline Müller and her frustration in using an online coordinate conversion tool, I set out to build my own. But wouldn't it be nice to visually represent where that converted coordinate is on a map? Yes. Yes, it would be.

One thing led to another and ultimately culminated in the tool you can use today, moulded by my personal requirements as well as valuable feedback and requests from test audiences.

The ATM is fully open source and also uses open-source data.

### 3.1 Tech Stack

The ATM is built from scratch in HTML5, CCS3 and vanilla JavaScript using leaflet and several APIs as well as local JSON "databases".

Python is used for the custom geoJSON converter and merger to process EAD SDO Report XML files.

A detailed technical overview including dependencies can be found on github.

### 3.2 Deployment & Hosting

The ATM is hosted on render.com as a static page and can be deployed directly from the render.com dashboard, which is connected to the github repo and allows deployment of the latest or a custom commit.

### 3.3 Source Code

The source code in its entirety can be found on github.

### 3.4 Changelog

A Trello board is used as a general status overview for the following:

- Feature Requests from AIM Personnel
  Requests or ideas by AIM personnel, regardless of their scope or actual chances of implementation (i.e., even unrealistic ideas are noted)
- Planned Features by weberml
  Planned features and ideas for later implementation by the developer. These are at least theoretically realistically achievable.
- Issues & Bugs
  Code bugs or UI/UX issues are noted here. Can also include API limitations and the like.
- In Progress
  Features and fixes that are being worked on in some capacity. Can also include implemented features/fixes for which feedback is required.
- Implemented/Fixed
  Completed feature/fix, deployed to production and not requiring feedback.
- Not implemented/fix not possible
  This can be for any reason like not realistic, requiring significant alteration of core logic, no API providers, etc.