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## **MERSEA IP**

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# **File format for exchange and common presentation of oil spill forecast model data in MERSEA demonstrations**

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## 1. INTRODUCTION

This technical report addresses MERSEA Deliverable D12.3.5 of Task 12.3.

### **TASK 12.3: Oil spill fate prediction**

D12.3.5 Report on oil spill forecast demonstrations in Mediterranean .....Mo 44

The oil spill forecast services at the three partners participating in MERSEA TASK 12.3 – the Norwegian Meteorological Institute (met.no), Meteo-France (MF) and the Oceanographic Centre, University of Cyprus (OC-UCY) – have all undergone significant developments in order to utilise ocean forcing data from the MERSEA Forecast TEPs. These developments are documented in D12.3.2 (WP12-MF-STR-01-1A) and D12.3.4 (MERSEA-WP12-METNO-STR-001). In order to evaluate the value of the MERSEA forcing data, the models will be applied in demonstration exercises in various ocean areas, including the Mediterranean Sea and the Nordic Seas.

In these demonstrations it is important to enable a comparison of the results from the various oil drift models as well as make the results easily viewable by selected users. A common viewing and data exchange platform is therefore required. On the suggestion of colleagues at MF, we have selected *Google Earth* as the platform for viewing, with the associated *KML* data format as the data packaging format. This solution has the advantage of making the results easily accessible and viewable to a broader audience.

This technical report documents the implementation of data from the oil spill forecast models and drifter observations in the Mersea Task 12.3 demonstrations in *KML* format. Beyond the task group, the intended readership for this report includes other providers of ocean drift forecast data who wish to reach a broader audience of users.

## 2. THE GOOGLE EARTH KML FORMAT

The *Google Earth KML* format is developed to allow display of diverse information graphically on *Google Earth* and *Google Maps*. *KML* is a tagged format, similar to *XML*. The format documented at <http://code.google.com/apis/kml/> and a programmer's reference is found at [http://code.google.com/apis/kml/documentation/kml\\_tags\\_beta1.html](http://code.google.com/apis/kml/documentation/kml_tags_beta1.html) (hereafter referred to as *kml\_ref*).

Data files coded in *KML* may be loaded into *Google Earth* (hereafter referred to as *GE*) or other compatible browser mapping applications directly from a local or network disk. In addition, *KML* files may be downloaded from a web page link directly into *GE*.

Displaying the output of the oil spill models participating in the MERSEA WP12.3 demonstrations involves, at the basic level, plotting simple point objects on the map. All of the models represent the spilled oil as a cloud of discrete particles, which evolve at discrete time intervals. Each particle represents a certain amount of oil, and has a position (latitude, longitude and depth) and chemical parameters that evolve with time. *KML* allows for the plotting of many graphical objects, both as static renderings and as time series.

Oil particles may thus be rendered on the map as dots of a few pixels' size. Using the *GE* time series animator, the cloud of particles can be shown to move and evolve on the map. An individual trajectory may also be displayed, by defining a segmented line.

One strength of the *KML* format is that it allows programmers to quickly code simple renderings of geographic data, while still allowing for more detailed presentation of data. The MERSEA WP12.3 partners are testing varying levels of detail in their *KML* formatting, depending to a certain degree on the complexity of the model data.

## 3. IMPLEMENTATION OF THE *KML* FORMAT

In this section, we will describe how data related to the oil spill forecast demonstrations related data are implemented in the *KML* format. This section will not give a detailed explanation of all the features of *KML* that could be used for such a purpose, but rather show some basic ways of coding the data rendering. The aim is to describe methods that are quick to implement and sufficient for the purpose. Examples of code elements are included both here and in the Appendices.

### 3.1. General structure

The general structure of the *KML* coded data is recognizable for anyone familiar with XML and similar tagged formats. In the implementations for oil spill forecast and related data, the code may essentially be broken down into three sections: graphical object definitions, static data and time series data.

#### 3.1.1. Graphical object definitions

By “graphical objects” we mean the graphical renderings of oil spill forecast data on the *GE* map, such as dots, icons and line segments. In order to define how certain objects are displayed (form, colour, size, etc.) we can use the *styles* feature of *KML*.

The following code snippet defines how oil particles that are located beneath the surface are to be displayed. The marker to be drawn is defined by the `IconStyle` tag, where, in this case, a specific icon in GIF format is fetched from a web site. Note the `scale` tag for sizing the icon.

```
<Style id="oildrift_SUBMERGED">
  <LabelStyle>
    <scale>0</scale>
  </LabelStyle>
  <IconStyle>
    <scale>0.1</scale>
    <Icon>
      <href>http://moncoze.met.no/graphics/purple.gif</href>
    </Icon>
  </IconStyle>
</Style>
```

Once defined in this manner at the top of the *KML* file, the `oildrift_SUBMERGED` style may be invoked later when plotting the individual oil particles. Note that it is not required to use styles, since all graphical objects have default settings (e.g., colour, icon, size, etc.). For oil spill forecast data, where there are hundreds of oil particles, it can be helpful to define styles to discriminate between oil particles with different properties.

#### 3.1.2. Static data

Static data are simply non-time-dependent data. For presentation of oil spill simulations, we may usefully treat drifter and particle trajectories as static data. The most basic rendition on a map is a marker at a given position, using the `Point` object, as shown in the following code snippet.

```
<Placemark>
  <name>Platform 17881</name>
  <Point>
    <coordinates>33.2800,33.6282,0.00</coordinates>
  </Point>
  <styleUrl>#oildrift_DRIFTER</styleUrl>
</Placemark>
```

In this very simple rendition, a marker defined by the `oildrift_DRIFTER` style (see above) is drawn at the position defined by the coordinates, which are defined by a [longitude,latitude,height] triplet. More information about the marker can be added, as exemplified in the following:

```
<Placemark>
  <name>Platform 17881</name>
  <Snippet MaxLines="2">
    PTR at 33.6282,33.2800,0.00
  </Snippet>
  <description>
    <![CDATA[
      <b>Latitude</b> : 32 28
      <br/><b>Longitude</b> : 34 56.9
      <br/><b>Date</b> : 01-Sep-2007 11:06:01
      <br/><b>Surface temperature<b> : 22.6
    ]]>
  </description>
  <Point>
    <coordinates>33.2800,33.6282,0.00</coordinates>
  </Point>
  <styleUrl>#oildrift_DRIFTER</styleUrl>
</Placemark>
```

Here, we have added the `name`, `snippet` and `description` attributes to display some textual information on the marker. The `name` and `description` texts are displayed when the user clicks on the marker, while the `snippet` text is displayed in the Places menu of *GE*.

A collection of markers can be displayed by adding similar `Point` blocks for each marker. The markers may be given different styles (colours, sizes, icons, etc.) as deemed appropriate.

A `LineString` object may be used to depict a series of line segments, as shown in the following code snippet. Geographic points are again represented as [longitude,latitude,height] triplets separated by whitespaces, and straight lines are drawn between consecutive points.

```

<Placemark>
  <name>Mean</name>
  <LineString>
    <extrude>1</extrude>
    <tessellate>1</tessellate>
    <coordinates>
33.2870,33.6282,0.00 33.2983,33.6275,0.00 33.3094,33.6270,0.00
33.3206,33.6265,0.00 33.3317,33.6263,0.00 33.3428,33.6262,0.00
33.3537,33.6263,0.00 33.3647,33.6265,0.00 33.3756,33.6269,0.00
    </coordinates>
  </LineString>
</Placemark>

```

The `extrude` and `tessellate` tags are concerned with drawing on the curved surface of the earth (see *kml\_ref*). Using the same coordinates for a block of `Point` objects and a `LineString` object may be used to depict, for example, the data points and trajectory of a drifter.

### 3.1.3. Time series data

The time series functionality in *GE* is invoked when constructs using the `TimeSpan` tag are encountered. In the following example, the `Folder` tag holds all data to be plotted during a certain time interval.

```

<Folder>
  <TimeSpan>
    <begin>2007-09-20T03:00:00Z</begin>
    <end>2007-09-20T04:00:00Z</end>
  </TimeSpan>
  <name>20 Sept. 2007 05.00.00</name>

  <Placemark>
  ...
</Placemark>
.
.
.
  <Placemark>
  ...
</Placemark>
</Folder>

<Folder>
  <TimeSpan>
    <begin>2007-09-20T04:00:00Z</begin>
    <end>2007-09-20T05:00:00Z</end>
  </TimeSpan>
  <name>20 Sept. 2007 06.00.00</name>

  <Placemark>
  .
  .
  .

```

The time interval is defined in the `TimeSpan` tag and the name of the `Folder` may be used to identify it in the `Places` menu of *GE*. Following the `TimeSpan` tag are `Placemark` tags for each of the markers to be displayed for the specified time interval. The `Placemark` tags



are entirely similar to those described above for static data. An additional `Folder` is added for each of the remaining times in the time series, as indicated in the code snippet. For time series data, the time span for the folder can be set to the same as the time interval between folders (here, one hour) so that there is an immediate transition on the screen from one time interval to the next.

### 3.2. Implementation at met.no

The *KML* implementation at met.no aims to display the following data from the oil spill simulation:

1. The movement and evolution of the oil particle cloud as a time series. Includes several oil particle styles.
2. Selected information on the individual oil particles.
3. The source position.
4. The current mean position of the initial batch of particles.
5. The trajectory of the initial batch of particles seeded as a static line.

This is a relatively verbose implementation that gives quite large *KML* files for a typical simulation. The *KML* files are >20 Mb in size and can take up to a minute to load into *GE*. Compressing the *KML* file to the *KMZ* format reduces the size significantly, but does not change the loading time. Excerpts of a sample file are shown in Appendix A.

Styles are defined at the beginning of the file for the following markers:

1. Spill source position
2. Inactive spill source position
3. Current mean position of the initial batch
4. Oil particles at the surface
5. Oil particles below the surface
6. Oil particles run aground (stranded)

The trajectory of the mean position of the initial batch of particles is drawn as a static line without icons at the vertices, using the `LineString` tag. The source position is also displayed statically, using a single `Placemark` tag.

Individual oil particle positions and the mean position of the initial batch of particles are displayed as a time series. Some extra information on each individual oil particle is included as a test of the feature. The following code snippet shows how each oil particle is displayed:

```
<Placemark>
  <name>Particle ID 8</name>
  <Snippet MaxLines="2">
    Oil particle at 33.6292,33.2812,0.00
  </Snippet>
  <description>
    <![CDATA[
      <b>met.no</b> oil spill model OD3D<br/>
      <ul><li>status = SURFACE</li><li>Lat = 33.6292</li><li>Lon =
33.2812</li>
      <li>Depth = 0.00</li><li>He = 0.0020</li><li>Ws = 0.0000</li>
      </ul>
    ]]>
  </description>
  <Point>
    <coordinates>33.2812,33.6292,0.00</coordinates>
  </Point>
  <styleUrl>#oildrift_SURFACE</styleUrl>
</Placemark>
```

The resulting display in *GE* is exemplified in the screenshots in Figure 3-1 and Figure 3-2.



Figure 3-1: Screenshot of Google Earth displaying a sample KML file from met.no. Objects shown include trajectory of the mean position, the spill source position (inactive), the current mean position, surface oil particles (red) and submerged oil particles (violet).

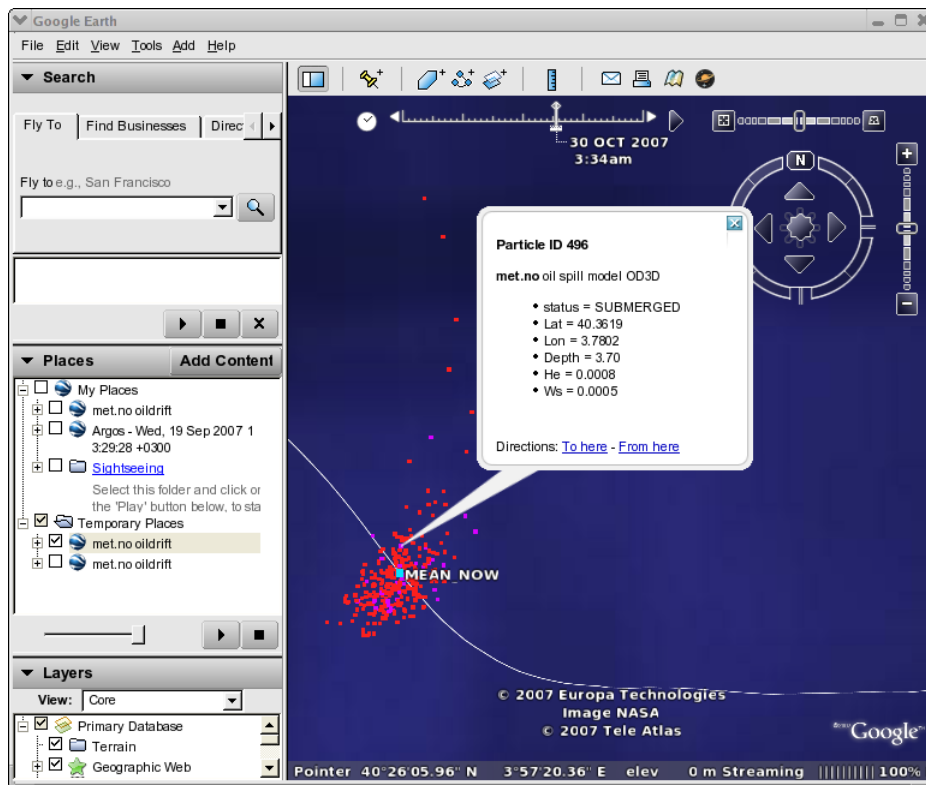


Figure 3-2: Screenshot of Google Earth, closeup of Figure 3-1, showing extra information on an individual oil particle.

### 3.3. Implementation at OC-UCY

The implementation at OC-UCY is less verbose than that used by met.no and MF, inasmuch the MedSlik model results are presented in a different manner. Typically, the number of seeded particles is  $\sim 10^5$ , which is two orders of magnitude larger than the other two models. For presentation, the concentration of particles in a moving grid (number of particles per grid cell) is calculated. This prohibits including information on the individual oil particles.

The *KML* implementation at OC-UCY includes display of the following data from the oil spill simulation:

1. The trajectory of the initial batch of particles seeded as a static line.
2. The position of the gridded oil particles as a time series.

This is a relatively simple implementation that gives compact *KML* files that are quick to download and load into *GE*. Excerpts of a sample file are shown in Appendix B.

Styles are defined at the beginning of the file for the following markers:

1. Non-empty grid cell locations ("POINT")
2. ("LAST\_POINT")

The trajectory of the mean position of the initial batch of particles is drawn as a static line without icons at the vertices, using the `LineString` tag.

The positions of non-empty grid cells are drawn using `Placemark` tags with the `POINT` style. For simplicity and quick loading, no information on the individual grid cells, e.g., concentration value, is included. An example of the display in *GE* is shown in Figure 3-5.

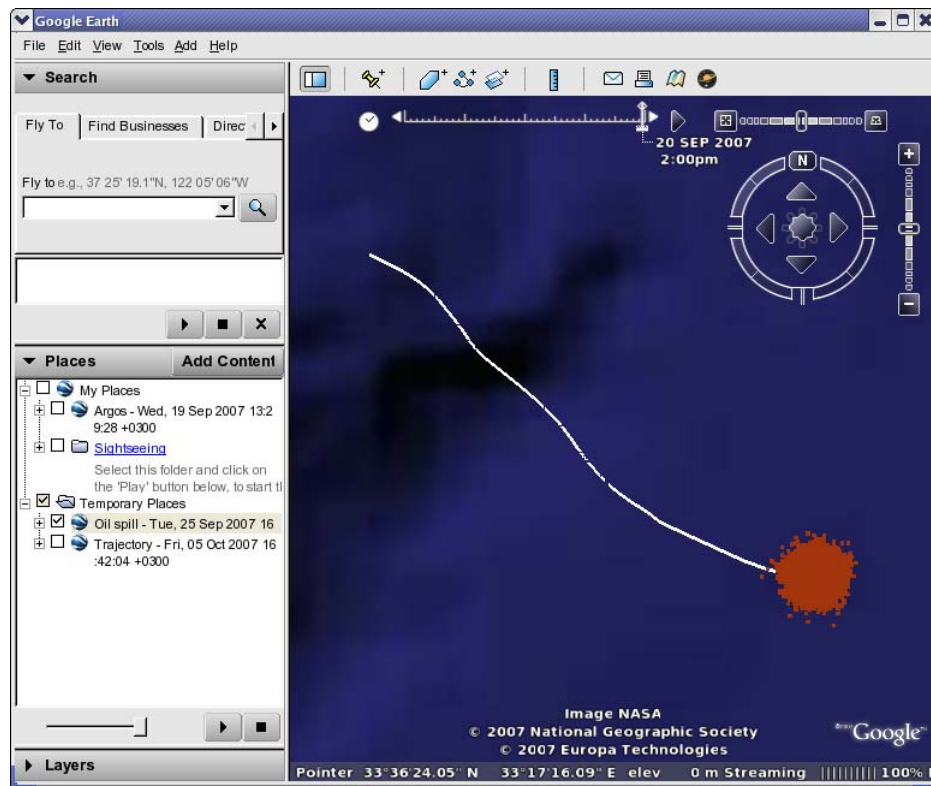


Figure 3-3: Screenshot of Google Earth displaying a sample KML file from OC-UCY. Objects shown include trajectory of the mean position and the non-empty oil grid cells (red).

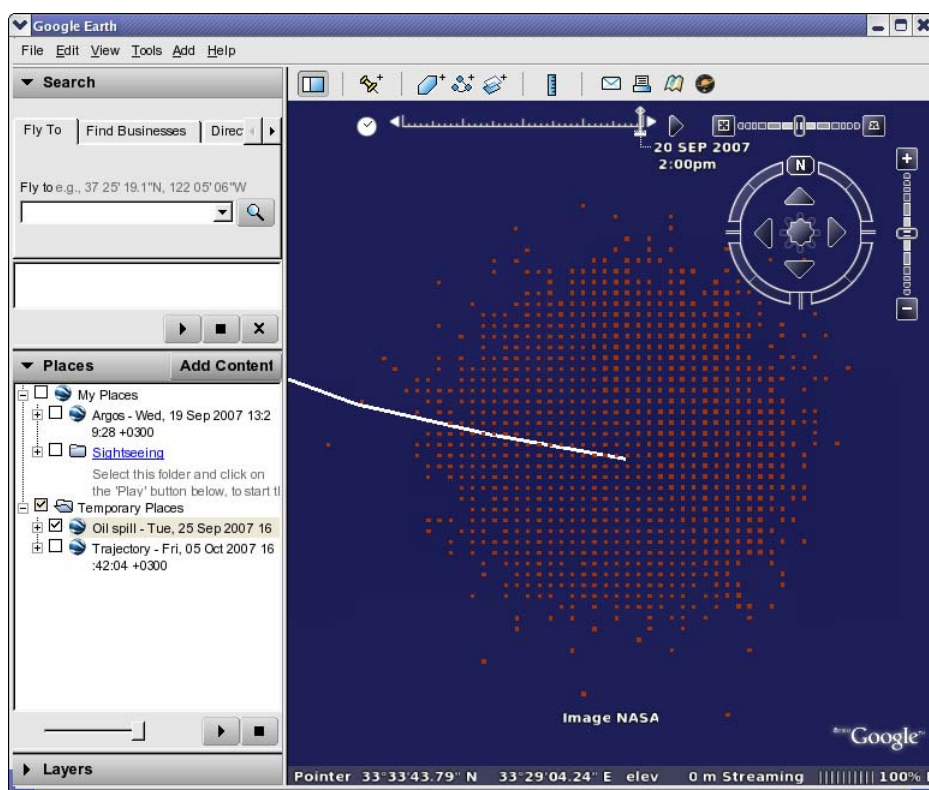


Figure 3-4: Screenshot of Google Earth, closeup of Figure 3-3, showing the gridded nature of the oil spill distribution in the OC-UCY results.

### 3.4. Implementation at Meteo-France

Since the output of the MF oil spill fate model is very similar to that of met.no, the *KML* implementation at Meteo-France is also quite comparable. In particular, the same styles are adopted in order to create displays with similar look and feel. The implementation at MF aims to display the following data from the oil spill simulation:

1. The movement and evolution of the oil particle cloud as a time series. Includes several oil particle styles.
2. The source position.

This is a relatively simple implementation that gives quite manageable *KML* files, which can load and display quickly. Excerpts of a sample file are shown in Appendix C. An example of the display for a single source in *GE* is shown in Figure 3-5. The implementation also allows for combining the simulation output for several simultaneous sources in the same *KML* file, as shown in Figure 3-6.



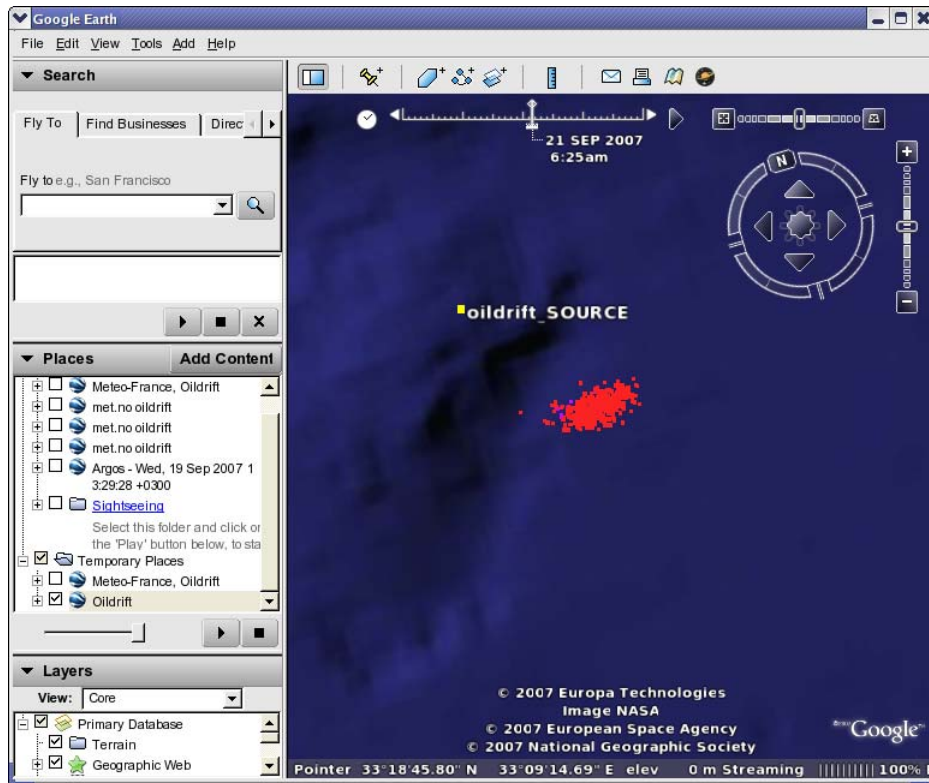


Figure 3-5: Screenshot of Google Earth displaying an sample KML file from Meteo-France. Objects shown include the spill source position, surface oil particles (red) and submerged oil particles (violet).

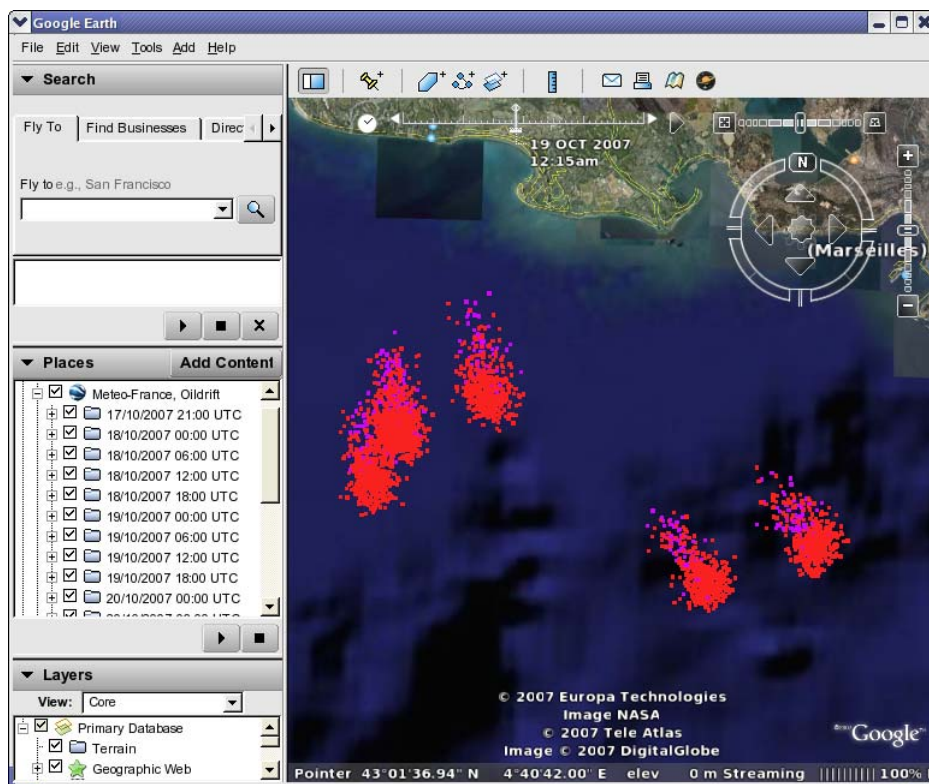


Figure 3-6: Screenshot of Google Earth displaying an sample KML file from Meteo-France. Objects shown are as described for Figure 3-5. Here, there are particle clouds from five simultaneous sources.

### 3.5. Implementation for drifter data

The basic drifter data obtained from Argos consist of position and time. Depending on the drifter instrumentation, other parameters may also be included, such as water temperature. Coding these data in *KML* is straightforward. Information that is displayed in *GE* include:

1. The positions of the drifter(s) at observation times.
2. The trajectory line of the drifters between observation times.
3. Selected information on the individual drifters at observation times.

All data are displayed as static, i.e., displayed at once on the map. Styles are defined at the beginning of the *KML* file for the following markers:

1. Latest observation position in the series.
2. Previous positions in the series.

This is a relatively simple implementation that gives *KML* files that load and display quickly. Excerpts of a sample file are shown in Appendix D. An example of the display for drifters deployed in the Eastern Mediterranean is shown in

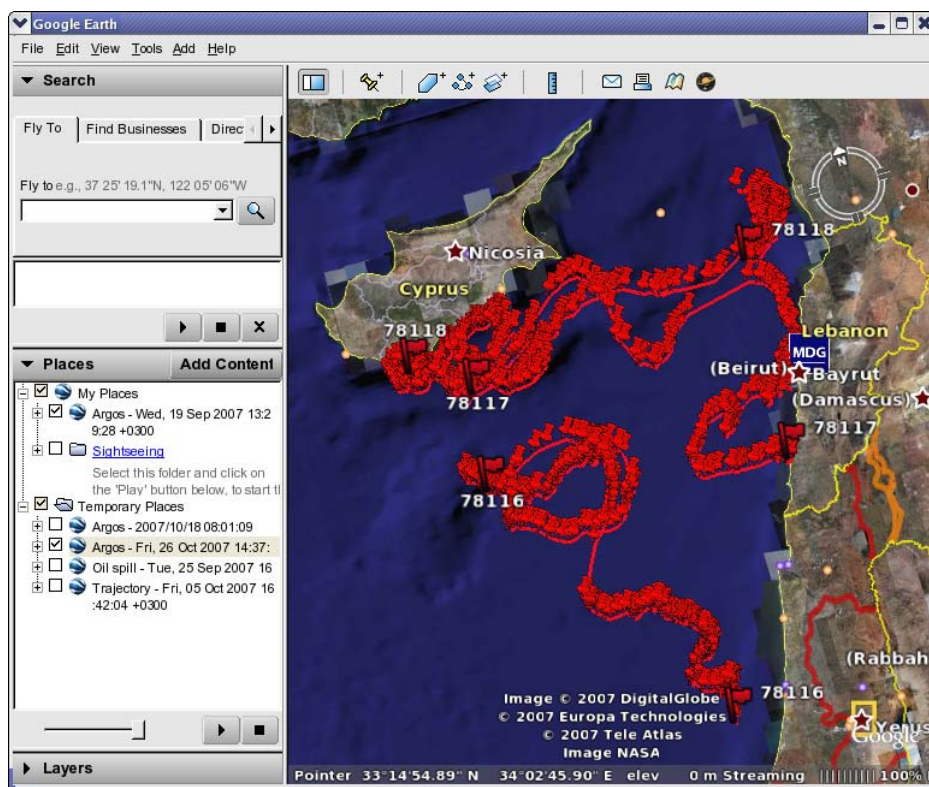


Figure 3-7: Screenshot of Google Earth showing the positions of three drifters.

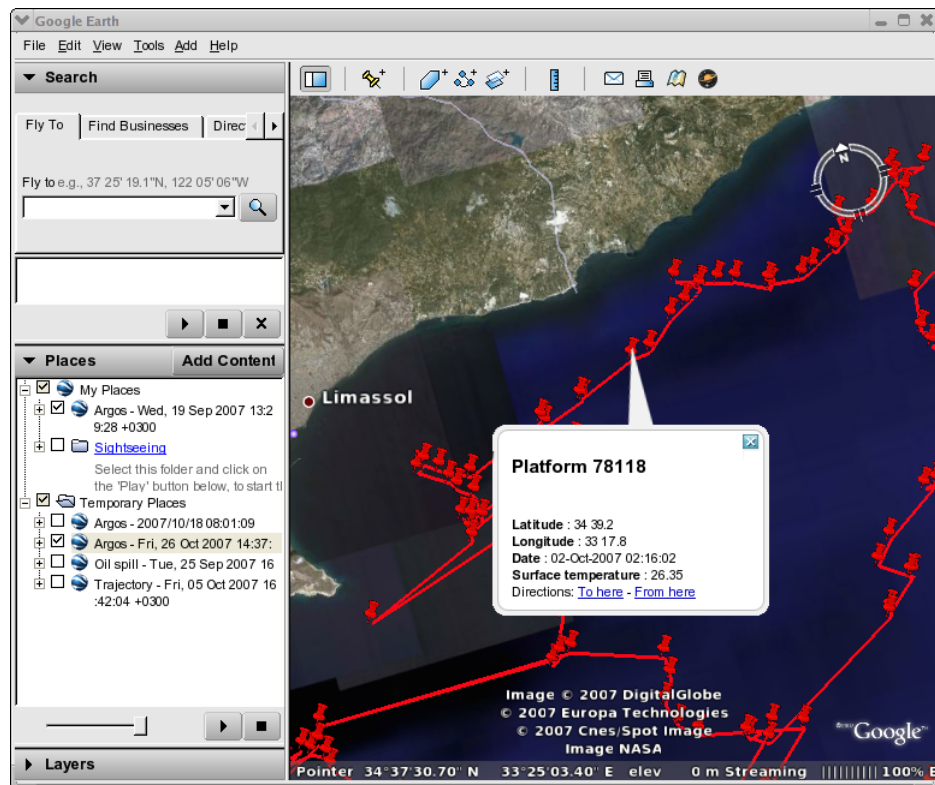


Figure 3-8: Screenshot of Google Earth showing textual information on the individual drifter datum.



## Appendix A. Example of met.no *KML* file for oil spill forecast data

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://earth.google.com/kml/2.1">
<Document>
  <visibility>0</visibility>
  <open>0</open>
```

### Define styles

```
<Style id="oildrift_SOURCE">
  <IconStyle>
    <scale>0.25</scale>
  </IconStyle>
  <LabelStyle>
    <scale>0.8</scale>
  </LabelStyle>
  <Icon>
    <href>http://moncoze.met.no/graphics/yellow.gif</href>
  </Icon>
</Style>

<Style id="oildrift_INACT.SOURCE">
  <IconStyle>
    <scale>0.25</scale>
  </IconStyle>
  <LabelStyle>
    <scale>0.8</scale>
  </LabelStyle>
  <Icon>
    <href>http://moncoze.met.no/graphics/darkyellow.gif</href>
  </Icon>
</Style>

<Style id="oildrift_SURFACE">
  <LabelStyle>
    <scale>0</scale>
  </LabelStyle>
  <IconStyle>
    <scale>0.1</scale>
  <Icon>
    <href>http://moncoze.met.no/graphics/red-1.gif</href>
  </Icon>
</IconStyle>
</Style>

<Style id="oildrift_SUBMERGED">
  <LabelStyle>
    <scale>0</scale>
  </LabelStyle>
  <IconStyle>
    <scale>0.1</scale>
  <Icon>
    <href>http://moncoze.met.no/graphics/purple.gif</href>
  </Icon>
</IconStyle>
</Style>

<Style id="oildrift_STRANDED">
  <LabelStyle>
    <scale>0</scale>
  </LabelStyle>
  <IconStyle>
    <scale>0.1</scale>
  <Icon>
    <href>http://moncoze.met.no/graphics/green.gif</href>
```

```

    </Icon>
  </IconStyle>
</Style>

<Style id="oildrift_MEAN">
  <IconStyle>
    <color>ff000000</color>
  </IconStyle>
  <LabelStyle>
    <scale>0</scale>
  </LabelStyle>
  <Icon>
    <href>http://maps.google.com/mapfiles/kml/pal4/icon24.png</href>
  </Icon>
</Style>

<Style id="oildrift_MEAN_NOW">
  <LabelStyle>
    <scale>0.8</scale>
  </LabelStyle>
  <IconStyle>
    <scale>0.2</scale>
  </IconStyle>
  <Icon>
    <href>http://moncoze.met.no/graphics/lightblue.gif</href>
  </Icon>
</IconStyle>
</Style>

<name>met.no oildrift</name>

```

#### Draw the trajectory of the mean position of the initial batch

```

  <Placemark>
    <name>Mean</name>
    <LineString>
      <extrude>1</extrude>
      <tessellate>1</tessellate>
      <coordinates>
33.2870,33.6282,0.00 33.2983,33.6275,0.00 33.3094,33.6270,0.00 33.3206,33.6265,0.00
33.3317,33.6263,0.00 33.3428,33.6262,0.00 33.3537,33.6263,0.00 33.3647,33.6265,0.00
33.3756,33.6269,0.00 33.3863,33.6274,0.00 33.3969,33.6282,0.00 33.4075,33.6290,0.00
33.4181,33.6300,0.00 33.4284,33.6313,0.00 33.4387,33.6327,0.00 33.4488,33.6343,0.00
33.4588,33.6360,0.00 33.4686,33.6378,0.00 33.4781,33.6398,0.00 33.4875,33.6419,0.00
33.4968,33.6442,0.00 33.5059,33.6466,0.00 33.5148,33.6491,0.00 33.5234,33.6517,0.00
33.5317,33.6544,0.00 33.5398,33.6572,0.00 33.5476,33.6600,0.00 33.5552,33.6631,0.00
33.5625,33.6662,0.00 33.5696,33.6695,0.00 33.5763,33.6730,0.00 33.5828,33.6765,0.00
33.5891,33.6801,0.00 33.5952,33.6838,0.00 33.6010,33.6876,0.00 33.6065,33.6915,0.00
33.6117,33.6955,0.00 33.6166,33.6997,0.00 33.6212,33.7042,0.00 33.6256,33.7090,0.00
33.6298,33.7139,0.00 33.6338,33.7191,0.00 33.6375,33.7245,0.00 33.6409,33.7300,0.00
33.6441,33.7358,0.00 33.6470,33.7418,0.00 33.6498,33.7479,0.00 33.6524,33.7542,0.00
33.6550,33.7607,0.00 33.6573,33.7676,0.00 33.6595,33.7746,0.00 33.6615,33.7818,0.00
33.6633,33.7893,0.00 33.6650,33.7970,0.00 33.6666,33.8049,0.00 33.6680,33.8129,0.00
33.6692,33.8211,0.00 33.6703,33.8295,0.00 33.6713,33.8381,0.00 33.6721,33.8468,0.00
33.6727,33.8558,0.00 33.6731,33.8649,0.00 33.6733,33.8742,0.00 33.6734,33.8836,0.00
33.6732,33.8932,0.00 33.6728,33.9028,0.00 33.6721,33.9126,0.00 33.6712,33.9224,0.00
33.6701,33.9323,0.00 33.6686,33.9421,0.00 33.6666,33.9519,0.00 33.6643,33.9616,0.00
33.6615,33.9712,0.00 33.6582,33.9807,0.00 33.6545,33.9901,0.00 33.6503,33.9994,0.00
33.6458,34.0085,0.00 33.6409,34.0175,0.00 33.6356,34.0265,0.00 33.6299,34.0355,0.00
33.6239,34.0443,0.00 33.6174,34.0531,0.00 33.6105,34.0619,0.00 33.6032,34.0705,0.00
33.5955,34.0790,0.00 33.5874,34.0874,0.00 33.5787,34.0957,0.00 33.5696,34.1040,0.00
33.5599,34.1121,0.00 33.5497,34.1200,0.00 33.5390,34.1278,0.00 33.5280,34.1354,0.00
33.5165,34.1429,0.00 33.5045,34.1502,0.00 33.4922,34.1573,0.00 33.4793,34.1643,0.00
33.4660,34.1711,0.00 33.4523,34.1778,0.00 33.4381,34.1842,0.00 33.4236,34.1904,0.00
33.4087,34.1965,0.00 33.3935,34.2022,0.00 33.3781,34.2078,0.00 33.3626,34.2131,0.00
33.3469,34.2180,0.00 33.3310,34.2226,0.00 33.3151,34.2269,0.00 33.2991,34.2307,0.00
33.2831,34.2342,0.00 33.2672,34.2372,0.00 33.2512,34.2398,0.00 33.2353,34.2419,0.00
33.2195,34.2437,0.00 33.2037,34.2450,0.00 33.1879,34.2458,0.00 33.1720,34.2462,0.00
33.1562,34.2462,0.00
      </coordinates>
    </LineString>
  </Placemark>

```



```

</description>
<Point>
  <coordinates>33.2756,33.6290,0.00</coordinates>
</Point>
  <styleUrl>#oildrift_MEAN_NOW</styleUrl>
</Placemark>

```

#### Position of source at time t1

```

<Placemark>
  <name>SOURCE</name>
  <Snippet MaxLines="2">
    Oil particle at 33.6300,33.2700,0.00
  </Snippet>
  <description>
    <![CDATA[
      <b>met.no</b> oil spill model OD3D<br/>
      <ul><li>status = SOURCE</li><li>Lat = 33.6300</li><li>Lon = 33.2700</li>
      <li>Depth = 0.00</li><li>He = 0.0000</li><li>Ws = 0.0000</li>
      </ul>
    ]]>
  </description>
  <Point>
    <coordinates>33.2700,33.6300,0.00</coordinates>
  </Point>
  <styleUrl>#oildrift_SOURCE</styleUrl>
</Placemark>

</Folder>

```

#### Time series: time t2

```

<Folder>
<TimeSpan>
  <begin>2007-09-20T04:00:00Z</begin>
  <end>2007-09-20T05:00:00Z</end>
</TimeSpan>
<name>20. sep. 2007 06.00.00</name>

```

#### Position of particle 1 at time t2

```

<Placemark>
  <name>Particle ID 1</name>
  <Snippet MaxLines="2">
    Oil particle at 33.6263,33.2933,0.00
  </Snippet>
  <description>
    <![CDATA[
      <b>met.no</b> oil spill model OD3D<br/>
      <ul><li>status = SURFACE</li><li>Lat = 33.6263</li><li>Lon = 33.2933</li>
      <li>Depth = 0.00</li><li>He = 0.0020</li><li>Ws = 0.0000</li>
      </ul>
    ]]>
  </description>
  <Point>
    <coordinates>33.2933,33.6263,0.00</coordinates>
  </Point>
  <styleUrl>#oildrift_SURFACE</styleUrl>
</Placemark>

```

```

.
.

```

#### ...positions of the remaining particles, mean of initial batch and source at time t2

```

.
.
</Folder>

```

```

.
.

```

#### Time series: times t3...end

```

.
.

```

```
</Document>  
</kml>
```

## Appendix B. Example of OC-UCY *KML* file for oil spill forecast

```
<?xml version="1.0" encoding="UTF-8"?><kml xmlns="http://earth.google.com/kml/2.0">
<Document>
  <name>Trajectory - Fri, 19 Oct 2007 12:44:26 +0300</name>
```

### Define styles

```
    <Style id="LAST_POINT">
      <IconStyle>
        <scale>0.1</scale>
        <color>ffffffff</color>
        <Icon>
          <href>http://www.oceanography.ucy.ac.cy/cycofos/argos-
placemark.png</href>
          <x>160</x>
          <y>128</y>
          <w>32</w>
          <h>32</h>
        </Icon>
      </IconStyle>
    </Style>
    <Style id="POINT">
      <IconStyle>
        <scale>0.1</scale>
        <color>ffffffff</color>
        <Icon>
          <href>http://www.oceanography.ucy.ac.cy/cycofos/argos-
placemark.png</href>
          <x>32</x>
          <y>248</y>
          <w>32</w>
          <h>32</h>
        </Icon>
      </IconStyle>
    </Style>
```

### Draw the trajectory of the mean position of the initial batch

```
  <Placemark>
    <name>Trajectory</name>
    <visibility>1</visibility>
    <open>0</open>
    <Style>
      <LineStyle>
        <color>ffffffff</color>
        <width>3</width>
      </LineStyle>
    </Style>
    <LineString>
      <extrude>1</extrude>
      <tessellate>1</tessellate>
      <coordinates>
        33.235293,33.471406
        33.235822,33.471402
        33.236975,33.471698
        .
        .
        .
        33.784065,33.334633
      </coordinates>
    </LineString>
  </Placemark>
```

### Time series of grid cell positions: time t1

```

<Folder>
  <name>33.7925</name>
  <TimeSpan>
    <begin>2007-09-18T02:00:00Z</begin>
    <end>2007-09-18T08:00:00Z</end>
  </TimeSpan>

  Position of grid cell 1 at time t1
  <Placemark>
    <styleUrl>#POINT</styleUrl>
    <Point>
      <coordinates>33.0246,33.8569</coordinates>
    </Point>
  </Placemark>
  Position of grid cell 2 at time t1
  <Placemark>
    <styleUrl>#POINT</styleUrl>
    <Point>
      <coordinates>33.0246,33.8551</coordinates>
    </Point>
  </Placemark>
  .
  .
  ..the remaining grid cells at time t1
  .
  .
</Folder>

Time series of grid cell positions: time t2
<Folder>
  <name>0003</name>
  <TimeSpan>
    <begin>2007-09-18T08:00:00Z</begin>
    <end>2007-09-18T14:00:00Z</end>
  </TimeSpan>
  Position of grid cell 1 at time t2
  <Placemark>
    <styleUrl>#POINT</styleUrl>
    <Point>
      <coordinates>33.0776,33.8281</coordinates>
    </Point>
  </Placemark>
  .
  .
  ...positions of grid cells 2... at time t2
  .
  .
</Folder>
.
.
Time series of grid cell positions: times t3...end
.
.
.
</Document>
</kml>

```

## Appendix C. Example of Meteo-France *KML* file for oil spill forecast

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://earth.google.com/kml/2.1">
<Document>
  <visibility>0</visibility>
  <open>0</open>
```

### Define styles

```
<Style id="oil drift_SOURCE">
  <IconStyle>
    <scale>0.2</scale>
    <Icon>
      <href>http://www.meteorologie.eu.org/mothy/google_earth/yellow.gif</href>
    </Icon>
  </IconStyle>
</Style>

<Style id="oil drift_SURFACE">
  <LabelStyle>
    <scale>0</scale>
  </LabelStyle>
  <IconStyle>
    <scale>0.1</scale>
    <Icon>
      <href>http://www.meteorologie.eu.org/mothy/google_earth/red.gif</href>
    </Icon>
  </IconStyle>
</Style>

<Style id="oil drift_SUBMERGED">
  <LabelStyle>
    <scale>0</scale>
  </LabelStyle>
  <IconStyle>
    <scale>0.1</scale>
    <Icon>
      <href>http://www.meteorologie.eu.org/mothy/google_earth/purple.gif</href>
    </Icon>
  </IconStyle>
</Style>

<Style id="oil drift_STRANDED">
  <LabelStyle>
    <scale>0</scale>
  </LabelStyle>
  <IconStyle>
    <scale>0.1</scale>
    <Icon>
      <href>http://www.meteorologie.eu.org/mothy/google_earth/lightblue.gif</href>
    </Icon>
  </IconStyle>
</Style>

<Style id="oil drift_MEAN">
  <IconStyle>
    <color>ff000000</color>
  </IconStyle>
  <LabelStyle>
    <scale>0</scale>
  </LabelStyle>
  <Icon>
    <href>http://maps.google.com/mapfiles/kml/pal4/icon24.png</href>
  </Icon>
</Style>
```



```
<Style id="oildrift_MEAN_NOW">
  <IconStyle>
    <scale>0.2</scale>
    <Icon>
      <href>http://www.meteorologie.eu.org/moathy/google_earth/green.gif</href>
    </Icon>
  </IconStyle>
</Style>
```

```
<name>Meteo-France, Oildrift</name>
```

**Positions of 3 sources**

```
<Folder>
<TimeSpan>
<begin>2007-10-04T19:00:00Z</begin>
<end>2007-10-04T20:00:00Z</end>
</TimeSpan>
<name>04/10/2007 19:00 UTC</name>
<Placemark>
<name>oildrift_SOURCE</name>
<Point><coordinates>33.8300,33.8700,0</coordinates></Point>
<styleUrl>#oildrift_SOURCE</styleUrl>
</Placemark>
<Placemark>
<name>oildrift_SOURCE</name>
<Point><coordinates>35.4300,33.8100,0</coordinates></Point>
<styleUrl>#oildrift_SOURCE</styleUrl>
</Placemark>
<Placemark>
<name>oildrift_SOURCE</name>
<Point><coordinates>33.2600,34.4700,0</coordinates></Point>
<styleUrl>#oildrift_SOURCE</styleUrl>
</Placemark>
</Folder>
```

**Time series: time t1**

```
<Folder>
<TimeSpan>
<begin>2007-10-05T00:00:00Z</begin>
<end>2007-10-05T01:00:00Z</end>
</TimeSpan>
<name>05/10/2007 00:00 UTC</name>
```

**Position of particle 1 at time t1**

```
<Placemark>
<name>oildrift_SUBMERGED</name>
<Point><coordinates>33.8295,33.8640,0</coordinates></Point>
<styleUrl>#oildrift_SUBMERGED</styleUrl>
</Placemark>
```

**Position of particle 2 at time t1**

```
<Placemark>
<name>oildrift_SUBMERGED</name>
<Point><coordinates>33.8360,33.8824,0</coordinates></Point>
<styleUrl>#oildrift_SUBMERGED</styleUrl>
</Placemark>
```

.  
.  
.

**Position of particle n at time t1**

```
<Placemark>
<name>oildrift_SURFACE</name>
<Point><coordinates>33.2569,34.4655,0</coordinates></Point>
<styleUrl>#oildrift_SURFACE</styleUrl>
</Placemark>
</Folder>
```

**Time series: time t2**

```
<Folder>
```

```
<TimeSpan>
<begin>2007-10-05T06:00:00Z</begin>
<end>2007-10-05T07:00:00Z</end>
</TimeSpan>
<name>05/10/2007 06:00 UTC</name>
Position of particle 1 at time t2
<Placemark>
<name>oildrift_SUBMERGED</name>
<Point><coordinates>33.8270,33.8628,0</coordinates></Point>
<styleUrl>#oildrift_SUBMERGED</styleUrl>
</Placemark>
.
.
.
Position of particle n at time t2
<Placemark>
<name>oildrift_SURFACE</name>
<Point><coordinates>33.2463,34.4624,0</coordinates></Point>
<styleUrl>#oildrift_SURFACE</styleUrl>
</Placemark>
</Folder>
.
.
Time series: times t3...end
.
.
</Document>
</kml>
```

## Appendix D. Example of KML file for drifter positions

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://earth.google.com/kml/2.0">
<Document>
  <name>Argos - 2007/10/18 08:01:09</name>
```

### Define styles

```
    <Style id="LAST_POINT">
      <IconStyle>
        <color>ff1305f9</color>
        <Icon>
          <href>root://icons/palette-4.png</href>
          <x>160</x>
          <y>128</y>
          <w>32</w>
          <h>32</h>
        </Icon>
      </IconStyle>
    </Style>
    <Style id="POINT">
      <IconStyle>
        <scale>0.6</scale>
        <color>ff1305f9</color>
        <Icon>
          <href>root://icons/palette-4.png</href>
          <x>32</x>
          <y>248</y>
          <w>32</w>
          <h>32</h>
        </Icon>
      </IconStyle>
    </Style>
```

### First drifter

```
  <Folder>
    <name>Platform 60212</name>
    <Placemark>
      <styleUrl>#LAST_POINT</styleUrl>
      <name>60212</name>
      <description><![CDATA[
        <b>Latitude</b> : 43° 13' 55"N
        <br/><b>Longitude</b> : 4° 17' 23"E
        <br/><b>Date</b> : 2007/10/18 06:16:35
        <br/><b>Location class</b> : 2
      ]]></description>
      <Point>
        <coordinates>4.28975,43.2322</coordinates>
      </Point>
    </Placemark>
```

### Draw the trajectory line segments

```
    <Placemark>
      <name>Trajectory</name>
      <visibility>1</visibility>
      <open>0</open>
      <Style>
        <LineStyle>
          <color>ff1305f9</color>
          <width>3</width>
        </LineStyle>
      </Style>
      <LineString>
        <extrude>1</extrude>
        <tessellate>1</tessellate>
```

```

        <coordinates>
7.38556,43.61382
7.35978,43.6149
7.3638,43.59899
.
.
.
4.32039,43.25698
4.28975,43.2322
        </coordinates>
    </LineString>
</Placemark>

```

### Place markers at observation locations, include text info

```

    <Folder>
        <name>Old locations</name>
        <description>Old locations of Argos platform
60212</description>
Observation 1
        <Placemark>
            <styleUrl>#POINT</styleUrl>

            <description><![CDATA[
                <h2>Plaform 60212</h2>

                <br/><b>Latitude</b> : 43° 36' 49"N
                <br/><b>Longitude</b> : 7° 23' 08"E
                <br/><b>Date</b> : 2007/10/10 17:03:41
                <br/><b>Location class<b> : 2
            ]]></description>
            <Point>
                <coordinates>7.38556,43.61382</coordinates>
            </Point>
        </Placemark>

Observation 2
        <Placemark>
            <styleUrl>#POINT</styleUrl>

            <description><![CDATA[
                <h2>Plaform 60212</h2>

                <br/><b>Latitude</b> : 43° 36' 53"N
                <br/><b>Longitude</b> : 7° 21' 35"E
                <br/><b>Date</b> : 2007/10/10 18:51:50
                <br/><b>Location class<b> : 1
            ]]></description>
            <Point>
                <coordinates>7.35978,43.6149</coordinates>
            </Point>
        </Placemark>
.
.
.
Observation N
        <Placemark>
            <styleUrl>#POINT</styleUrl>

            <description><![CDATA[
                <h2>Plaform 60212</h2>

                <br/><b>Latitude</b> : 43° 35' 56"N
                <br/><b>Longitude</b> : 7° 21' 49"E
                <br/><b>Date</b> : 2007/10/17 16:11:21
                <br/><b>Location class<b> : 3
            ]]></description>
            <Point>
                <coordinates>7.3638,43.59899</coordinates>
            </Point>

```

```
        </Placemark>
    </Folder>
```

```
</Folder>
```

**Repeat the above block structure for each drifter**

```
.
.
.
```

```
</Document>>
</kml>
```