

GeoHab Video Workshop - Trondheim, 3-4th May 2009

Geo-referencing video images: issues and approaches

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Overview

Part 1 What is Geo-referencing?

Part 2 Geo-referenced scientific data

Part 3 Geo-referencing underwater video images

Part 4 A word about error

Search

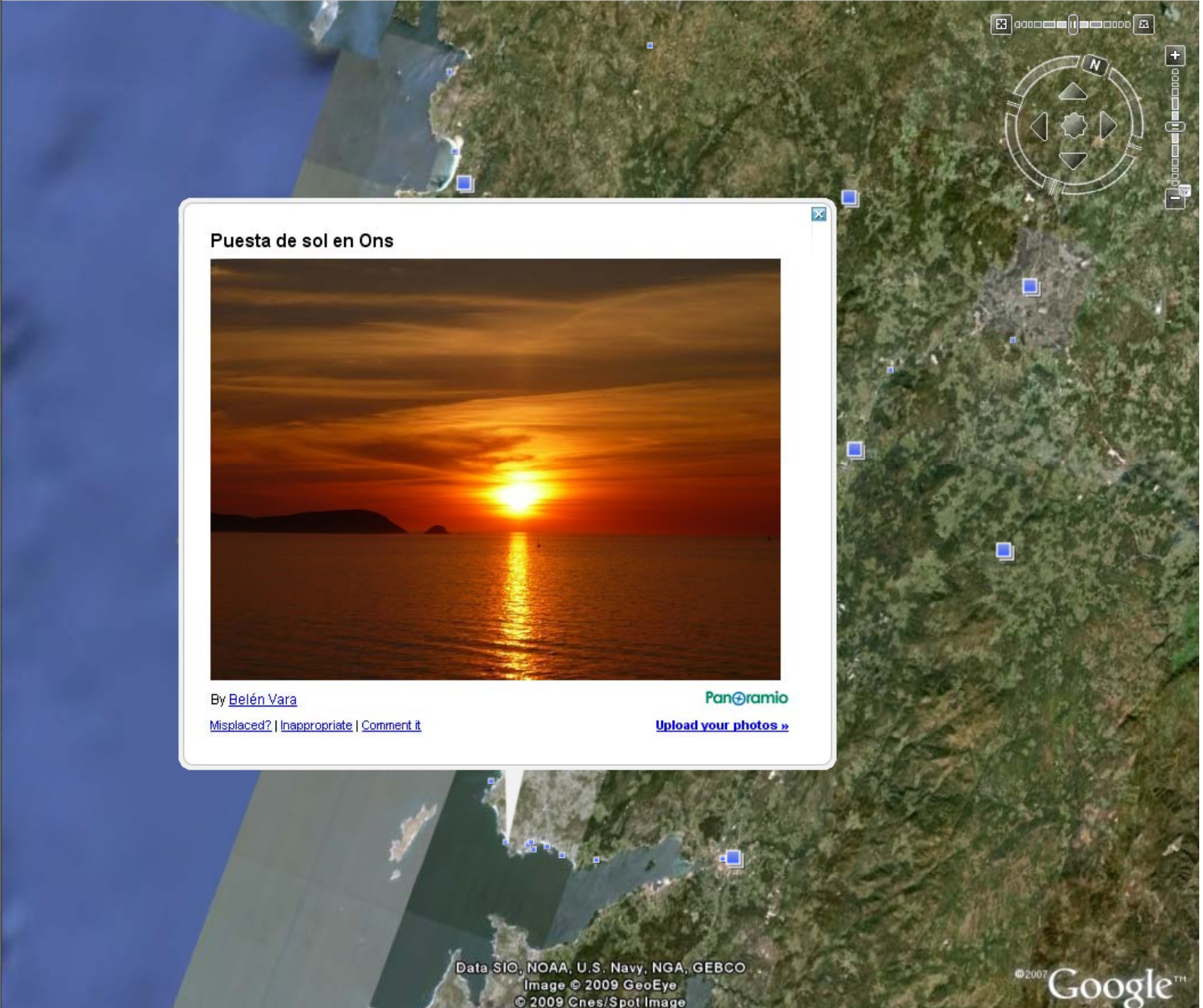
Fly To Find Businesses Directions
Fly to e.g., Tokyo, Japan

Places Add Content

- Imperial Palace, Japan
- Christ The Redeemer, Brazil
- Las Vegas, US
- Lisbon, Portugal
- Saint Peter's Basilica, Vatica
- Basilica of El Pilar, Spain
- London Eye, UK
- Sydney Olympic Site, Austral
- Red Square, Russian Federa
- Mount Saint Helens, US
- Former Republican Palace, Ir
- Manhattan Island, US
- Forbidden City, China
- Reichstag, Germany
- Google Campus, US
- Temporary Places

Layers

- View: Core
- Geographic Web
 - Roads
 - 3D Buildings
 - Borders and Labels
 - Weather
 - Gallery
 - Global Awareness
 - Places of Interest
 - More
 - US Government
 - Spot Image
 - SPOT One World, One Y
 - DigitalGlobe Coverage



What is geo-referencing, in science?

Data point i

Variable = v_i
(Factor = A)

-
-

Data point i

Variable = v_i
(Factor = A)
Position = (x_i, y_i)

-
-

Geo-referenced scientific data

- Object 1
 Variable= v_1
 (Factor=A)
 Position= (x_1, y_1)
- Object 2
 Variable= v_2
 (Factor=A)
 Position= (x_2, y_2)

...
- Object P
 ...

	V	x	y
O ₁			
O ₂			
...			
O _p			

Hypothesis testing/
 Model parameterization

Associate position with data point

x	y	V

Mapping

Associate data point with position

Attributes of data_matrix							
FID	Shape *	Type	x field	y field	Substrate	Acesta_exc	Alcyonium
0	Point	KH2	618311.225	6533926.345	1		0
1	Point	KH2	618311.133	6533926.671	1		0
2	Point	KH2	618310.63	6533926.493	1		0
3	Point	KH2	618309.69	6533925.9	1		0
4	Point	KH2	618308.844	6533925.366	1		0
5	Point	KH2	618307.335	6533924.378	1		0
6	Point	KH2	618303.935	6533922.102	1		0
7	Point	KH2	618302.667	6533921.213	1		0
8	Point	KH2	618300.564	6533919.541	1		0
9	Point	KH2	618299.27	6533918.512	1		0
10	Point	KH2	618297.769	6533917.429	1		0
11	Point	KH2	618295.234	6533915.874	1		0
12	Point	KH2	618292.331	6533914.073	1		0
13	Point	KH2	618290.183	6533913.689	1		0

Getting a value for the variable(s)

Sampling device: Camera (remotely operated)

Type of data: Recorded images

- David Bowden: Methods for data extraction from seabed video and still images
- Jörg Ontrup: Automated detection of coral and sponges in video data
- Aleksej Šaškov: Identification of benthic habitats using drop-down video
- Scott M. Gallager: Classification of benthic images acquired with HabCam
- Oscar Pizarro: Towards image-based habitat classification
- Jessica A. Sameoto: An approach to the analysis of video-based surveys of benthic habitats

The geo-referencing problem:

“What’s the exact position of the images being considered?”

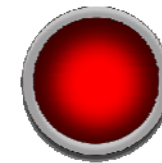
The geo-referencing problem, in this particular case:

“Where was the camera located at the time of recording of the image in question?”

“What is the estimated error?”

Set up 1

Positional data overlaid on video images



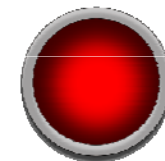
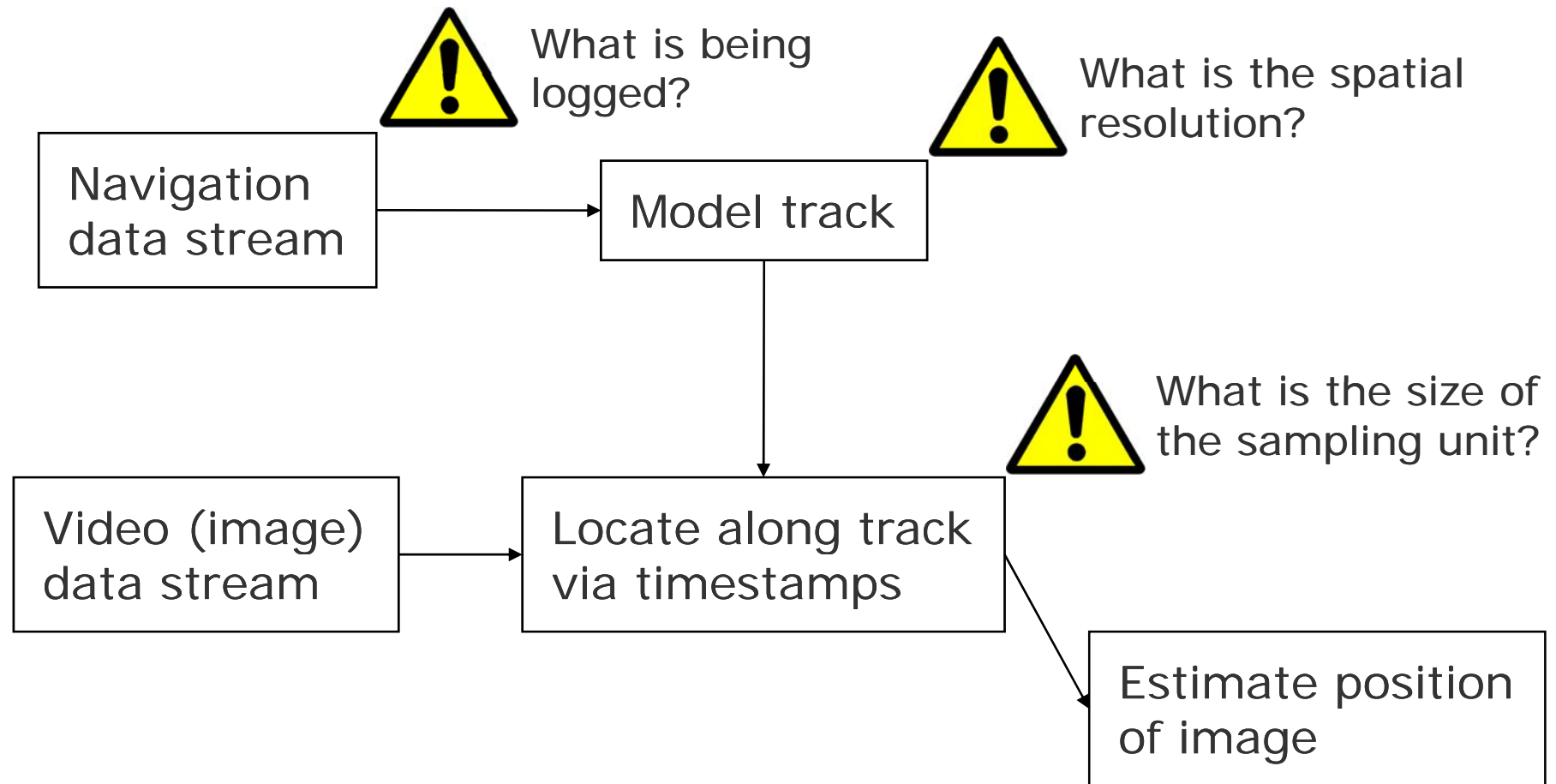
Set up 2

Two data streams with one thing in common (time)

Recorded images:
data to be extracted
+ timecode burned in

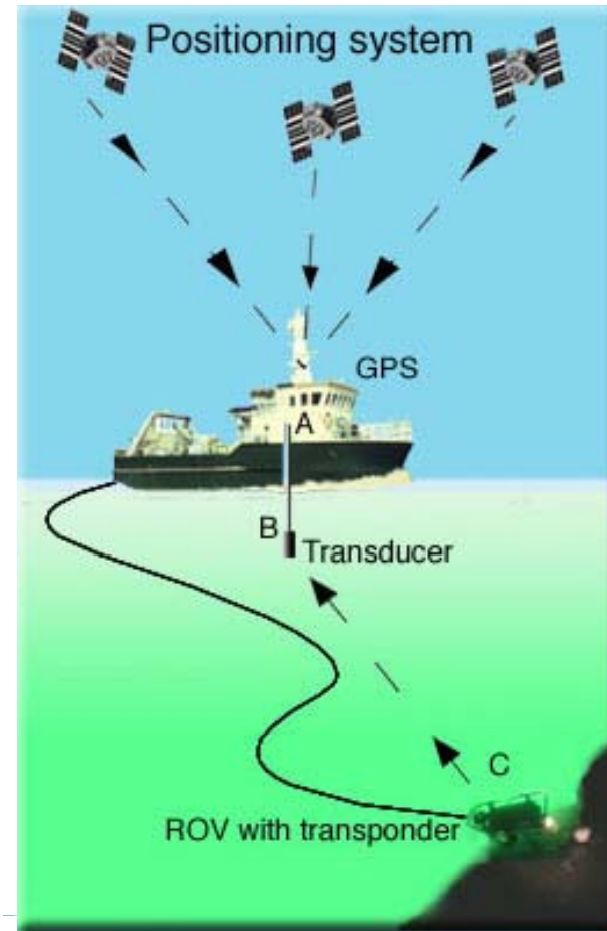
Navigation data:
position fix
+ timestamp



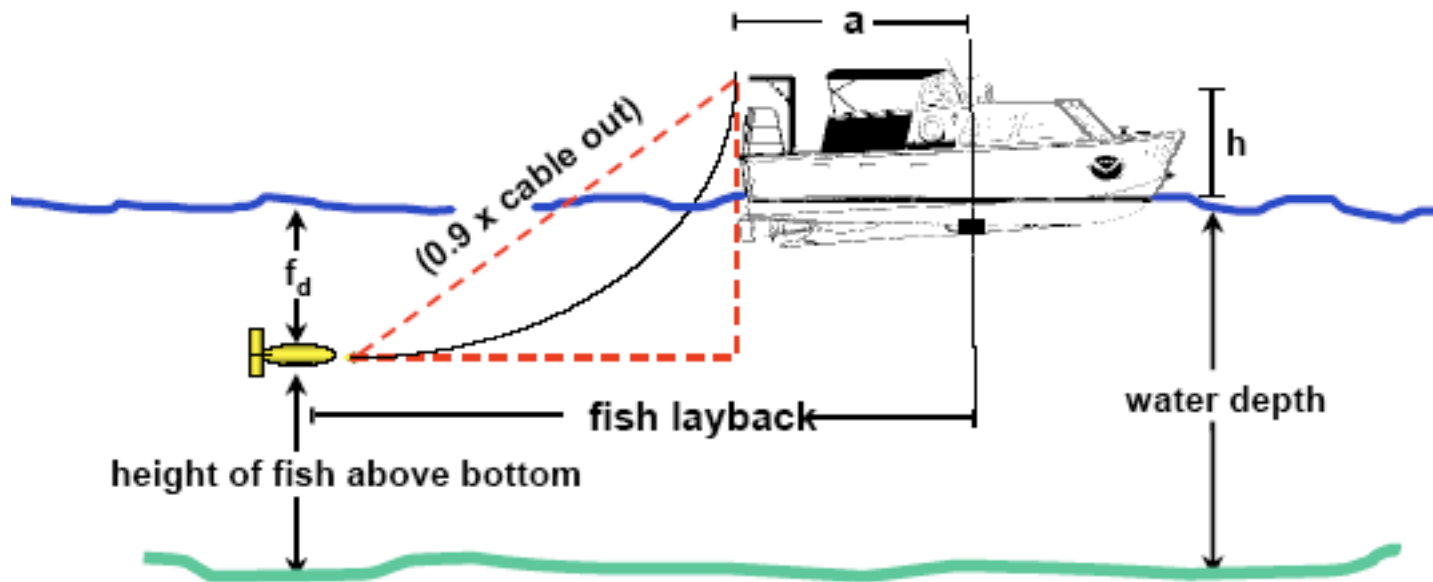


Getting navigation data

- Raw HPR data (hyperterminal, NEMACO)
- Olex
- Adelie



Getting navigation data



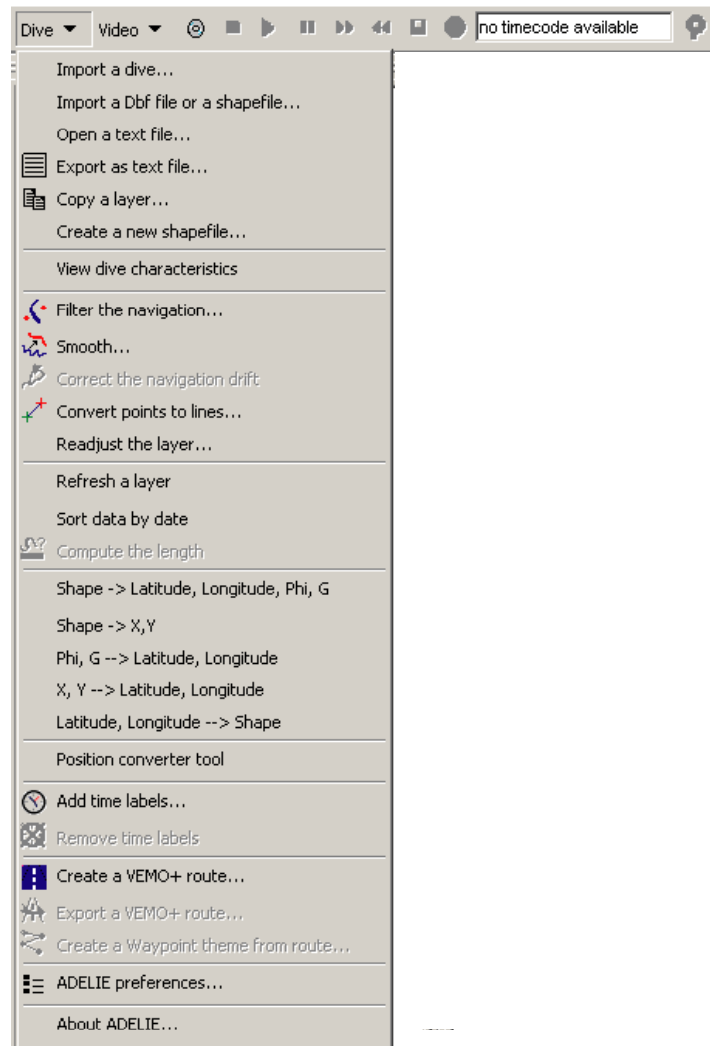
$$\text{fish layback} = a + \sqrt{[(0.9 \times \text{cable out})^2 - (h + f_d)^2]}$$

where a = layback of A-frame from echo sounder transducer

h = height of cable block on A-frame above waterline

f_d = depth of side scan sonar fish = water depth - height of fish above bottom

Adelie-GIS



HPR data

```
$PSIMGPS,071023134529.34,G,5852.4354,N,01106.4479,E*1D
$PSIMSNS,134529.25,B23,1,1,1.5,1.3,,215.8,,1,0.129,,M121*4B
$PSIMSSB,134529.25,B23,A,???,C,N,M,56.01,34.54,3.81,2.94,T,0.045369,*5F
$INGLL,5852.46556,N,01106.48394,E,134529.25,A,D*79
$PSIMGPS,071023134530.34,G,5852.4355,N,01106.4478,E*15
$PSIMSNS,134530.31,B23,1,1,0.0,1.7,,214.0,,1,0.119,,M121*4C
$PSIMSSB,134530.31,B23,A,???,C,N,M,35.03,-10.17,77.36,4.75,T,0.056709,*4F
$INGLL,5852.45429,N,01106.43737,E,134530.31,A,D*78
$PSIMSNS,134531.34,B23,1,1,2.4,1.1,,213.3,,1,0.129,,M121*4F
$PSIMSSB,134531.34,B23,A,,C,N,M,-7.05,-5.85,77.55,4.49,T,0.051153,*55
$INGLL,5852.43160,N,01106.44191,E,134531.34,A,D*7F
```

5852.46556,N

DDMM.mmmmm

Lat (DD.ddddd) =

$58 + (52.46556)/60 =$

$58 + 0.874426 =$

58.874426

01106.48394,E

DDMM.mmmmm

Long (DD.ddddd) =

$011 + (06.48394)/60 =$

$11 + 0.108065 =$

11.108065

134529.25

hhmmss.ss

Date/time (yyyy/mm/dd
hh:mm:ss) =

2007/10/23 13:45:25

Olex data

- Rute HPR-strek
- Rutetype Strek
- Linjefarge Brun
- Plottsett 1
- 3473.41770 699.38620 1023906793 Brunsirke
- 3473.41910 699.38860 1023906823 Brunsirke
- 3473.42030 699.38320 1023906839 Brunsirke
- 3473.42020 699.37710 1023906854 Brunsirke
- 3473.42110 699.37150 1023906870 Brunsirke
- 3473.41880 699.36710 1023906886 Brunsirke
- 3473.41620 699.37090 1023906898 Brunsirke

3473.41770

Lat (arcmin)

Lat (DD.ddddd)=

3473.41770 /60=

57.890295

699.38620

Long (arcmin)

Long (DD.ddddd)=

699.38620 /60=

11.656437

1023906793

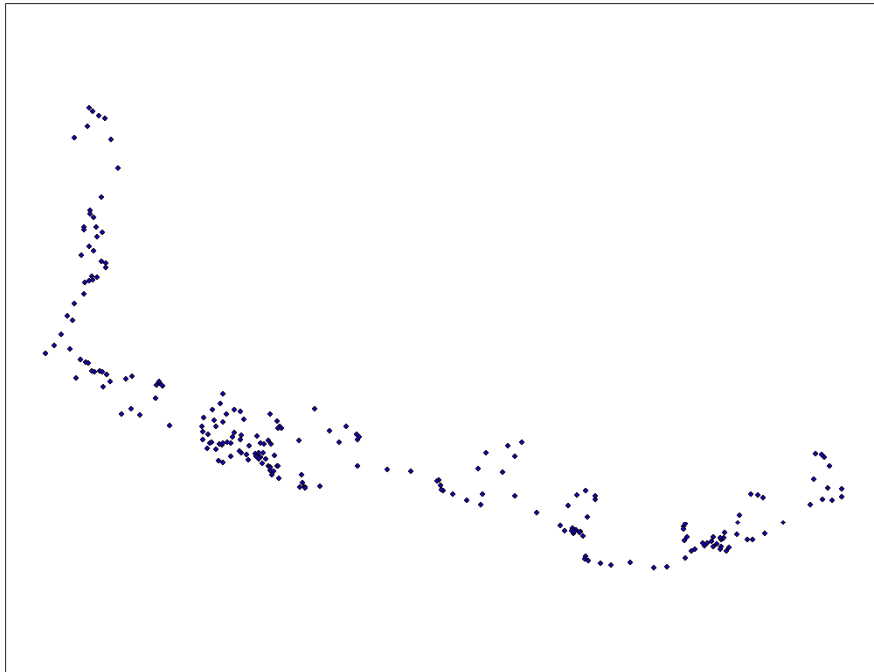
Unix time

Date/Time =

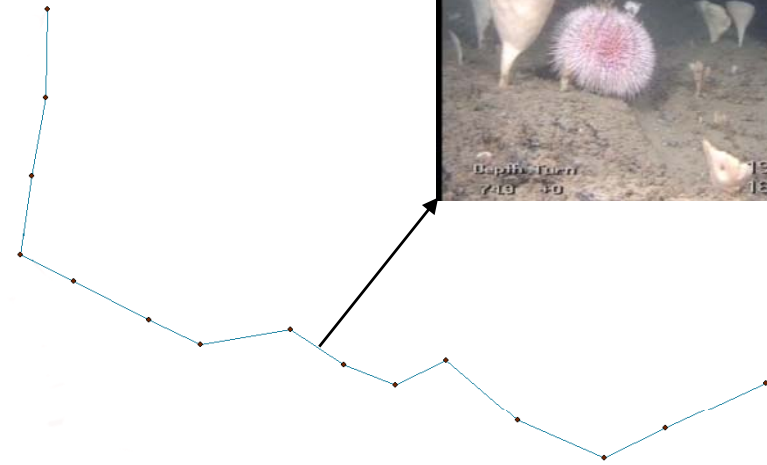
DateAdd("s",olex_data!unix_time,
"01/01/1970")=

12/06/2002 18:33:13

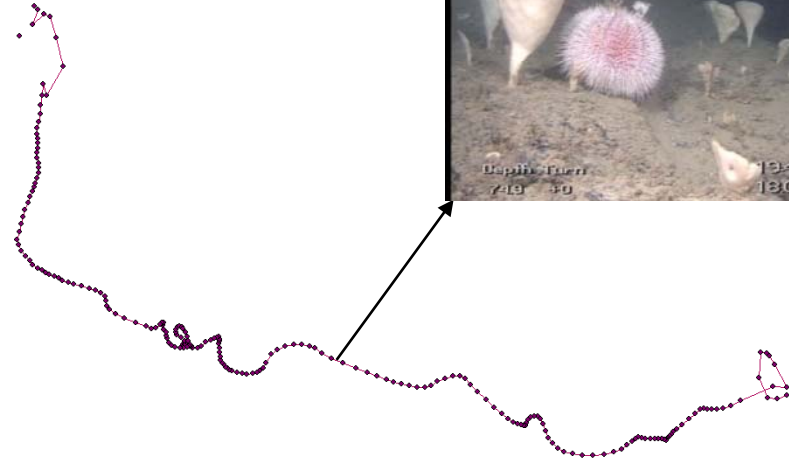
Modeling the tracks



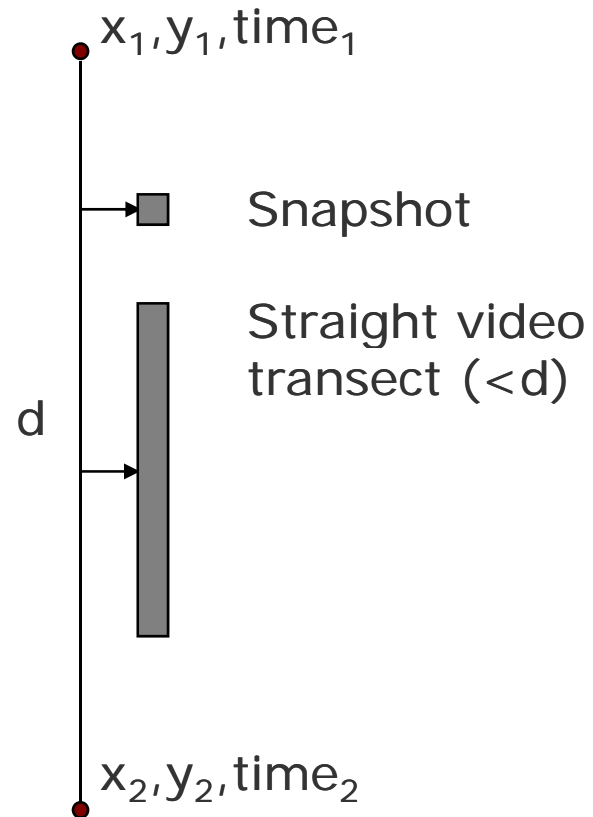
If $d > \text{threshold}$,
then mid point

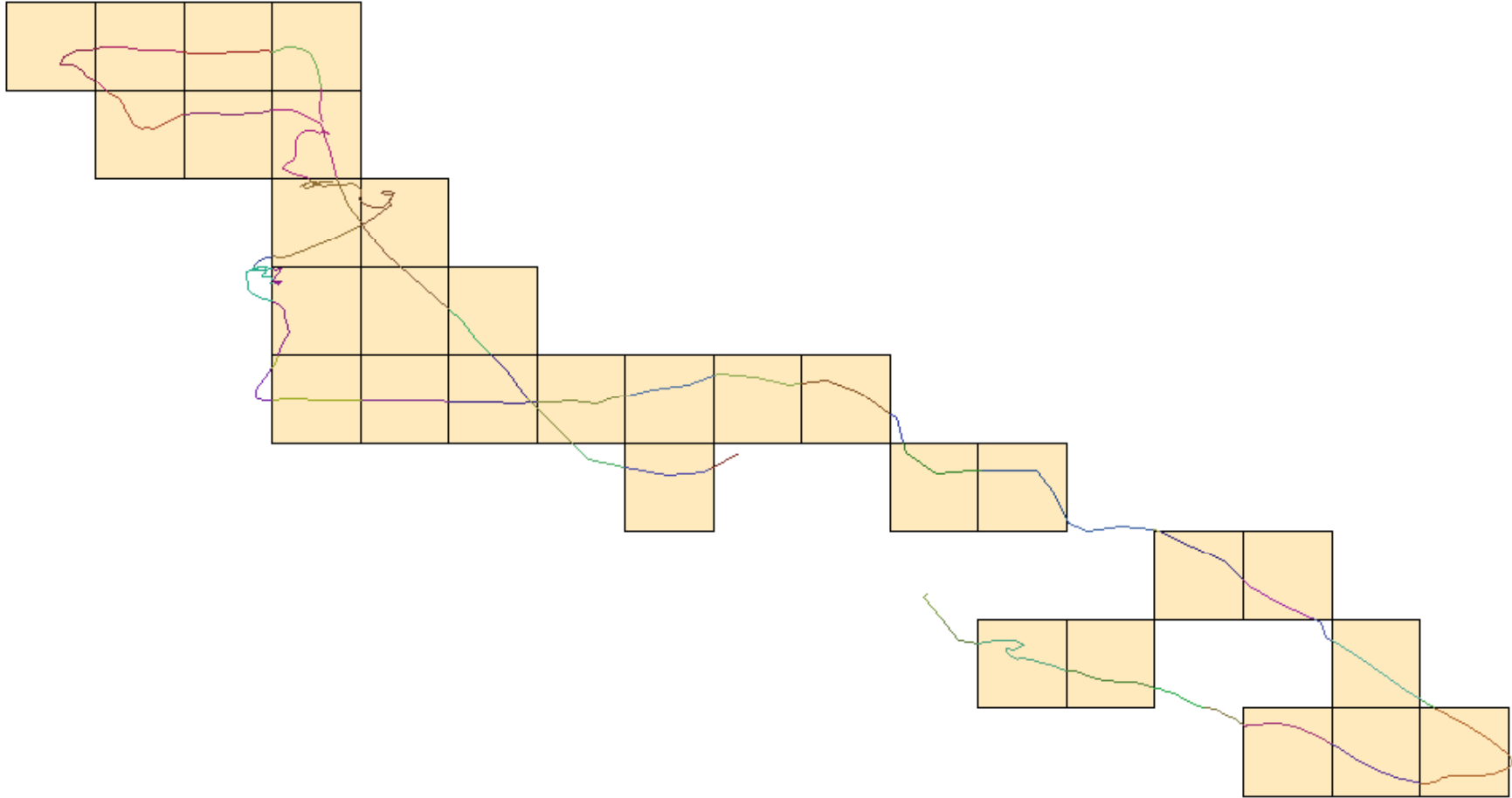


Fit gaussian
function



Estimating positions





Sources of error

- Position fix error (compensated for by smoothing)
- Interpolation between smoothed points
- Angle of camera
- Time out of synch

