Expert Couplet Node (ECN) for Aberdeen City and the Aberdeenshire Coast (University of Aberdeen (UoA) and Aberdeen City Council (ACC))

1. General Information on the Aberdeen coast study site (supplied from previous projects e.g. SARCP (AICSM) and AICSM/ACC for the Aberdeen Beach Project)

2. The Aberdeen coast study site area from an ICZM/Climate Change perspective. An example from SACRP (South Aberdeen Coastal Regeneration Project) on coastal and waterfront regeneration (MS-Powerpoint presentation (PPT))

3. The Expert Couplet Node (ECN) of the University of Aberdeen (UoA) and Aberdeen City Council (ACC) for the Aberdeen and Aberdeenshire coast

4. RESULTS from the Climate Change and Scenarios Workshop to identify the ISSUES and the IMPACTS on SECTORS due to climate change along the Aberdeen and Aberdeenshire coast. In addition, also to highlight the use and role of GIS as an educational and geovisualization tool in climate change.

5. IMCORE collection of case studies on coastal erosion and flooding

6. Datasets: Ordnance survey 1:10,000 raster map, Ordnance Survey (OS) Land-Form PROFILE 1:10,000 DTM, 2001 Census output area/population data, SEPA Flood maps, Ordnance Survey Aerial Imagery, flood incident database (Aberdeen City Council), Aberdeen city catchments and watercourses etc…

7. GIS Training videos (e.g how to create a sea level rise contour)/ Support

8. Climate change leaflet and website (http://www.aberdeenclimatechange.net)

9. Aberdeen Beach Case Study.

10. IMCORE bus advert

11. Coastal Geotools 2011 conference

1. General Information on the Aberdeen coast study site (supplied from previous projects e.g. SACRP and Amy Taylor Beach nourishment program)

Aberdeen beach is an important asset for Aberdeen City. The beach itself is also a popular tourist and recreational attraction, for example the main recreational activities include: surfing, canoeing, walking, cycling, running and swimming. The beach experiences a semidiurnal tide with a meso-tidal range. The groynes and blockwork revetments in place on the beach were installed to protect Aberdeen beach and associated commercial areas from coastal erosion. Groynes interrupt long-shore water flow, limiting sediment movement and removal, and blockwork revetments protect the shoreline from waves and flooding.

2. The Aberdeen Study Site Area from an ICZM/Climate Change perspective. Example from SACRP on coastal regeneration (MS-PowerPoint presentation)

Relevant facts:

- The city area extends to 184.46 km^2 (71.22 sq mi) and includes the former burghs of Old Aberdeen, New Aberdeen, Woodside and the Royal Burgh of Torry to the south of River Dee. In 2008 this gave the city a population density of 1,131 /km^2 (2,929 /sq mi)

- Built at the mouth of two major Scottish rivers, the Dee and the Don, and covering an area of 188.46 square kilometers (72.76 square miles)
- Traditional industries such as fishing and farming in and around the city but
- Fuelled by the oil and gas industry, earning the city its epithet as 'Oil Capital of Europe'.

Typology of Stakeholders:

Stakeholders	Type
Old Torry Heritage Society	Community Association
East Grampian Coastal Partnership	Community Association
Cove and Altens Community Council	Local Authority
Aberdeenshire Council	Local Authority
Aberdeen City Council	Local Authority
Kelda Water	Utilities
Scottish Water	Utilities
Scottish Environmental Protection Agency	Government Agency
SNH	Government Agency
Macaulay Institute	Academic
University of Aberdeen / RGU	Academic
Aberdeen Harbour Board	Independent Statutary Authority

3. The Expert Couplet Node of Aberdeen University (UoA) and Aberdeen City Council (ACC) for Aberdeen City and the Aberdeenshire coast

The University of Aberdeen has a wide range of expertise and past experience in ICZM, MSP GIS, remote sensing, cartography and Internet mapping. These have been utilised to assist in the production of materials for Aberdeen and Aberdeenshire.
Aberdeen City Council has been working with Aberdeen University supplying data for the IMCORE projects. Specifically, the climate change workshop Aberdeen City Council supplied data for flooding areas, catchments, and waterways.
The main objectives and issues to be addressed in IMCORE by this Expert Couplet are:

- Issues of Climate Change for local population and stakeholders in particular coastal flooding and erosion.
- Education workshops to contribute to raising awareness of the problem within companies and organization, with the goal of integrating climate change issues into their plans.

4. RESULTS from the workshops to identify the ISSUES and the IMPACTS on SECTORS due to climate change for Aberdeen and Aberdeenshire Coast.

Project background:

- IMCORE = Innovative Management for Europe's Changing Coastal Resource
- Funded under the Interreg IVB programme (www.nweurope.eu)
- Project goal is to promote a trans-national, innovative and sustainable approach to reducing the Ecological, Social and Economic impacts of climate change on the coastal resources of North West Europe.
- Partners composed of expert couplets from different countries in NW Europe (UK, Ireland, France, and Belgium)

Climate Change Workshop – Issues Identification
Workshop date: 20th August 2009
Organised by: David R. Green and Barry J Bleichner (University of Aberdeen), Peter Inglis (Aberdeen City Council)
Workshop focused on and discussed:

- What does Climate Change mean to you and your job?

- What are the major issues concerning Climate Change affecting you and your job?
- What are you and your organisation doing about Climate Change?

Climate change issues were identified in this workshop with descriptions of future predictions. Possible reasons for climate change were presented and the problems it will bring were discussed. Climate change considerations were discussed in terms of how climate change affects stakeholder's jobs and what their organizations can do about it.
Future climate change predictions presented in this workshop are:

- Increased temperatures from 2° to 3.5° C by 2080
- Increase in winter rainfall by 25%
- More intense storms
- Less snowfall by 90%
- Greater incidence of strong winds and larger waves
- Increased flood risks from rivers and seas, as well as possible sea level rise of 61cm
- Water temperature increase may affect geographical distribution of marine species and thus abundance of commercial species and marine mammals

The aim of this workshop was to provide an introduction to climate change and the potential issues it will create in the future.

You can download the presentation at the following address:
http://www.aberdeenclimatechange.net/uploads/files/Climate%20change%20issues%20-%20Workshop4.pdf

Scenarios Workshop - The Impact of Climate Change on Flooding in Coastal Communities in Aberdeen and Aberdeenshire.

Scenarios workshop date: 31th Mat 2010
Organised by: David R. Green, Guillaume De La Fons, Thomas Bedford, Thomas Danks, Alissa J. Johnson (University of Aberdeen), Peter Inglis, David Fryer and Dr Joseph Somevi (Aberdeen City Council).

The workshop focused on the following questions and discussed:

- Is Aberdeen City at risk from flooding caused by climate change?
- Which areas of Aberdeen City are at risk to future flooding?
- What degree of Aberdeen City population will be affected by future flooding?
- What are the main problems flooding will cause?
- What are the possible solutions to future climate change and flooding?

Learning Tasks:

- Learn about the impact of Climate Change on flooding events in Aberdeen and Aberdeenshire
- Examine the potential of gaming technology to explore various flooding scenarios
- Use flood data, visualisation technology, and GIS tools to analyse the effects of Climate Change on flooding in Aberdeen and Aberdeenshire

Aims and Objectives

The aim of this workshop was to raise awareness about the Impact of Climate Change on Flooding in Coastal Communities in Aberdeen and Aberdeenshire. Delegates were given the opportunity to investigate some potential effects of Climate Change on flooding scenarios. They used spatial datasets, GIS technology and other tools to visualize the flooding scenarios and to provide new opportunities to integrate climate change into your own profession by defining and addressing these issues.

Results:
The climate change issue, flooding was discussed in this workshop with potential risks and solutions identified. Presentations were done at the end of the workshop on risks identified and possible solutions/prevention measures. Various educational tools were used in this workshop to provide a range of information to participants about climate change and flooding.

Feedback for the workshop was very positive from all stakeholders. The combination of different, interesting education techniques (GIS task, serious games, quiz and lectures) provided an effective enjoyable workshop. The GIS task and serious games were specifically highlighted as being very beneficial to the delegates, helping to highlight the issue of future flooding. A series of presentations performed by the delegates based on what they had learnt were produced at the end. The content of these presentations showed that education on flood risk was successful with the areas around the river Don, Dee and harbour being highlighted by all groups as having the biggest potential to flood when sea level rises. Various solutions were finally discussed at the end.

You can download the report at the following address:
http://www.aberdeenclimatechange.net/uploads/files/IMCORE%20Climate%20change%20workshop%2031st%20May%202010.pdf

Secondary Education scenario workshop – The impact of Climate Change on sea level rise for Stonehaven Coast
Workshop date: TBA
Organised by: David R. Green, Guillaume De La Fons, Thomas Bedford, Thomas Danks, Lukasz D. Langowski (University of Aberdeen), Peter Inglis and David Fryer (Aberdeen City Council)
The workshop will focus on and discuss:

- What is Climate Change?
- How does Climate Change affect your local community?
- The impact of Sea level rise on Stonehaven's coast

Learning Tasks:

- Learn about the impact of Climate Change on Sea level rise in Stonehaven and Aberdeenshire
- The use of interactive games to gain an understanding of what climate change is.
- Use flood and sea level data, visualisation technology, and GIS tools to analyse the effects of Climate Change on Stonehaven coast

Aims and Objectives

The aim of this workshop will be to provide education on climate change, specifically what is climate change. Pupils will be given the opportunity to investigate some potential effects of climate change using a number of scenarios. Spatial datasets, interactive games, GIS technology and other tools will be used to visualize the scenarios and provide information on climate change. These scenarios were also used highlighting the potential risks of climate change to Aberdeenshire coast.

5. IMCORE collection of case studies

Case Studies created for IMCORE were based on a predefined template. This template ensured consistency in formatting and content as well as a higher end quality of information for the user. The template ensured the below case studies included: Introduction, aim and objectives of the case study, history of the study area, intended learning outcomes, illustrative maps, graphs and photographs.

Aberdeen Coast – Case Study:
A case study was created for the Aberdeen coast. This case study focused on coastal erosion and flooding, with an example of a previous nourishment programme. The nourishment program was undertaken by Aberdeen City Council with monitoring work carried out by the University of Aberdeen (Amy Taylor). Amy Taylor's PowerPoint provided data on the nourishment program, specifically erosion levels, sea defence and wave height. From this a case study was created based on the potential climate change has on increasing coastal erosion and flooding. Future climate change predictions for Aberdeen were based on an identification of climate change issues workshop, run by and the University of Aberdeen and Aberdeen City Council. The combination of these two sources allowed a series of questions to be created based on case study material. These questions were used to help educate people about climate change for the region of Aberdeen and highlight the potential impacts coastal erosion, flooding and climate change will have for Aberdeen coast.

Sands of Forvie –Estuaries:
A proposed case study for the sands of Forive, is to focus on climate change in a estuarine environment. The Ythan area is proposed as previous work on weed mat monitoring has been done in the past. Potential information could be gained for subject material from OceanLab.

6. Datasets: Ordnance survey 1:10,000 raster map, Ordnance Survey (OS) Land-Form PROFILE 1:10,000 DTM, 2001 Census output area/population data, SEPA Flood maps, Ordnance survey Aerial Imagery, flood incident database (Aberdeen city council), Aberdeen city catchments and watercourses.

- **Workshop GeoDataBase (GDB)**
  The preferred 'container' for multiple datasets relating to the same subject in ArcGIS. In this case, a 'file' GeoDataBase was created, and all datasets needed for the workshop were imported into it. The main benefit of using a GDB, rather than many individual files, is that all datasets are collected together in one place, and can easily be located and identified within ArcCatalog. In addition, spatial references (which are required in order for datasets to be displayed properly) are permanently associated with datasets, whereas when GDBs are not used, they must be assigned each time some datasets (some of the OS data in particular) are opened. Finally, GDBs drastically increase the speed of opening and manipulating some large datasets, such as the Ordnance Survey raster maps and MasterMap datasets.

  The following descriptions apply to the individual datasets which have now been imported into the GDB.

- **Ordnance Survey 1:10,000 raster map (abdn_OS10K)**
  'Traditional' maps of land features (roads, houses, rivers etc)

  These are topographic maps (although they don't show height i.e. contours) at the largest scale (smallest area coverage, highest detail) with complete national coverage supplied by Ordnance Survey. The information contained in the maps has been surveyed at a scale of 1:1250 for cities, and 1 pixel on the image viewed at 100% size on a computer screen represents an area of 0.635m (63.5cm) on the ground.

  These data were supplied as TIFF images (a format that uses lossless compression to retain image quality), and have been imported into the workshop GDB so that they permanently retain their spatial reference settings and redraw more quickly in ArcGIS.

- **Digital Terrain Model – BlueSky 2m Elevation Data and Ordnance Survey (OS) Land-Form PROFILE 1:10,000 DTM (abdn_DTM)**

A 3D digital model of the Earth

This is a model of the land, in the form of a regular grid with a height value at each grid-line intersection. The DTM was created by mosaicking two sets of elevation data; a 2m resolution (2m grid) dataset from Bluesky created using LiDAR, and one with 10m resolution derived from Ordnance Survey 1:10,000 scale maps, which have contours spaced at 5m intervals. Height values for the Ordnance Survey data are accurate to half the contour interval on the map, in this case ±2.5m. Height data to produce the original contour maps were derived from a programme of photogrammetry completed in 1987. Both datasets were referenced to the Ordnance Survey Great Britain 1936 datum and projected in British National Grid as supplied.

The BlueSky data were are supplied as OS 1km^2 grid tiles in ASCII format, and the OS data were supplied as OS 5km^2 grid tiles , originally in NTF format, which were converted to ASCII for use in ArcGIS, mosaicked with the BlueSky data to fill any gaps, and imported into the GDB.

- **2001 Census output area/population data (census_areas)**
  Census Output Area polygons with population data

  These originated as two separate datasets which have been combined for ease of use. Population data from the most recent (2001) census are provided by Scotland's Census Results OnLine (SCROL, www.scrol.gov.uk). Usual resident population data were obtained for each Census Output Area (aggregations of small numbers of postcode areas, usually between two and four, to ensure data are anonymous) within each of the 43 Statistic Wards for Aberdeen, with 1861 individual units in total.

  The population data were then added as attributes to digital map representing each of the 1861 Census Output Areas as polygons, such that the record in the database for each polygon contains the usual resident population figure for that area. The Census Output Area boundaries dataset was obtained from the UKBORDERS section of the EDINA National Data Centre website (www.edina.ac.uk).

- **Flood maps (river_flood and coast_flood)**
  Areas with a 0.5% (1 in 200) chance of being flooded in any one year

  These were created from the SEPA flood map (freely available online at http://www.sepa.org.uk/flooding/flood_map.aspx). The data are provided as polygons which cover the area with a 0.5% (1 in 200) chance of being flooded in any given year, based on calculations of likely water levels, catchment area of waterways, slope directions and a variety of other characteristics (see http://www.sepa.org.uk/flooding/flood_map/about_the_map.aspx for more information). The polygons were digitised from the online maps then combined into two files, one for Aberdeen, one for Stonehaven.

  As the flood map dataset was created with national coverage (of Scotland), it does not use the highest resolution data available, and does not use all available data. As a result, not all factors are taken into account in the calculation of the susceptibility of an area to flooding, such as any flood defences in place. In addition, the positional accuracy of parts of the polygons may be relatively low, especially in urban areas, as the maps provided online are at 1:25,000 scale. Consequently, the flood maps should only be seen as indicative in the context of this exercise, and certainly should not be seen as an accurate representation of the real world (which is a tempting conclusion to draw, especially when combined with the other datasets provided, which have much higher positional accuracy and resolution). For more information on the limitations of the maps, see the websites above.

- **Aerial Imagery ('bod.jp2', 'centre.jp2', 'harbour.jp2', 'dee.jp2')**
  High-resolution photos of Aberdeen from above

  Very high quality aerial photos of Aberdeen, supplied by Ordnance Survey as part of a dataset which matches the MasterMap database. Each original image covers 1km^2, and several of these have been 'mosaicked' together to produce larger images covering areas of interest listed above. The original images had a resolution of 10cm, meaning anything on the ground which measures 10cm or is resolved in the imagery. To make the datasets more manageable, the images were resampled to 1/3 of the original resolution, and were compressed using JPEG2000 compression. The images are embedded with Ordnance Survey Coordinates referenced to the Ordnance Survey of Great Britain 1936 datum, and so will align with all other Ordnance Survey data.
  Ensure that when the data are loaded into ArcMap, 'harbour.jp2' is above 'centre.jp2'.

- **OS Mastermap**
  Highly accurate GIS dataset of surface features

  OS Mastermap is an entirely-digital dataset with complete coverage of the UK with features stored as points, lines and polygons. As there are no paper versions of this product available, data are not provided at a 'scale' as such, but they have been surveyed at specific scales. According to the User's Guide for this dataset, areas are surveyed at "a scale of data capture appropriate to the density of features". OS Mastermap data have a positional accuracy of 1m.

  Data are not supplied in tiles as for the other formats, rather complete features are supplied for a particular area requested by the user.

  Mastermap data are supplied in GML format, for the workshop we extracted relevant data and imported it into the GDB as feature classes for ease of use and management. See below for features extracted from Mastermap.

- **Buildings layer (important_buildings)**

  A dataset containing locations and outlines of some examples of important buildings in peoples' everyday lives to allow the exploration of their vulnerability to flooding. The buildings shown are just a small selection for indicative purposes, and the selection is not exhaustive. The building locations and outlines were taken from the Ordnance Survey Mastermap dataset (see above).

- **Water areas layer (water_areas)**

  A polygon file containing all significant surface waterways in the city, extracted from the Ordnance Survey mastermap dataset using the 'Theme' attribute.

- **Railways layer**

  Railways in Aberdeen extracted from OS Mastermap using the 'Theme' attribute.

- **Roads layer (roads)**

A dataset containing all the road centrelines in the Aberdeen City, clipped to the area of Aberdeen city to reduce the size of the dataset.

Aberdeen City Council Datasets

- **Flooding incidents (flood_incidents)**

  A point dataset showing locations of flooding incidents contained in the City Council's database for the period 2000-2004. The points are linked to an anonymised database on flood incidents which gives an indication of the type and severity of the incident, and any remedial action taken.

- **Catchments (catchments)**

  The area drained by each significant river in the Aberdeen city area and Deeside, apart from the river Don.

- **Watercourse lines layer (Council_data -> watercourses)**

  A line dataset showing most significant watercourses (rivers, streams, drains, gullies etc) in Aberdeen city.

7. GIS Training videos / Support

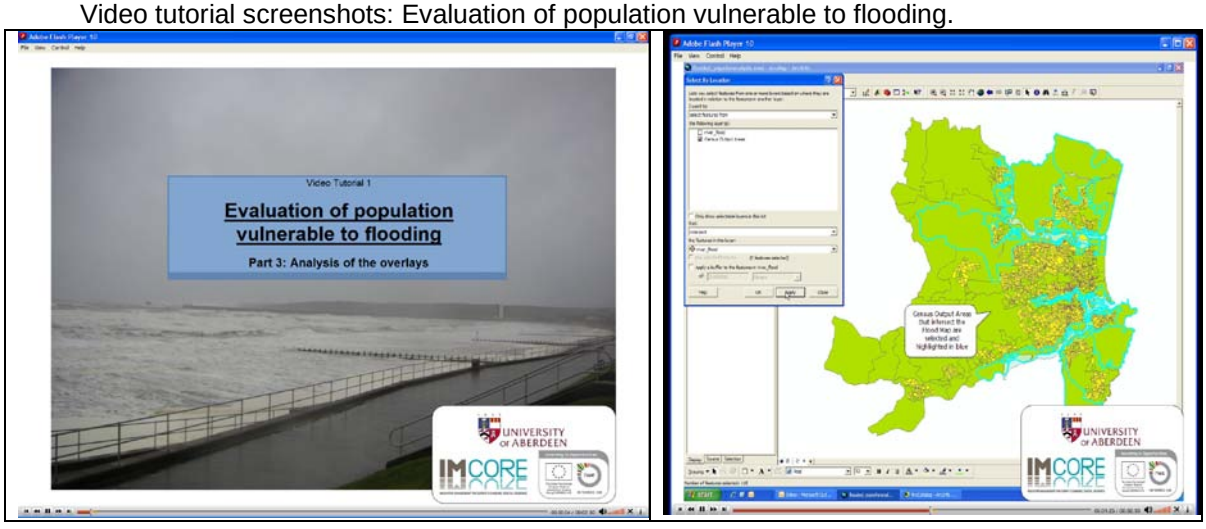
Training videos were developed to provide a tool for stakeholders to perform and learn some of the GIS tasks shown at the Scenarios workshop:

- Create a sea level contour for Aberdeen
- Finding population of areas vulnerable to flooding,
- Finding highest/lowest elevations
- Creating map

The training videos give a step by step guide with a voiceover to help complete and learn fundamental components in ArcGIS software.

You can access these videos at the following address:
http://www.aberdeenclimatechange.net/gis/

Video tutorial screenshots: Evaluation of population vulnerable to flooding.



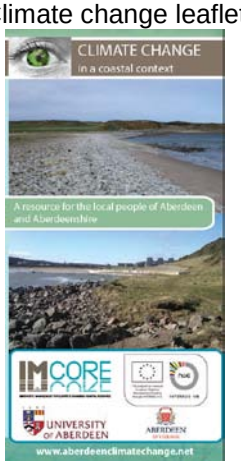
The University of Aberdeen provide GIS, remote sensing and visualisation support for all Partners:

- Sea level rise mapping for Envision.
- Goole Earth sea level rise visualisation for Belgium.
- Remote sensing and GIS Support for Sefton.
- GIS Support for Ulster.

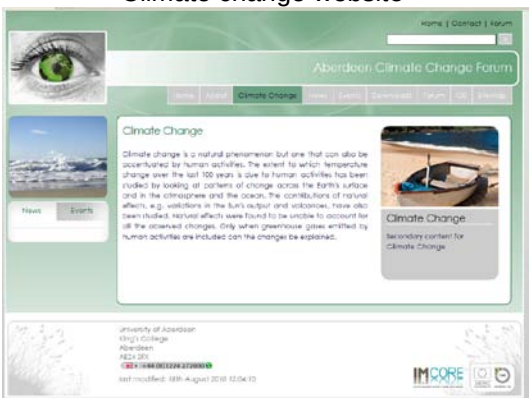
8. Climate change leaflet, website, banner and postcard

Development of a website and a leaflet about climate change for the community in Aberdeen and Aberdeenshire. These two developments provided a source of information for climate change to the local communities. The leaflet and website supplied information to the local community on Aberdeen City Council climate change action plan, the IMCORE project and essential information on climate change and the drivers and impacts.

Climate change leaflet



Climate change website



Banner

Postcard

You can access these documents at the following addresses:

- Leaflet
http://www.aberdeenclimatechange.net/uploads/files/Leaflet%20-%20Climate%20change%20in%20a%20coastal%20context.pdf

- Website
http://www.aberdeenclimatechange.net/

- Banner
http://www.aberdeenclimatechange.net/uploads/files/Climate%20change%20and%20your%20community.pdf

- Postcard
http://www.aberdeenclimatechange.net/uploads/files/Aberdeen%20Postcard.pdf

9. Aberdeen Beach Case Study

Aberdeen developed a case study template for IMCORE's Work Package 2.5 then following this guideline an Aberdeen Beach Case Study about historical context, drivers and issues of climate change was produced.

You can access this case study at the address below:

http://www.aberdeenclimatechange.net/uploads/files/Aberdeen%20Beach%20-%20Case%20Study.pdf

10. IMCORE bus advert

- IMCORE bus advert – Streetliner
http://www.aberdeenclimatechange.net/uploads/files/IMCORE%20-%20Bus%20-%20Streetliner.pdf

- IMCORE bus advert – Interior panel
http://www.aberdeenclimatechange.net/uploads/files/IMCORE%20-%20Bus%20-%20Interior%20panel.pdf

- Pictures
http://www.flickr.com/photos/abdn_imcore/sets/72157625746823106/with/5330513811/

11. Coastal Geotools 2011 conference – USA

The Coastal GeoTools conference is held every two years and focuses on geospatial data, tools, technology, and information for coastal resource management professionals.

You can access Aberdeen's presentation at the address below:

http://www.aberdeenclimatechange.net/uploads/files/Coastal%20GeoTools%20-%20Aberdeen%20presentation.pdf