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Earth Observation activities for the environment in Slovenia

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1. Introduction: A brief Historical Overview on Earth Observation Activities

The map of Styria, Carniola, Carinthia and other provinces (1657) (ger. Hertzogthuber Steyer, Karnten, Krain, & c) ranges among the oldest maps of Slovenian territory, mapped by Nicholas Sanson (1600-1667). One of the most significant sources for the research of the history of Slovene territory and its people was made by Janez Vajkard Valvasor (1641-1693), since 1687 member of the British Royal Society, who published a monumental book containing the topography of Carinthia and Carniola as well as a comprehensive historical, geographical and ethnological description of the then Slovenian lands, titled *Die Ehre des Hertzogthums Crain* (in Slovenian: "Slava Vojvodine Kranjske"). However, he was also the author of several maps of Slovenian and neighbor provinces (Korošec, 1978; Gašperič, 2007). The first systematic surveying and mapping of the today's Slovenian territory dates back into the 18th century when the Josephine military map (1763-1787) (ger. Josephinische Landesaufnahme) was established (for the whole Austro-Hungarian monarchy). Despite the fact, that the 1st military mapping was done without precise surveying measurements and cartographic projection, these maps (the scale 1:28,880) and reach archive of attribute data are often used as a first class historic source for the study of geomorphology, hydrology, land-use, cultural landscapes and geographical names since the archive of the surveying is well maintained. Insufficient quality of maps from 1st military mapping led to new surveys in the 19th century. The 2nd military mapping (1807-1869) is considered as relatively accurate, based on good surveying foundation, on the basis of common terrain measurements of land cadastre and maps for topographical purposes (URL1).

The oldest official land register based on cadastral surveying in the territory of today's Slovenia is the Franciscan cadastre (Fig.1) from the first half of the 19th century (1818-1828). The main scale was 1:2880. For mountainous area scale 1:5760 and for cities 1:1440 or 1:720 was used. The Franciscan cadastre was produced in Krim coordinate system (in Vienna fathoms or later in meters) as the origin of measurements in the most present Slovenia. Later, Gauss-Krueger cartographic projection was adopted on the bases of the Bessel ellipsoid (URL1).

In the first part of 20th century, a systematic topographic mapping was developed, mainly done by the Royal Military Geographical Institute in Belgrade. After the WWII, the tasks were carried on by the Military Geographical Institute of the Yugoslav People's Army in Belgrade (VGI). Slovenia was the only Republic of the former SFRY which developed certain parts of the cartographic system under the sponsorship of the Republic Surveying and Mapping

Authority: it covered the entire territory with the sheets of a basic topographic map at 1:5,000 and 1:10,000 (TTN 5/10); from the Military Geographical Institute it commissioned the so-called economic edition of the topographic map at 1:25,000 (TK 25 VGI) and in addition to the printed copies it also obtained the copies of reproduction originals; it created its own map at 1:50,000 (TK 50 GZS), created and updated a system of general maps (PK) in scales between 1:250,000 and 1:1,000,000 and finally, it created the first topographic records DMR 100 (digital terrain model, started by GZS), ROTE (register of spatial units) and EHIŠ (register of house numbers) for the entire territory. In this period, the topographic mapping was strongly influenced by the technological development of photogrammetry – since the beginning of the 70-ies of the past century, the Surveying and Mapping Authority has been implemented also the cycling aerial surveying(CAS) for the whole Slovenian territory (URL3).



Figure 1. Land cadastre map of Kostanjevica, Slovenia, from the beginning of 19th century (URL2).

With the attainment of independence (1991), the administration of the system of national maps and topographic databases was entirely taken over by the Surveying and Mapping Authority of the Republic of Slovenia. The Surveying and Mapping Authority of the Republic of Slovenia (SMA) is a body within the Ministry of Environment and Spatial Planning. The competence of the SMA comprises the assignments of the national land survey service, which include the creation, administration and updating of databases related to the basic geodetic system, real estate, state border, spatial units and house numbers, and to the topographic and cartographic system (URL3).

The SMA is responsible for administering the topographic system of the Republic of Slovenia, which encompasses basic topographic map at scales 1:5,000 and 1:10,000, topographic database, national topographic maps at 1:25,000 and 1:50,000, national general maps, generalized cartographic database, aerial and orthophoto images, digital height models, Register of Geographical Names and the Consolidated Cadastre of Public Infrastructure. The task of the SMA encompasses also systemic aerial triangulation, planning, monitoring and supervision of aerial surveys and creation of standard photogrammetric products. Cyclic aerial surveys were implemented between 1975 and 2005. The most common survey scale was 1:17,500. In 2005 a quarter of the territory of Slovenia was surveyed in color. In 2006 the entire territory of Slovenia was surveyed with a digital camera in the visible color spectrum and near infrared spectrum. Last aerial survey was done in 2009 to 2011. Analog

orthophotos began to be produced in the 1980s. In the middle of 1990s, the systemic digital creation of orthophotos began, with the pixel size of 0.5 m (DOF 5). Slovenia was completely covered by DOF 5 for the first time in August 2001. Using the digital camera images from 2006, by June 2007 new orthophotos with the resolution of 0.25 m were made for 14% of the territory of Slovenia and 0.5 m resolution for the entire territory of Slovenia. Additionally, an orthophoto in the near infrared spectrum and with a resolution of 1 m was generated. Orthophoto serves as a basis for the depiction of different spatial information, as a basis for acquiring derived data and for spatial analyses. It is available to the users as a raster file in several raster formats. Orthophoto updating is planned at 3- to 5-year cycles, depending on the number of changes in space as well as the interest and needs of users. Different digital elevation models (DEM) are available at the national level. The first DEM of 100 m resolution was produced in 70-ies of the 20th century from analog map at scales 1:5,000 and 1:10,000. In the production line of the first edition of orthophoto (1995-2003) a DEM of 25 m resolution was produced with the image matching methods. From Interferometric SAR imagery, DEM of 25 m and 100 m were produced as well. The most homogenous and examined DEM referred as Digital relief model of Slovenia was produced from more than 25 different data sources in the resolutions of 12.5m, 25 m and 100 m. With the new edition of orthophoto produced from digital aerial imagery, a new DEM of 5 m resolution was produced with the image matching methods. In 2011 and 2012, the entire territory of Slovenia will be scanned with lidar technology with the average density of 5 points / m² and DEM of the 1 m resolution will be interpolated (URL3).

The SMA is a member of EuroGeographics. Since 1996, it has been a member of the European association for real estate management (UN/ECE WPLA - Working Party on Land Administration) within the United Nations Economic Commission for Europe. On the 28th of May in 2008 Slovenia signed an agreement on closer cooperation between ESA and Slovenia. In January 2010, Slovenia became the sixth European country to sign the European Cooperating State Agreement with ESA. It is also a member of GEO – a group which is coordinating efforts to build a Global Earth Observation System of Systems, or GEOSS.

2. Current Status of Earth Observation Activities: Policies

2.1. National policies and implementation

The Surveying and Mapping Authority (SMA) of the Republic of Slovenia is responsible for development of Spatial Data Infrastructure of Slovenia. According to the Spatial Information Act (Official Gazette of RS, No. 8/2010, hereinafter, the ISI Act), which transposed the Directive 2007/2/EC of the European Parliament and of the Council establishing an Infrastructure for Spatial Information in the European Community (INSPIRE), the SMA is also the contact point for implementation of the INSPIRE Directive, since the ISI Act specifies that the tasks of the national contact point shall be implemented by the ministry responsible for land survey (URL4).

The SMA established a uniform metadata system available to the users on the *Prostor portal* (URL5). It contains description of over 100 data sets, and particularly the metadata descriptions of geodetic data are regularly updated. The updated online portal is an access point to information, services, and applications related to geodetic and real property information. It is not only the image that is changed; the portal now provides more content and enables users to navigate more easily and faster towards desired information. The SMA provides to the users the following options of accessing the data:

- Map Viewer, which enables searching and displaying the location based on an address or geographical name (URL6),
- public access to real estate data (URL7),
- Central Evidence of Spatial Data (URL8),
- personal access to one's own data for real estate owners,
- public access to the Real Estate Market Register,
- access to geodetic data for registered users, which also enables access to personal data.

The Environmental Agency at the Ministry of the Environment and Spatial Planning enables the users to access, browse and download environmental data (noise chart, measuring network, fields of nature, water, climate change, air, environment and seismology):

- access to environmental data via the Environmental Atlas and the Weather Portal:
 - Environmental Atlas (URL9).
 - Weather Portal (URL10).
- public access to the issued water permits, archived hydrological data, and download of environmental data,
- data from the national monitoring station network of:
 - hydrology: (URL11),
 - meteorology: (URL12),
 - seismology: (URL13),
 - metadata portal (URL14),
 - data sources on the environment (URL15).

The data download services have been in development for several years now. This way, the Environmental Agency of the Republic of Slovenia and the Surveying and Mapping Authority of the Republic of Slovenia provide access to data to their users. Particularly the web feature services are being developed, which enable downloading the spatial data sets and their parts to the users in a standard manner. WFSs are used by many public authorities for accessing the data of the Land Cadastre, Buildings Cadastre, Register of Spatial Units, the Aggregate Economic Cadastre of Public Infrastructure, and others (URL16).

The access service is also provided by the private sector. Geopedia (Fig. 2), Gaea+, Najdi.si and Bioportal are one of the largest. In addition, there are also systems for accessing the spatial data for the needs of the municipalities. Among the largest systems providing such service to municipalities are the Spatial Information System of Municipalities (PISO) and the Internet system – iObčina. Larger municipalities, such as Ljubljana, Maribor and Koper, developed their own systems.

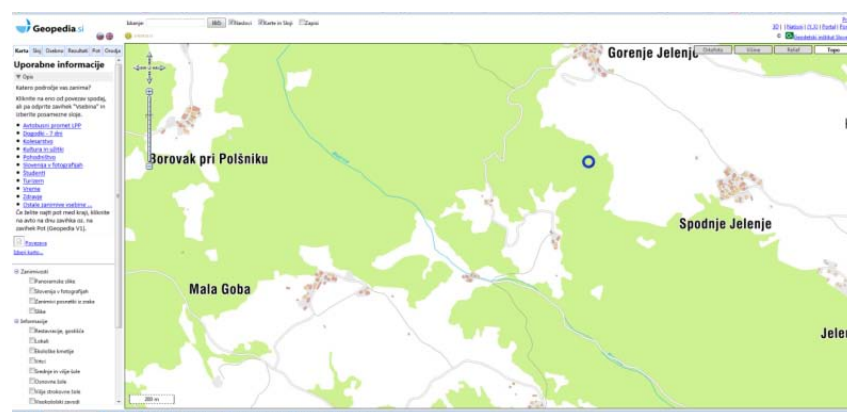


Figure 2. Geopedia portal (URL50).

2.2. Official national data and projection

The Surveying and Mapping Authority of the Republic of Slovenia is responsible for the establishment, maintenance and management of the national coordinate system. National coordinate system is divided into two components, namely horizontal and height component. Currently there are in Slovenia:

- Vertical National Coordinate System,
- Horizontal National Coordinate System (D48/GK),
- Horizontal National Coordinate System (D96/TM).

2.2.1. Vertical National Coordinate System

The basic surveying leveling network of the Republic of Slovenia is defined by the heights of the benchmarks in the normal orthometric height system, which was introduced in the 19th century, when extensive first surveying of leveling networks was performed throughout the Europe. These height points in Slovenia refer to the basic leveling surveying with the point of origin in Trieste (Italy), and are adjusted at the level of the fundamental benchmark in Ruše. This system is outdated and a new height system that will base on normal heights and gravimetric measurements is under development.

2.2.2. Horizontal National Coordinate System

In Slovenia, two national horizontal national coordinate systems are in use. The old national grid D48/GK (ellipsoid Bessel 1841, Gauss-Krüger projection) has being replaced (since 2008) by D96/TM (ellipsoid GRS80, Transversal Mercator projection) although majority of spatial data are still related to D48/GK.

2.2.2.1. Horizontal National Coordinate System D48/GK

The national horizontal coordinate system D48/GK is based on local spheroid (ellipsoid) Bessel (1841) with parameters $a=6,377,397.155$ m, $e=1/299.15281285$. The spheroid touches the geoid in point Hermannskogel with astronomic coordinates $\phi=48^{\circ} 16' 15.29''$, $\lambda=16^{\circ} 17' 55.04''$ E (Greenwich), $H = 558.66$ m. The geodetic network is oriented with side Hermannskogel - Hundesheimer Berg $\alpha = 107^{\circ} 31' 41,70\%$. The projection is Slovene Gauss-Krueger conformal transversal cylindrical projection, with the following parameters (URL16):

- Latitude of origin $0^{\circ} 00' 00''$,
- Longitude of origin $15^{\circ} 00' 00''$ E of Greenwich,
- Central meridian $15^{\circ} 00' 00''$ E of Greenwich,
- False easting +500,000 m,
- False northing -5,000,000 m,
- Modulation factor 0.9999,
- Projection zone width $3^{\circ} 15'$.

The national horizontal coordinate system D48/GK:

- Ellipsoid: Bessel 1841
- Map Projection: Gauss-Krüger (conformal transversal cylindrical projection)
- Central Point/Datum: Hermannskogel

2.2.2.2. Horizontal National Coordinate System D96/TM

The national horizontal coordinate system D96/TM is based on ellipsoid GRS80 with parameters $a = 6,378,137$ m, $e = 1/298.257222101$. The projection is Transverse Mercator projection, with the following parameters (URL16):

- Latitude of origin $0^{\circ} 00' 00''$,
- Longitude of origin $15^{\circ} 00' 00''$ E of Greenwich,
- Central meridian $15^{\circ} 00' 00''$ E of Greenwich,
- False easting +500,000 m,
- False northing -5,000,000 m,
- Modulation factor 0.9999,
- Projection zone width $3^{\circ} 15'$.

On the URL17 portal there is a free online service that allows transformation of coordinates between coordinate systems ETRS89 (D96/TM) and D48/GK (SiTra).

The national horizontal coordinate system D96/TM:

- Ellipsoid: GRS8
- Map Projection: Transverse Mercator
- Central Point/Datum: D96 – ETRS89

2.3. Information sharing policies

2.3.1. Organizations providing various spatial Data Sets and Services

2.3.1.1. Ministry of the Environment and Spatial Planning

The Ministry of the Environment and Spatial Planning ensures promotes and coordinates efforts toward sustainable development, while striving for social well-being based on a wise and efficient use of natural resources. The Ministry directs the spatial development, with the aim of maintaining and developing the quality of architectural and urban heritage and cultural landscape, while at the same time ensuring economic, social and cultural development. It is responsible for adequate water resources, water quality, and sustainable management of surface, underground and seawater, since water is one of the most important natural resources in Slovenia. In pursuing the objectives of sustainable development, the Ministry establishes cooperation with local communities according to the principles of partnership and subsidiarity (URL18). In the framework of the Ministry there are three directorates:

- Environment Directorate

TYPES OF DATA: The Directorate provides the following data:

- Water, built-up and infertile land use.
 - Small combustion installations.
 - Habitats and biotopes: Plant and animal species databases.
 - Species distributions: Plant and animal species.
- Directorate of Spatial Planning.

TYPES OF DATA: The Directorate provides the following data:

- National spatial planning documents.
- Public Services and investment directorate

The Surveying and Mapping authority of the RS and Environmental Agency are two of four bodies under the Ministry.

2.3.1.1.1. Environmental Agency.

The Environmental Agency is a body of the Ministry of the Environment and Spatial Planning. It performs expert, analytical, regulatory and administrative tasks related to the environment at the national level. Thus the Agency's mission is to monitor, analyze and forecast natural phenomena and processes in the environment, and to reduce natural threats to people and property. These tasks are performed by the national services for meteorology, hydrology and seismology. The Agency's mission is also to monitor environmental contamination and to provide reliable public environmental data; to this end, the Agency has the appropriate measuring network and laboratories in place. Its mission of exceptional importance is, moreover, to meet the requirements regarding environmental protection deriving from the regulations in force, to preserve natural resources and the biotic diversity and to ensure sustainable development of the country (URL10).

TYPES OF DATA: In the period between 2007 and 2011, the Agency regularly prepared predominantly thematic maps concerning the environment. Many maps were made and they were submitted as reports at various conventions in the European Union or as appendices of the Agency's annual reports. The Environmental Agency provides the users data from the national monitoring station network of hydrology, meteorology, seismology, etc. The Agency provides the following data:

- Data on hydrography: Water Cadastre, Water bodies, Digital base of watersheds, System for groundwater data storing and processing.
- Data on Protected sites: Register of areas of ecological importance, Register of special protection areas, Register of natural values, Register of protected areas.
- Data on land-cover: Corine land cover.
- Data on human health and safety: Air pollution areas, Noise charts.
- Oceanographic features - data about altitude and temperature of the sea.
- Bio-geographical regions.
- Other data: Automatic station database for environmental monitoring, Sampling measuring site for determining water quality, Water permits for production and industrial facilities; Hydrographical regulation zones and reporting units; Natural risk zones - earthquakes, seismic risk; Climate chart about rain, wind, snow, sun and temperature;

The geodetic data for the atlas were provided by the Surveying and Mapping Authority of the Republic of Slovenia.

2.3.1.1.2. Surveying and Mapping Authority of the RS.

The Surveying and Mapping Authority (SMA) of the Republic of Slovenia is a body within the Ministry of Environment and Spatial Planning. The competence of the Surveying and Mapping Authority of the Republic of Slovenia comprises the assignments of the national land survey service, which include the creation, administration and updating of databases pertaining to the basic geodetic system, real estate, state border, spatial units and house numbers, and to the topographic and cartographic system. The land survey service is responsible for the basic data on physical space and real estate in the finalized databases and provides services pertaining to the registration of changes in physical space and on real estate properties, performs the role of a coordinator in the field of the real estate system and the spatial data infrastructure, and, in cooperation with the Ministry of Finance, is introducing mass real estate valuation with the goal of creating foundations for successful and efficient real estate administration and provision of data for objective and

comprehensive real estate taxation as well as increased efficiency of the real estate market. It creates conditions for implementing land surveys and ensures the compliance of the national coordinate system with the European coordinate system (Mlakar et. al, 2008).

TYPES OF DATA: The SMA is providing the following data:

- Coordinate reference systems – geodetic points.
- Spatial units:
 - Register of Spatial, Administrative and Statistical Units.
 - Addresses Register of Spatial Units.
- Real property and infrastructure data:
 - Land Cadastre,
 - Building Cadastre,
 - Consolidated Cadastre of Public Infrastructure.
- Topographical data:
 - basic topographic map at 1:5,000 and 1:10,000 (TTN),
 - topographic database (DTK 5),
 - national topographic maps at 1:25,000 (DTK 25) and 1:50,000 (DTK 50), national general maps (DPK),
 - generalized cartographic database (GKB),
 - aerial images and orthophotos,
 - digital terrain models (DMR, DMV),
 - Register of Geographical Names (REZI).

2.3.1.2. Ministry of Defence

2.3.1.2.1. Administration of the Republic of Slovenia for Civil Protection and Disaster Relief
Administration of the Republic of Slovenia for Civil Protection and Disaster Relief (hereinafter referred to as ACPDR) is a constituent body of the Ministry of Defence. It performs administrative and professional protection, rescue and relief tasks as well as other tasks regarding protection against natural and other disasters. ACPDR is divided into six internal organizational units (four sectors and two services) based in Ljubljana as well as 13 other ACPDR branches operating throughout Slovenia. Within each branch there is a regional notification centre that performs a 24-hour duty service. Altogether, 330 people are employed at ACPDR branches and notification centres. The ARSCPDR's key task is to monitor, notify and alert in the event of a disaster. The operation of protection, rescue and relief forces is supported by a uniform and autonomous communication and information system for protection and relief, which is interoperable with related national and international systems, especially with the EU Common Emergency Communication and Information System (CECIS) (URL19).

2.3.1.2.2. Logistics Directorate

The bearer of the development of the cartographic system for defense purposes is the Logistic Directorate - Civil Defense Sector's Department for Spatial Planning and Cartography. The department develops and plans the creation of the cartographic system in line with NATO standards. It takes into account the needs of users within the Ministry of Defense and harmonizes them with the plans of the Surveying and Mapping Authority of the Republic of Slovenia, since, in line with the 2004 agreement, for reasons of economy, military and civilian maps are largely prepared and created in parallel. The development of

the cartographic system requires activities involving international cooperation as map-making does not end at the national border. Mutual agreements enable the exchange of geographic data. The department keeps abreast of the development of NATO standards and is responsible for their incorporation into Slovenian military standards (URL3).

TYPES OF DATA:

- Military topographic maps (VTK 25, VTK 50 and VTK 100).
- Joint Operations Graphics 1501 G and A map (at 1:250,000).
- General map of the Republic of Slovenia defense administrations with their branches at 1:250,000.
- Air navigation map of the Republic of Slovenia at 1:250,000 for the purposes of defense (VFR).
- Orthophotomaps of training areas.
- Other data important for military and national defense.

Together with the creation of the national topographic map at 1:25,000 (DTK 25) in the period between 1994 and 1999, the Ministry of Defense of the Republic of Slovenia upgraded the DTK 25 map with certain data important for defense purposes and published it as DTK 25 for defense purposes (DTK 25 MO). Characteristics of roads and bridges, the densities and types of forests were added and certain important objects were marked. In 2004 began the transformation of DTK 25 MO into a military topographical map at 1:25,000, which is in line with the basic requirements for the interoperability of cartographic bases and geocoded data required by NATO. It represents the first level in the cartographic system of criteria set out in the NATO STANAG 3677 standard. Military topographic map at 1:50,000 (VTK 50) is a basic map of the cartographic system laid out by the NATO policies and STANAG 3677 standard. The creation was implemented in the period between 2000 and 2005. The updating of the contents of VTK 50 began in 2006. The third from the set of military topographic maps is the military topographic map at 1:100,000. It is intended primarily for defense planning and regional operations. Furthermore, Joint Operations Graphics map (at 1:250,000) is a map set out in the STANAG 3600 standard and STANAG 3677 criteria system. It is created as a ground map 1501 G (Ground) and air map 1501 A (Air). Its purpose is global military planning and it is set out in NATO geographic policy as well. The map has been created in the UTM system.

2.3.1.3. Ministry of Agriculture, Forestry and Food

The Ministry of Agriculture, Forestry and Food of the Republic of Slovenia performs tasks in the following areas: agriculture, rural development, forestry – hunting and fisheries, and food safety and quality. Within the Ministry there are 4 internal bodies which perform tasks relating to the implementation of measures in the areas of agriculture, forestry, foodstuffs and fisheries in accordance with national policy and the EU Common Agricultural Policy; supervise the implementation of laws and other regulations and acts within the operational sphere of the Ministry; carries out the administrative tasks, and inspection and control in the veterinary and phytosanitary sectors. Work of the Ministry is organized within three directorates, which perform tasks in key minister's areas:

- Directorate for Agriculture,
- Directorate for Forestry, Hunting and Fisheries,
- Directorate for Food Safety.

TYPES OF DATA: For the purpose of regular work of the Ministry and for the individual end users, several GIS web-based applications have been developed (URL20). Among the other data, the Ministry is providing:

- Pedological Maps (in cooperation with the University of Ljubljana, Biotechnical Faculty-pedological database).
- Data on land use: Land use database – RABA. Less-favored areas.
- Data on agricultural and forest land: Land identification system – GERK, Register of farm holdings; Register of common pastures, Wine growing units, Forestry registers and databases; Cadastre of bee pastures.
- Data on agricultural and aquaculture facilities: Register on land consolidation (under construction), agro-melioration and melioration; Record of irrigation and drainage systems and equipment.

Bodies affiliated to the Ministry are Agency of the Republic of Slovenia for Agricultural Markets and Rural Development; Veterinary Administration of the Republic of Slovenia; Inspectorate of the Republic of Slovenia for Agriculture, Forestry and Food; and Phytosanitary Administration of the Republic of Slovenia (URL21).

2.3.1.3.1. Agency for Agricultural Markets and Rural Development

The Agency for Agricultural Markets and Rural Development (AKTRP) has been operating since 2000 as a body within the Ministry of Agriculture, Forestry and Food. It was established for the implementation of programmes of the agricultural policy reform, alignment to the EU common agricultural policy and payment of SAPARD pre-accession assistance (URL22).

2.3.1.3.2. Phytosanitary Administration of the Republic of Slovenia

The Phytosanitary Administration of the Republic of Slovenia provides for the protection of plants against pests, protection of plant products and regulated articles so as to prevent harmful effects of the application of plant protection products and fertilisers. It further on provides for the implementation of other measures for the protection of plants, which are important in the light of human and animal health and for the environment, and in particular for the consumer protection by means of the production of safe food (URL23).

2.3.1.4. Ministry of Transport

The Ministry of Transport performs tasks in the field of railway transport, air transport, maritime and inland waterway transport and road transport (with the exception of road transport safety control), as well as tasks in the field of transport infrastructure and cableway installations. The Ministry is structured into offices that perform duties falling within the competencies of the Ministry:

- Transport Directorate,
- International Affairs Directorate,
- Roads Directorate,
- Railway and Cableway directorate,
- Civil Aviation Directorate.

The Civil Aviation Directorate of the Ministry of Transport carries out the tasks stipulated in the Aviation Act, including in particular the regulation and supervision of civil aviation, the implementation of specific administrative matters, continuing oversight, the supervision of

the implementation of aviation regulations and legal acts that are in force and applicable in the Republic of Slovenia, and violation proceedings related to the following:

- access to air routes, public service obligations and fixing of prices,
- international air transport,
- access to the ground handling market at airports,
- allocation of slots at airports (URL24).

2.3.1.5. Maritime Directorate

The Ministry of Transport performs tasks in the field of railway transport, air transport, maritime and inland waterway transport and road transport (with the exception

2.3.1.5.1. Slovenian Roads Agency

The Slovene Roads Agency is a body affiliated to the Ministry of Transport of the Republic of Slovenia. It undertakes technical, developmental, organisational and administrative tasks relating to the construction, maintenance and protection of main and regional roads and some dual carriageway sections, as well as tasks relating to freight and passenger road transport. The tasks of the Slovene Roads Agency also include the preparation of proposals for investment into national roads under its jurisdiction, as well as coordination relating to the designing, construction and reconstruction of roads and its facilities. The Agency collects and processes the various data required in the assessment of road investment decisions and performs tasks adopted by the National Assembly, the Government and the Ministry of Transport (URL25).

TYPES OF DATA: The Agency is responsible for data on public roads network and is maintaining:

- Register of Public Roads.

2.3.1.5.2. Slovenian Maritime Administration

The Slovenian Maritime Administration was established in January 1995 as a Maritime Administration and is working under the cover of The Ministry of Transport. The Slovenian Maritime Administration is responsible for the economic development of the port infrastructure and safety at sea, inland waters and lakes. Administration carries out a wide range of tasks encompassing all aspects of maritime activity: the safety of navigation, pollution prevention, seaways, ports and harbours, ship surveys, issuing of certificates and documents required to be carried on board ships, port state control, registration of ships, registration of pleasure boats, the issue of seamen books and Certificates of Competence in the Merchant Marine, Boat Leaders Certificates, search and rescue at sea. Primarily in the interest of the safe navigation of ships sailing into the Luka Koper port and additionally for reasons of the fast- growing maritime tourism, the Maritime Directorate, is implementing the role of a national hydrographic administration in cooperation with the Geodetic Institute of Slovenia. The role of the hydrographic administration is to collect and disseminate important information for seafarers and to administer Slovenian nautical maps and other publications important for maritime transport. All maps and publications are prepared at the Geodetic Institute of Slovenia (URL26).

TYPES OF DATA:

- The Bay of Koper map at 1:12,000.

- Nautical maps: Piran Bay 02, 1:12,000, 1st edition 2004, Bay of Trieste 03, 1:75,000, 1st edition 2005, Bay of Koper INT 3469, 1:12,000, 1st edition 2005, Slovenian Sea – small maps, 1:15,000, 1:100,000, 1st edition 2005.

2.3.1.6. Ministry of Interior

TYPES OF DATA: within the Ministry several data for the purpose of police and security, migration and integration affairs and other interior affairs are maintained – among the others also:

- Central population Register.

2.3.1.7. Ministry of the Economy

The Ministry of the Economy is divided into four directorates, covering entrepreneurship and competitiveness, tourism and internationalisation, internal market and energy.

TYPES OF DATA: within the Ministry several data for the purpose of economic development and energy supply are maintained – among the others also:

- Energy resources.

2.3.1.8. Ministry of Higher Education, Science and Technology

The Information Society Directorate at the Ministry of Higher Education, Science and Technology of the Republic of Slovenia has the representative role in the field of Slovenian cooperation with the ESA.

2.3.1.9. Geodetic Institute of Slovenia

The Geodetic Institute of Slovenia is a public institution, which was established by the state and implements various developmental and professional technical assignments of the national land survey service, including assignments in the fields of topography and cartography. The Institute implements other activities outside the scope of the public service. In the fields of topography and cartography the assignments include the acquisition of topographic data, their administration and depiction in the form of various maps, photogrammetric acquisition of topographic data on the basis of aerial photos using analytical and digital photogrammetric stations or satellite images. In addition to technological and content designs, it also implements cartographic editing, counseling, comprehensive graphic design of maps, prospects, atlases and other publications as well as their preparation for polychromatic printing (URL3).

2.3.1.10. Geological Survey of Slovenia

The main purpose of the Geological Survey of Slovenia is to provide geological expertise and information about the geology of Slovenia. Geological data are fundamental for decision making in fields such as: protection of human health and the environment, drinking water supply, geohazard mitigation, urban planning, mineral resources exploration and exploitation, etc (URL27).

2.3.2. Type of data

The Geological Survey is responsible for maintaining data in the field of geology and it provides data on:

- Hydrology: Water systems, Underground water.

- Geology: Lithological and Tectonical Charts, Hidrogeological and Geothermal Charts.
- Natural risk zones: Landslides database and Gravels database.
- Mineral Resources: Locations of mineral resources.

2.3.3. Cost of Data

The right of each person to acquire information held by a public body is laid down by article 39 of the Constitution of the Republic of Slovenia. The main content of the constitutional provision could be described as the right of individuals to get informed about the work of public sector bodies and by this means exercising control over the transparency of their work, thus assuring public control on their decision making processes. To implement the constitutional right to access, the Slovenian Parliament adopted the Access to public sector information Act which entered into force on the 22nd of March 2003 (PSI). This Act imposes the obligation on public bodies to provide all public sector information, held by a particular public body, on the internet. Each public body is obliged to establish a catalogue of public sector information administered by the public body which is the main framework for the provision of public sector information.

Slovenia has adopted a unique pricing and charging policy based on the intended purpose of the re-user. The public body may charge for the PSI reuse for commercial purposes, except in cases of re-use for the purpose of providing information, ensuring the freedom of expression, and re-use of information for purposes of culture and art and media's re-use of information. All data and products produced by the surveying service of the SMA, for example, are public and accessible by all users for their own use against the payment of material costs. Terms and conditions of use of geodetic data, Price list of material expenses for issuing geodetic data and Price list for re-use of geodetic data for gainful purposes for data collections kept by the national geodetic service, renewed in February 2010, and are available on the website of the SMA (URL28; URL29).

For any use but the 'gainful use' that can be charged for, only the costs of the material for the dissemination can be charged. For 'gainful use', the users pay for the data and the material costs (URL30).

The general public in Slovenia already uses the existing elements of the infrastructure for spatial information under the conditions defined by the Act on the Access to Information of Public Character (Official Gazette of RS, No. 51/2006 - UPB-2) and the Personal Data Protection Act (Official Gazette of RS, No. 94/2007 - UPB-1). Thus, particularly the services of data searching, accessing and downloading are available to the users. For digital data use direct budgetary users pay only material costs, while for analogical data and products they are charged the compensation like other users.

Free access to cartographic data is available to all users, allowing them to search for a location and a display of this location on the selected cartographic basis (orthophoto, a basic topographic map, national topographic maps, etc.) free of charge. It is possible to search a location in two ways – using an address or a geographical name. This, for example, makes it possible to obtain an image and a location of a building on an orthophoto map by supplying its address. This service is available at URL6.

Public access is access to the latest registered data in the Land Cadastre, the Building Cadastre, the Register of Spatial Units, the Consolidated Cadastre of Public Infrastructure, and real estate transactions on the basis of a real estate identifier (land parcel number, a

building or part of a building number or an address). The service is free of charge and publicly available at URL5.

Personal access allows an individual a free of charge access to graphic and descriptive data on real estate properties which are owned by that individual and are administered in geodetic records as such. This kind of access allows everyone, after they demonstrate their identity with an appropriate digital certificate, to verify the accuracy of the recorded data in the Land Cadastre, the Building Cadastre and the Register of Spatial Units, and take appropriate action in case of discrepancies (URL5).

2.3.4. Other service of Geo(spatial) data

2.3.4.1. The Urban Planning Institute of Ljubljana

LUZ, d.d. (Ljubljanski urbanistični zavod, d.d. - Ljubljana Urban Planning Institute) was established 50 years ago with the purpose of drafting the general plan of the city of Ljubljana. Since the establishment, they have drafted numerous urban planning schemes. They are 'at home' as far as spatial planning is concerned. They are characterized by tradition, versatility, quality and connections. We have many satisfied clients and successfully concluded projects. Individually and in cooperation with business partners, companies, experts and groups, they draft plans in the areas of spatial planning, urban planning, architecture and landscape architecture, environmental protection, transport planning, public utility infrastructure, energy and spatial information systems. They are increasingly developing new working areas. They are making our presence felt also in the area of urban economics and are examining opportunities offered by international projects (URL31).

2.3.4.2. Slovenian Forestry Institute

Mission and vision of the Institute (URL32):

- maintenance of forest ecosystem productivity and biodiversity, and resistance to stress,
- forest ecosystem monitoring,
- forest health research and monitoring,
- acquainting the public with forestry and its relevance in Slovenia,
- comprehending the structure and functions of forest ecosystems and physiology of forest trees,
- comprehending the effects of climate change on forest ecosystems,
- forest management as net carbon drain with emphasis on processes and biodiversity in forest soil,
- forest genetic resources maintenance and research,
- approval of seed stands,
- certification of forest reproduction material,
- implementation of environmentally friendly forest work techniques and technologies,
- promotion of wood as of renewable raw material and energy source,
- building of certification system for forest handling and tracing of wood to the ecologically aware buyer of wood and its products,
- scientific research work,
- publishing of important research achievements at home and abroad,
- publishing of expert scientific monographic series *Studia Forestalia Slovenica* (jointly with BF).

2.3.4.3. Agricultural institute of Slovenia

Agricultural Institute of Slovenia is a public research institution founded in 1898. Its present founder is the Government of the Republic of Slovenia. Its foundation rights are asserted through the representatives of the Ministry of Education, Science and Sport and Ministry of Agriculture, Forestry and Food on the Board of Directors. The founder must also agree about the appointment of Institute's director, gives the final approval of annual work program and other important documents (URL33).

2.3.4.4. Web geoportals (Services of geodetic and spatial data)

- Geoportal ARSO,
- MKGP portal – GERK viewer,
- Geopedia,
- PISO,
- Gaea+ (Fig. 3),
- Najdi.si,
- MonolitMap,
- Bioportal
- iSlovenija
- TIS.

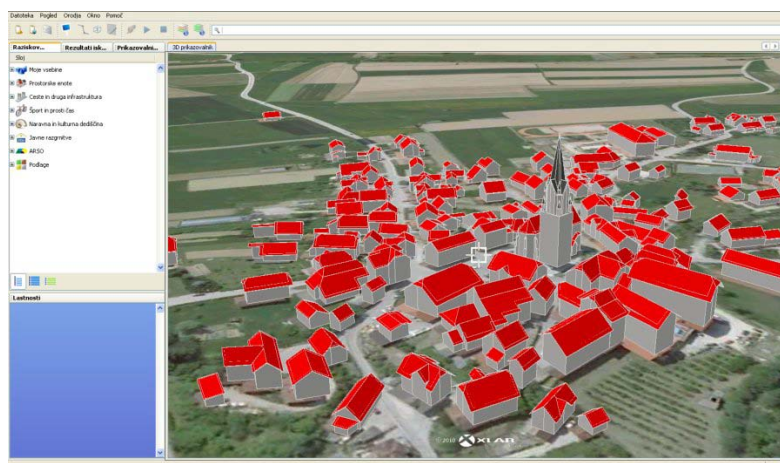


Figure 3. Gaea+, advanced 3D visualization tool with 3D reconstruction (URL51).

2.3.5. Royalties - Usage Restrictions

2.3.5.1. Legal protection of GI by intellectual property rights

The Copyright and Related Rights Act dates from 30 March 1995 (Official Gazette RS, No. 21/95) and has been in force since 29 April 1995. Cartographic and photographic works are in particular considered as copyright works (article 5). According to article 8 of the Copyright Act copyright protection shall not be afforded to official legislative, administrative and judicial texts. Articles 141.a to 141.f provide for special legal protection of databases. Article 141.a stipulates that “the protection of a database or its contents shall apply irrespective of their protection by copyright or by other rights”. The Copyright Act was amended on 1 May 2004 in order to incorporate the regulations of the 2001 Directive on copyright in the information society.

2.3.5.2. Restricted access to GI further to the legal protection of privacy

In 2004, the Personal Data Protection Act replaced the Law on Personal Data Protection of 1999. Both laws are based on Directive 95/46/EC. The 2004 Act was amended once more with regard to the status of the Information Commissioner. Personal data must be processed lawfully and fairly and they must be adequate and in their extent appropriate in relation to the purposes for which they are collected and further processed. Directive 2002/58 on privacy and electronic communications has been transposed into Slovenian law.

2.3.5.3. Licensing framework

In 2003, the Act on Access to Public Information has been adopted (the changes and additions of the Act, published on July 15th, 2005). The aim of this Act is to ensure that the work of the bodies is public and open, and to enable natural and legal entities to exercise their rights to acquire information held by public authorities. With a view to achieve the aim of this Act, the bodies shall endeavor to inform the public on their work to the greatest extent possible.

2.3.5.4. Basic provisions

Legal entities or natural persons (hereinafter referred to as "the applicants") have free access to public information. Each applicant shall have, at his request, the right to acquire information from the body by acquiring such information for consulting it on the spot, or by acquiring a transcript, a copy or an electronic record of such information. Every applicant has the right, under the same conditions as all other persons, to acquire the right to re-use information for commercial or noncommercial purposes.

The body shall make its documents available through electronic means where possible and appropriate whereas this shall not imply an obligation, for the purposes of re-use of information, to provide conversion of the documents from one form to the other or to provide extracts from documents where this would involve disproportionate effort, going beyond a simple operation, nor shall it imply the obligation to continue with the creation of certain information only for the purposes of re-use of information by other bodies or other persons.

2.3.5.5. Transmission of information to the World Wide Web

Each body is obliged to transmit to the World Wide Web the following public information:

- Consolidated texts of regulations relating to the field of work of the body, linked to the state register of regulations on the Web.
- Programs, strategies, views, opinions and instructions of general nature important for the interaction of the body with natural and legal persons and for deciding on their rights or obligations respectively, studies, and other similar documents relating to the field of work of the body.
- Proposals for regulations, programs, strategies, and other similar documents relating to the field of work of the body.
- All publications and tendering documentation in accordance with regulations governing public procurements.
- Information on their activities and administrative, judicial and other services.
- All public information requested by the applicants at least three times.

- Other public information.

Each body should facilitate, free of charge, access to information referred to in the preceding paragraph.

The Ministry also enables access to information from the first paragraph via the joint government portal e-uprava.

2.3.5.6. Request for access or re-use procedure

The applicant requests access to public information by way of written request for access to or the re-use of public information, he can also issue an informal request.

The applicant who files a written request for access to or the re-use of public information shall enjoy legal protection.

2.3.5.7. Cost and other conditions for transmitting and re-use of public information

Consultation on the spot of the requested information shall be free of charge. The body may charge the applicant the material costs for the transmission of a transcript, copy or electronic record of the requested information. The body can charge for the re-use of information for commercial purposes, except in case of re-use for the purpose of providing information, ensuring the freedom of expression, culture and art and media's re-use of information.

The price may not exceed the costs of collecting, producing, reproducing, and disseminating, together with a reasonable return on investment. The price must be adjusted for cost-effectiveness, set within a common accounting period and consistent with applicable accounting principles of the body concerned. The cost calculation method for the price is itself public information, and the body must in accordance with this Act, transmit it to every applicant which so requests. The body does not charge for the re-use of information if it transmits the same information to the internet free of charge.

2.4. Need of military clearance for specific data sets

Decree on defining defense needs (Official Gazette of RS, No. 30/2003) stated that the following data are prohibited for publications (including in the framework of SDI):

- Data on the type, purpose and condition of the objects and functional areas, important for defense (elements of military airports, position of military control of air-traffic, etc.).
- Data on object adaption for the purpose of defense.
- Data on transitoriness for military vehicles out off roads.

The data are accessible based on special permission of the Ministry of Defense of the Republic of Slovenia if the use of these data is in public or scientific interest.

2.5. Use of EO application on environmental decision making processes

A variety of different EO data available in Slovenia (refer to the detailed information above) are used in many different applications on environmental decision making processes on different levels (Ministries, Municipalities, Directorates, Institutes, Agencies etc.). An extensive research based on questionnaires (in 2005, URL34) showed very frequent use of orthophoto in different projects and environmental decision making processing in Slovenia (55 % of the interviewed users use orthophoto daily in their work, 28 % many times a week). It was reported that orthophoto is used as a layer in GIS applications, in spatial planning, in planning of surveying projects, for complementing topographic data, for transforming digital

cadastral maps into the GK projection, for acquiring land cover data, for visualization of spatial data etc.

There are no data available about number of EO application on decision making processes.

2.6. National remote sensing data distribution centers

There are no official national public resellers of remote sensing data.

2.7. Relevant national public and private administration institutes, officials

Relevant national institutions and organizations are listed and described in the point 2.3 Information sharing policies of this paper.

2.8. Coordinators of identified ongoing or completed EU or national sponsored projects

Cartography in e-educational materials for history and geography in primary and secondary schools, Ministry of Education and Sport, Republic of Slovenia, 2009-2010.

Geoinformation infrastructure and sustainable spatial development of Slovenia, National research programme 2009-2011, Ministry of Higher Education, Science and Technology, Republic of Slovenia.

COST Action TU0801 – Semantic Enrichment of 3D city models for sustainable urban development, URL35.

Center of Excellence for Space Sciences and Technologies – Vesolje-SI (Space-SI), Financed by Ministry of Higher Education, Science and Technology, Republic of Slovenia, co-financed by ESRR, (2010-), URL36.

3. Current Status of Earth Observation Activities : Data – Applications

3.1. Existing national data sets

The most complete list of the existing digital spatial data in the Republic of Slovenia can be found at Central Evidence of Spatial Metadata (URL37).

3.2. Processing capability of EO data

Processing capability of EO data in Slovenia is estimated as satisfactory.

3.3. Data collection capability (Aerial Photography, LIDAR)

There are a few private companies providing aerial and LIDAR surveying in Slovenia.

3.4. EUPOS data availability and costs

Slovenia has an observer status in EUPOS cooperation. In 1999 the Surveying and Mapping Authority of the Republic of Slovenia (hereinafter: SMA) started activities connected with the establishment of the first permanent reference GNSS station in the territory of Slovenia. Soon after the termination of this project, the SMA decided to continue activities and develop the national permanent GNSS network. This network was designed to cover the needs of many potential users from geodynamics to the cadastral and geodetic control.

From 2006 the national permanent GNSS network consists of 15 points (Fig. 4). The GNSS network and the national GNSS service together form the SIGNAL (SI–Slovenia, G–Geodesy, NA–NAvigation, L–Location) which is a sub-body of the SMA. The national GNSS service consists of an operational centre, a data centre and an analytical centre.

The SIGNAL network exchanges data in real time with stations of the Austrian network APOS (Austrian Positioning Service), the Hungarian national network (GNSSNet.hu), Croatian and Italian stations. The Surveying and Mapping Authority of the Republic of Slovenia, as the manager of the system of permanent GNSS stations called SIGNAL, concluded in 2010 the agreements on data exchange with all neighbouring countries.

There is a monthly fee for using the SIGNAL network; however the user can carry out measurements on the field also without the SIGNAL network and download from the network web page the differential corrections in the RINEX format.

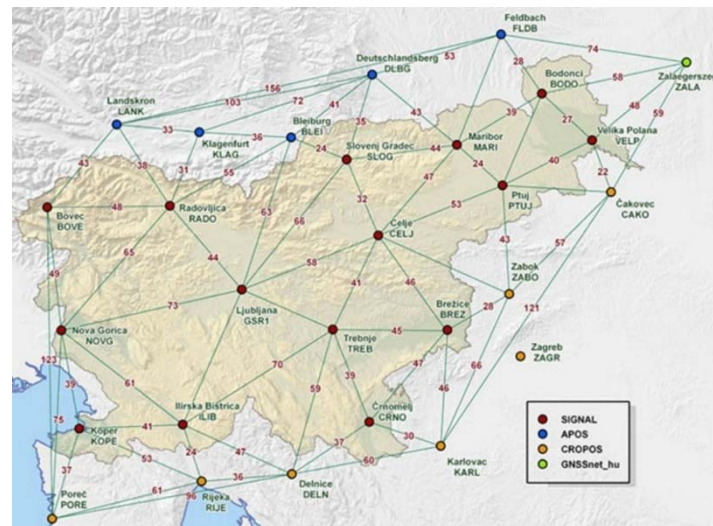


Figure 4. The location of the 15 permanent GNSS stations of the SIGNAL network (URL38).

3.5. Level of conformation with the INSPIRE Directive

The Infrastructure for Spatial Information Act (Official Gazette of RS, No. 8/2010, hereinafter, the ISI Act), which transposed the Directive 2007/2/EC of the European Parliament and of the Council establishing an Infrastructure for Spatial Information in the European Community (INSPIRE), determines a national contact point for contacting the European Commission regarding the INSPIRE Directive and for efficient implementation of the infrastructure for spatial information. In addition, the ISI Act specifies that the tasks of the national contact point shall be implemented by the ministry responsible for land survey, which in this case means the Ministry of the Environment and Spatial Planning and the Surveying and Mapping Authority of the Republic of Slovenia as the body affiliated to the Ministry (URL39).

Until the adoption of the mentioned Act, the infrastructure for spatial information, as it is known in some other European states, was not yet established operationally in Slovenia. Nevertheless, some elements of the infrastructure for spatial information already existed in Slovenia, namely, the metadata, the spatial data sets and the services related thereto, which have been available in digital form for over 10 years, there are also particular network services and technologies, and the individual users have been concluding agreements on data sharing, accessing and using (URL39).

It can be determined that a number of elements of this infrastructure already exist in Slovenia. Namely, the legal regulation promoted the exchange and rational use of spatial information because this field has been mentioned in many regulations and documents such as, for example:

- Act on the Access to Information of Public Character,
- Electronic Commerce and Electronic Signature Act,
- Copyright and Related Rights Act,
- Spatial Planning Act,
- real estate legislation.

The field of infrastructure for spatial information is also limited and outlined in some national strategic documents such as, for example:

- Slovenia's Development Strategy (URL40).
- e-commerce strategy in the public administration bodies and the action plan
- for e-commerce in the public administration (URL41),
- e-Government Strategy of the Republic of Slovenia (URL41).

Currently, the national Geoportal as foreseen by the Infrastructure for Spatial Information Act has not been yet established in Slovenia. It is planned to be established in the second half of this year. The existing spatial data sets and particular web services are already available to the users via various web portals and access points of public authorities.

4. Current Status of Earth Observation Activities : Capacities

4.1. Institutional and public awareness on benefits of EO systems in environmental monitoring

In Slovenia there is satisfactory institutional and public awareness on benefits of EO systems in environmental monitoring, being even increased by extensive natural disasters in the last years (floods, dryness, fires etc.).

4.2. National budget allocation to EO programs

SMA (annual or biannual plans): public tenders; mainly for production and infrastructure, some methodological projects and expert work, few research projects.

4.3. Funding initiatives and participation to research programs

Slovenian Research Agency: public tenders; basic and applicative research projects, target research projects; co-financing post-graduate study for young researchers International programs: EU Frame Programs, COST, Interreg programs, etc.

4.4. Dedicated undergraduate and graduate programs, curricula and personnel – Relevant education and training centers

Table 1. Dedicated undergraduate and graduate programs, curricula and personnel – Relevant education and training centers

Institute	Undergraduate program	Graduate program	Training	Personnel	Web site	Curricula
University of Ljubljana, Faculty of Civil and Geodetic Engineering, Department of Geodesy	3 (BA) + 2 (MA) years	Yes	Yes	40	URL42	URL43
University of Ljubljana, Faculty of Arts - Department of Geography	3 (BA) + 2 (MA) years	Yes	Yes	20	URL44	URL45

Institute	Undergraduate program	Graduate program	Training	Personnel	Web site	Curricula
University of Ljubljana, Biotechnical Faculty - Department of Forestry	3 (BA) + 2 (MA) years	Yes	Yes	30	URL46	URL47
University of Maribor, Department for Geography and the Geography Study	3 (BA) + 2 (MA) years	Yes	Yes	10	URL48	URL30

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- URL2: http://sigov3.sigov.si/cgi-bin/htqlcgi/arhiv/enos_isk_kat.htm
- URL3: http://icaci.org/documents/national_reports/2007-2011/Slovenia.pdf
- URL4: <https://www.ip-rs.si/index.php?id=324>
- URL5: <http://prostor.gov.si>
- URL6: <http://prostor.gov.si/iokno/iokno.jsp>
- URL7: <http://prostor.gov.si/emoneta/index.jsp>
- URL8: http://prostor.gov.si/cepp_ang/index.jsp
- URL9: <http://gis.arso.gov.si/atlasokolja/>
- URL10: <http://meteo.arso.gov.si/>
- URL11: <http://www.arso.gov.si/vode/podatki/>
- URL12: <http://www.arso.gov.si/vreme/napovedi%20in%20podatki/>
- URL13: <http://www.arso.gov.si/potresi/obvestila%20o%20potresih/>
- URL14: <http://gis.arso.gov.si/mpportal/>
- URL15: <http://kpv.arso.gov.si/>
- URL16: <http://inspire.jrc.ec.europa.eu/reports/stateofplay2009/rcr09SIv91.pdf>
- URL17: <http://e-prostor.gov.si/index.php?id=299>
- URL18: http://www.mop.gov.si/en/about_the_ministry/responsibilities/
- URL19: <http://www.mo.gov.si/en/>
- URL20: http://www.mkgp.gov.si/si/spletne_aplikacije/
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- URL23: www.furs.si/en/
- URL24: www.mzp.gov.si/en/areas_of_work/
- URL25: www.dc.gov.si/en/slovene_roads_agency/
- URL26: www.up.gov.si/en/areas_of_work/

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