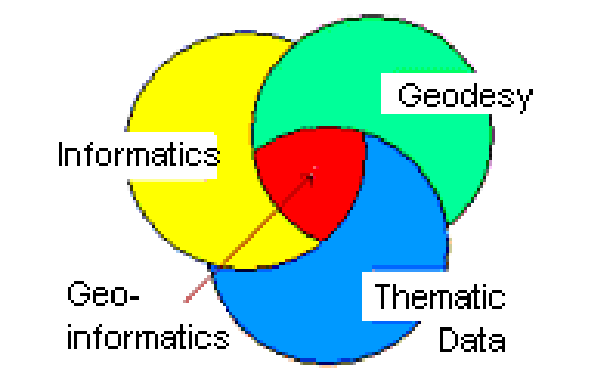
GEO-INFORMATICS

Geo-informatics applications in Disaster Risk Management and is an emerging field in last two decades. Geo-informatics, which includes Remote Sensing, Geographic Information System, Global Positioning Systems, and Internet Mapping Services, provides the most powerful technology for all phases of disaster management i.e. hazard mapping, monitoring, risk assessment, emergency response and reconstruction. Planning for disaster management would need to consider the spatial and temporal aspects of the location[1].

Geo-informatics has been described as *"the science and technology dealing with the structure and character of spatial information, its capture, its classification and qualification, its storage, processing, portrayal and dissemination, including the infrastructure necessary to secure optimal use of this information". It is also defined as "the art, science or technology dealing with the acquisition, storage, processing, production, presentation and dissemination of geoinformation[2]."*



Geo-informatics and Background Sciences

The problem solving of geo-informatics is accomplished in Geographical Information Systems. These are specialized information systems containing the conceptual model and the computer program package for problem solving, the geographical location dependent thematic data, furthermore the hardware and software means to visualize, store and analyze the data[3].

Geographical Information System

Geographic Information System (GIS) is a computer based application of technology involving spatial and attributes information to act as a decision support tool. It keeps information in different layers and generates various combinations pertaining to the requirement of the decision making. In the recent times, GIS has emerged as an effective tool in management of disasters since, geo-spatial data and socio-economic information need to be amalgamated for the better decision making in handling a disaster or to plan for tackling a disaster in a better way. GIS could be utilized by the different line departments and agencies who are stakeholders in the disaster management process. Some basic hardware like computer system, printer, network systems, along with GIS software are required to set up the GIS in any organization[4].

Elements of GIS

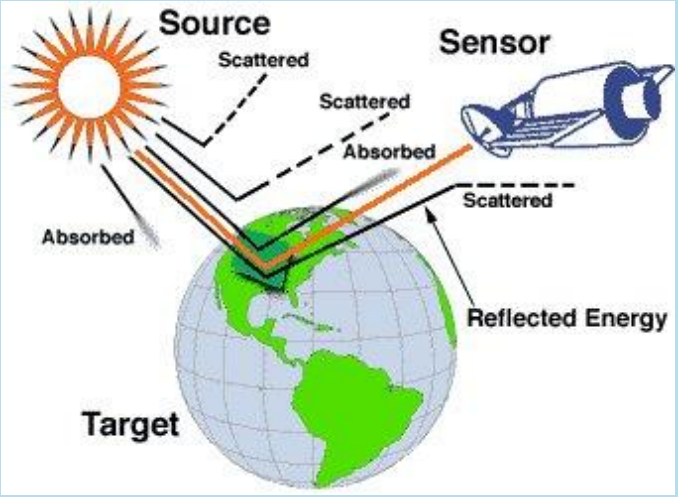
Source: http://www.expertsmind.com/questions/geographic-information-system-30132448.aspx

One of the more powerful functions of a GIS is that it allows users to synthesize or combine different layers of information to identify resource distribution patterns that may otherwise not be obvious. For example, using various map overlay techniques, threatened and endangered species data may be combined with wetland information to determine if any of the freshwater tidal wetlands in an area provide

habitat for sensitive or critical species. This information could be used to develop specialized resource management plans that protect critical wetlands or it could be used to identify areas where the reintroduction of a threatened or endangered species might be successful. This information also can be used in the design of survey strategies and methods to focus on areas of potential threatened and endangered species locations[5].

Remote Sensing

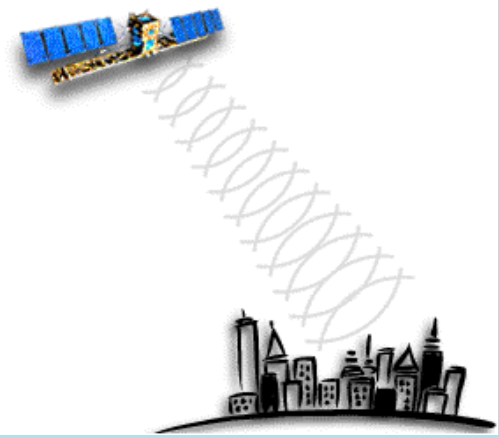
Remote sensing is the acquisition of information about an object or phenomenon without making physical contact with the object and thus in contrast to in situ observation. In modern usage, the term generally refers to the use of aerial sensor technologies to detect and classify objects on Earth (both on the surface, and in the atmosphere and oceans) by means of propagated signals (e.g. electromagnetic radiation). It may be split into active remote sensing, when a signal is first emitted from aircraft or satellites or passive (e.g. sunlight) when information is merely recorded[6].



Passive Remote Sensing, Solar Source

Source: http://www.gisknowledge.net/topic/remote_sensing_and_dia/tutorial_remote_sensing_modes_solution.htm

The Earth Observation satellites provide comprehensive, synoptic and multi temporal coverage of large areas in real time and at frequent intervals and thus have become valuable for continuous monitoring of atmospheric as well as surface parameters related to natural disasters[7]. Geo-stationary satellites provide continuous and synoptic observations over large areas on weather including cyclone-monitoring. Polar orbiting satellites have the advantage of providing much higher resolution imageries, even though at low temporal frequency, which could be used for detailed monitoring, damage assessment and long-term relief management.



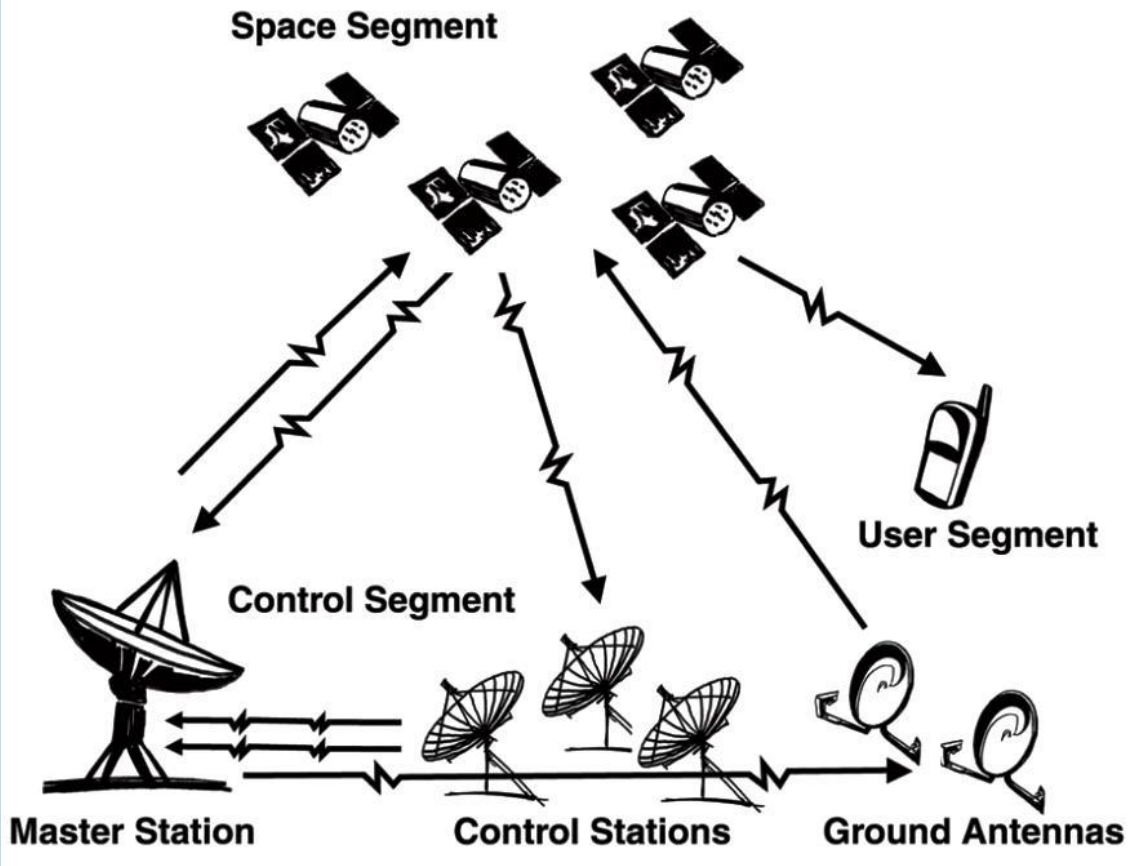
Active Remote Sensing, Artificial Source
Source:
http://www.gisknowledge.net/topic/remote_sensing_and_dia/tutorial_remote_sensing_modes_solution.htm

The vast capabilities of communication satellites are available for timely dissemination of early warning and real-time coordination of relief operations. The advent of Very Small Aperture Terminals (VSAT) and Ultra Small Aperture Terminals (USAT) and phased - array antennae have enhanced the capability further by offering low cost, viable technological solutions towards management and mitigation of disasters. Satellite communication capabilities- fixed and mobile are vital for effective communication, especially in data collection, distress alerting, position location and coordinating relief operations in the field. In addition, Search and Rescue satellites provide capabilities such as position determination facilities onboard which could be useful in a variety of land, sea and air distress situations[7].

Global Positioning System

The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The system provides critical capabilities to military, civil and commercial users around the world. It is maintained by the United States government and is freely accessible to anyone with a GPS receiver[8]. GPS is used on incidents in a variety of ways, such as[9]:

- To determine position locations; for example, you need to radio a helicopter pilot the coordinates of your position location so the pilot can pick you up
- To navigate from one location to another; for example, you need to travel from a lookout to the fire perimeter
- To create digitized maps; for example, you are assigned to plot the fire perimeter and hot spots
- To determine distance between two points or how far you are from another location



Segments of Global Positioning System

The basis of the GPS is a constellation of satellites that are continuously orbiting the earth. These satellites, which are equipped with atomic clocks, transmit radio signals that contain their exact location, time, and other information. The radio signals from the satellites, which are monitored and corrected by control stations, are picked up by the GPS receiver. A GPS receiver needs only three satellites to plot a rough, 2D position, which will not be very accurate. Ideally, four or more satellites are needed to plot a 3D position, which is much more accurate[9].

References

[1] http://nidm.gov.in/PDF/modules/geo.pdf
[2] http://www.wamis.org/agm/pubs/agm8/Paper-6.pdf
[3] http://meip.x5.hu/files/1619
[4] http://www.osdma.org/ViewDetails.aspx?vchglinkid=GL024&vchplinkid=PL049

[5] http://www.nerrs.noaa.gov/doc/siteprofile/acebasin/html/gis_data/gisint2.htm
[6] http://en.wikipedia.org/wiki/Remote_sensing
[7] http://saarc-sadkn.org/theme_tech_geo.aspx
[8] http://en.wikipedia.org/wiki/Global_Positioning_System
[9] http://www.nwcg.gov/pms/pubs/475/PMS475_chap5.pdf