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Earth Observation Satellites Series and its Potentialities

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Abstract— Science is one of the tools to explore earth Information. Space science leading its efforts in three main areas: (i) Development of Remote Sensing Satellites, (ii) Development of Communication and Metrological Satellites, (iii) Development of Different types of Launch Vehicles to put the satellites in proper orbits. Remote Sensing means acquiring information about a phenomenon object or surface while at a distance from it. Satellite is a secondary object that revolves in a closed orbit around a planet or the sun for scientific research. Remote Sensing Satellites has proved way for human to understand of weather forecasting, to observe the phenomena on the earth's surface, under oceans and underneath the surface of the earth. This paper describes a review of Earth Observation Satellites which has launched by ISRO after 2013 and their scope in the field of Remote Sensing and future missions to be undertaken.

Keywords : Remote Sensor, Satellite, Satellite Orbit, Payload

I. INTRODUCTION

The first Remote Sensing Satellite was launched by Russians sputnik 1 on October 4th, 1957 in space. There are various satellites which used for different purpose like earth observation, navigation, communication, weather forecasting etc. Out of these purposes we discuss Earth Observation Satellite series and its potentialities. The possibilities to view the earth's surface from above had opened up new vistas of opportunities of mankind. To use remotely sensed data, satellite remote sensing lies in its ability to provide a synoptic view of the earth's surface and the detect features at electromagnetic wavelengths, which are not visible to the human eyes. The need of Earth Observation (EO) has to support the understanding and planning of global changes to our planet is rapidly increasing. It is several satellites that provide the global coverage required to understand global issues.

II. REMOTE SENSING PLATFORMS FOR EARTH OBSERVATION

Platform is a stage to amount the camera or sensor to acquire the information about a target under investigation. based on its altitude above earth surface. platforms may be classified as (1) Ground based (2) Air borne and (3) Space borne. While the first imager used for remote sensing come from balloons and later from airplanes. today the satellites or sap craft are widely used for data collection.[1]

Ground Based Platforms

At the Initial stage of Remote Sensing used for Earth Observation that gathering information about earth resources studies. Those are mainly used for collecting the ground truth or for laboratory simulation studies.

Air Borne Platforms

Aircrafts are generally used to acquire aerial photographs for photo-interpretation and photogrammetric purposes. Scanners are tested against their utility and performance from these platforms before these are flown onboard satellite missions. High flying balloons provide an important tool for probing the atmosphere. In past eras such balloons had launched. Even then it is an essential part of high altitude atmospheric research.

Space Borne Platforms

In Space Platforms are not being affected by the Earth's atmosphere. These platforms are freely moving in their orbits around the Earth and entire Earth or a part of the Earth can be covered at specified intervals**.** Satellite is placed in one of three types of orbits around the Earth: geostationary, polar or sun-synchronous. These orbits are fixed, a single satellite orbit can be adjusted slightly to maintain consistency over time, but it cannot be changed from one type to another. The type of orbit determines the design of the sensor, its altitude with respect to the Earth, and its instantaneous field of view. Area on the Earth that allow viewing at any particular moment in time.

We consider space borne platform in this paper. As of 2017, different government space agencies are in existence; 13 of those have launch capacity, six government space agencies – ISRO, ESO, CNSA, JAXA, NASA have full launch capabilities. In this paper we consider on Indian Space Research Organization (ISRO), which have launched large number of satellites in the space. Basically we consider those satellites which have launched after 2013 for the purpose of EO. And also focus on future EO program related to cartographic.

Satellite Classification According to Orbit

The selection of Orbit depends on objectives of the instrument of the satellite and its application. Earth application can be classified into the groups of Earth Surface, Climate, Energy, Weather, Agriculture and so on….. [2].The parameter of Orbit can be select on the basis of altitude, shape and inclination. They are related to the required performance of the instruments.[3]

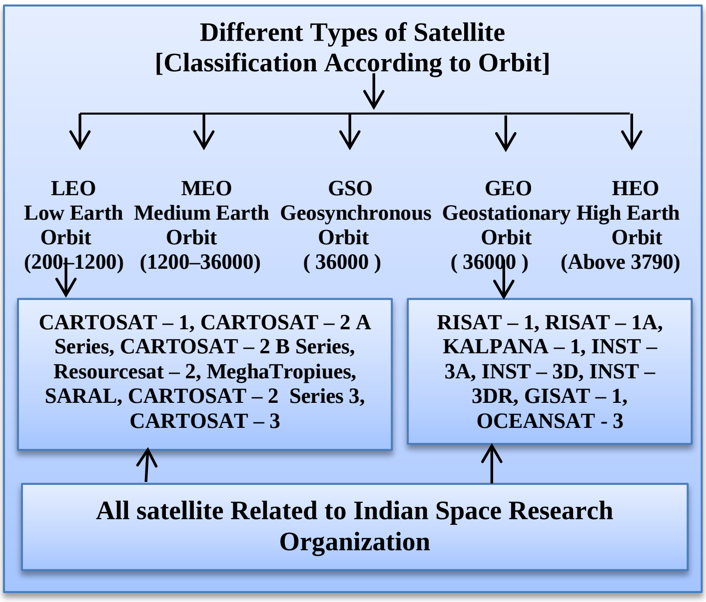

Figure 1: Satellite Classifications According to Orbit

In Earth satellite orbit, main considerations are the Radiometric Sensitivity, Revisit Time and the Resolution of the image. Indian Earth Observation System (IEOS) operates in Low Earth Orbit (LEO), Geosynchronous Orbit (GSO) and Geostationary Earth Orbit (GEO), including associated ground segment to ensure data and services on a continued and assured basis. In Figure 1 see the classification of satellite according to Orbit.

Table 1 ISRO launch satellite after 2013 and near in future for the EO as per orbit classification

ISRO SPACE MISSIONS 2013 – 2018

MISSIONS	***Earth Observation***	
Orbit	***Polar Sun Synchronization***	***Geostationary Orbit***
2013	SARAL (February 25, 2013)	INSAT – 3D (July 26, 2013)
2014 – 15		
2016	CARTOSAT – 2 Series (June 2, 2016) RESOURCESAT - 2A (Dec 7, 2016)	INSAT – 3DR (Sept 8, 2016) Note - Metrological and Cartographic Application
2017	CARTOSAT – 2 Series 3 (Second Quarter 2017)	
2018	CARTOSAT – 3 (First Quarter 2018)	GISAT – 1 (Expected by 2018) Note - Cartographic Application OCEANSAT - 3 (Expected by 2018) Note - Metrological and Cartographic Application RISAT – 1A (First Quarter 2018) Note - Metrological and Cartographic Application

a) **Polar Orbit or Sun-Synchronous:** In this polar orbit, cycle the Earth from North Pole to South Pole. The polar orbits have an inclination of approximately 99 degree's with the equator to maintain a sun synchronous overpass. The satellite passes over all places on earth having the same latitude twice in each orbit at the same local sun-time. These satellites facilitate global coverage and circularity ensures that spatial resolution is maintained. Further, the ground trace of the sun-synchronous satellite can be made to recur over a scene exactly at intervals of fixed number of days by maintaining the height of the orbit to a close tolerance, thus ensuring repetitive observations of a scene at the same local time.

b) **Geo-Stationary Orbit:** This is a position for a satellite that it keeps pace with the rotations of the Earth. For a satellite orbiting in the equatorial plane of Earth from west to east at about 36000km above the Earth, the period of revolution of satellite exactly coincides with that of the rotation of the Earth about its own axis. Thus the satellite appears stationary with respect to the Earth. These are the extensively used for communication and meteorological observations. Due to the large distance from Earth, high resolution imaging from geostationary satellites is difficult. It will be for the future enhancement for the cartographic applications.

In 1988 ISRO has launched first EO satellite IRS – 1A. In present days different satellite related to EO can be launch in both of the Orbit. Currently, the remote sensing satellites constellation that are operational in Polar Sun Synchronize orbit for developmental projects includes Resourcesat – 2, Cartosat – 1 & 2, Cartosat – 2 series, RISAT – 1, Oceansat – 2, Megha-Tropiues, SARAL, SCATSAT – 1 and Resourcesat – 2A. Though Cartosat – 1, Cartosat - 2 and Oceansat – 2 satellites have completed their designed mission life in orbit. It continues to provide imaging services for the remote sensing user community. Now operating from geostationary orbit, in the INSAT series of satellites, with meteorological payloads provide data for generating various parameters, namely, cloud motion vectors, cloud top temperature, water vapors content vertical profiles of temperature, humidity and facilitate weather forecasting, genesis of cyclones and their track prediction etc.

Till the 2016, ISRO launched INSAT – 3D geostationary satellite for meteorological purpose. After that INSAT - 3DR geostationary satellite is repeat the INSAT – 3D satellite with improved geo-location accuracy and enhanced imaging earth application.

Satellite Launch in Polar Orbit or Sun-synchronous Orbit

SARAL was launched on February 25, 2013 with ARGOS and ALTIA (SARAL) is a joint Indo-French satellite mission for oceanographic studies. SARAL performs altimetry measurements designed to study ocean circulation and sea surface elevation. The payloads of SARAL are: **a) Ka band Altimater, ALTIKA** – built by the French National Space Agency CNES. The payload intended for oceanographic applications, operates at 35.75 Giga Hertz. **b) ARGOS Data Collection System** – built by the French National Space Agency CNES. ARGOS contributes to the development and operational implementation of the global ARGOS Data Collection System. It will collect a variety of data from ocean bus to transmit the same to the ARGOS Ground Segment for subsequent processing and distribution. **c) Solid State C-band Transponder (SCBT)** - is from ISRO and intended RADAR calibration. It is a continuation of such support provided by C-Band Transponders flown in the earlier IRS-P3 and IRS-P5 missions. The payloads of SARAL are accommodated in the Indian Mini Satellite-2 bus, which is built by ISRO.

CARTOSAT – 2 Series was launched on June 2, 2016. It is the primary satellite carried by PSLV-C34. This satellite is similar to the earlier Cartosat-2, 2A and 2B. After its injection into a 505 km polar Sun Synchronous Orbit by PSLV-C4, the satellite was brought to operational configuration following which it will begin providing regular remote sensing services using Panchromatic and Multi-spectral cameras. The imagery of Cartosat-2 series satellite will be useful cartographic application, urban and rural applications, coastal land use and regulation, utility management lie road network monitoring, water distribution, creation of land use maps, precision study, change detection to bring out geographical and manmade features and various other Land Information System (LIS) and Geographical Information System (GIS) applications.

RESOU RCESAT – 2A was launched on Dec 7, 2016. It is a follow on mission to Resourcesat – 2 that provides data continuity to the user with improved frequency. The configuration is similar to Resourcesat-2 with three-tier imaging capability. The spacecraft mass is around 1,200 kg and a mission life of 5 years. The satellite was placed in polar sun synchronous orbit of 817 km altitude with an inclination of 98.69 deg.

CARTOSAT – 2 Series 3 will be launching in Second Quarter 2017. This satellite is similar to the earlier Cartosat-2 satellites. After its injection into a 505 km polar sun synchronous orbit the satellite was brought to operational configuration. The imagery of Cartosat-2 Series Satellite will be useful for cartographic applications, urban and rural applications, infrastructure planning utility management like road network monitoring, water grids, creation of land use maps, change detection and other studies.
Its primary mission objective provide of high-resolution scene specific spot imagery. This is similar configuration to earlier satellite. The satellite is planned to be launched by PSLV into a nominal altitude of 500 km. The satellite is capable of a long track and across track steering, nominally up to ± 26 degree providing spot images in continuous imaging mode. Cartosat-2 Series Satellite 3 is planned to be launched by the second quarter of 2017.

CARTOSAT – 3 will be launching in First Quarter of 2018. It is an advance angle and new generation of satellite with panchromatic and multispectral imaging capability, with an operational life of 5 years. Many new technologies / elements are being developed like highly agile structural platform, payload platform, data handling and transmission systems, advanced onboard computer and new power electronics, dual gimbal antenna, etc. The satellite readiness is expected by first quarter of 2018.

Satellite Launching in Geostationary Orbit or Geosynchronous Orbit

INSAT – 3D was launched on July 26, 2013. It is an advanced weather satellite and positioned at the orbital slot of 82 degree East longitude in the geostationary orbit. It has added a new dimension to weather monitoring through its Atmospheric Sounding System, which provides vertical profiles of temperature (40 levels from surface to ~70 km), humidity (21 levels from surface to ~ 15 km) and integrated ozone from surface to top of the atmosphere. Payloads onboard INSAT-3D are 6 Channel Imager, 19 Channel Sounder, Data Relay Transponder (DRT) and Satellite Aided Search and Rescue (SAS&R) Transponder.

INSAT – 3DR was launched on Sept 8, 2016. GSLV-F05 launch vehicle and positioned at the orbital slot of 74 degree East longitude in the geostationary orbit. It is a repeat mission of INSAT-3D satellite with improved geo-location accuracy and enhanced band-to-band registration. The radiometric measurements have been improved using Black Body calibration. It has an Atmospheric Sounding System of 19 channels (Visible-1, SWIR-6, MWIR-5, LWIR-7) capable of providing vertical profiles of temperature (40 levels from surface to ~ 70 km), humidity (21 levels from surface to ~ 15 km) and integrated ozone from surface to top of the atmosphere. INSAT-3DR is also having an Imager capable of imaging earth and its environment in six spectral channels (Visible-1, SWIR-1, MIR-1, Water Vapour IR-1, Thermal IR 1-1, Thermal IR 2-1). It is also having a Data Relay Transponder (DRT) and a Satellite Aided Search and Rescue (SAS&R) Transponder payloads.

GISAT – 1 (Geoimaging Satellite) will launch in 2018 expected. It is a geo imaging satellite operating from geostationary orbit to provide high temporal resolution. The GISAT-1 payload can provide a spatial resolution in the range of 50 m to 1.5 km, depending on the spectral band (VNIR, SWIR, TIR) used. The satellite platform is a modified version of I-1K bus, with a lift-off mass of 2,100 kg. The space craft is planned to be positioned at 93.5 degree east.

OCEANSAT – 3 will launch in 2018 expected. It is a continuity mission of Oceansat-2. It has three payloads a 13-Band Ocean Color Monitor (OCM), a 2-Band Long Wave (thermal) Infrared Sea Surface Temperature Monitor (SSTM) and a Ku-Band Pencil Beam Scatter meter. Improvements planned in the Oceansat-3 are simultaneous measurement of ocean color and SST, newer applications with increased number of bands and reduced bandwidth, wind vectors at 25 km spatial resolution, improvements in signal to noise ratio, coverage from near pole to pole, etc. Oceansat-3 is planned to be launch in 2018.

RISAT – 1A will launch in First Quarter 2018 expected. It is a repeat mission of RISAT-1 with C-Band Synthetic Aperture Radar (SAR) payload to facilitate cloud penetration and other earth observation applications and day / night imaging disaster management. The data from RISAT-1A will be used for applications in the areas of agriculture, forestry, soil moisture and hydrology, and ocean studies. The RISAT-1A satellite is planned to be launch in the 2018.

III. SUMMARY FOR EARTH OBSERVATION SATELLITES WHICH HAVE LAUNCHED AFTER 2013

Geological applications shall be benefited if viewing of earth surface at varying sun angles is done. Du to sun-synchronous orbits chosen, the present satellites can view the surface only at fixed sun angle. Above all, highly transient phenomena are rarely observed b these satellites. High spatial resolution results in low temporal resolution. Presently only two types of data are available for land-surface monitoring and assessment. First, high resolution data from sensors like Panchromatic, LISS– II, LISS-IV and AWiFS which image the earth at low repeated. Second, data from meteorological satellites like INSAT, which observed the earth at high repetitive rates but have coarse spatial resolution. Each satellite has its payload specification and that use for particular application. Summary of satellite those launch after 2013 by the ISRO organization in polar sun synchronization orbit and geostationary orbit for the EO with its payload specification as well as its application that fulfill by that particular satellite in table 2.

IV. FUTURE OF EARTH OBSERVATION SATELLITES

An earth observation system / mission and payloads on the space platform have to be carefully planned and designed keeping in view the user requirements and the technological constraints. Some of the broad considerations for a earth observation system in Geostationary Satellite (ISRO report, 15-16) are as follows:

- Observation of the earth surface using geostationary satellite
  - Improved geo-location accuracy and enhanced band-to-band registration.
  - It is also envisaged to realize a Geo Imaging Satellite to enable near real time imaging.
  - Overall aim is to maintain the continuity of services and carryout enhancements in technological capabilities with respect to sensors and payloads to meet the operational applications.
  - Repetitive monitoring at global scale.
  - To provide near real time images of the large areas of the country, under cloud free conditions, at frequent intervals.
- Calibration of sensors
- Synergy between sensors
- Timely access data : ground acquisition / processing / distribution infrastructure for cartographic application.

- Supporting activities: simulations, campaigns and modeling efforts.

	Satellite	Date of Launch	Payload Specification	Applications
Polar Sun Synchronization Orbit	**SARAL**[C3]	February 25, 2013	1) ALTIKA - Ka band Altimeter (35.5 – 36 GHz), dual frequency radiometer (24 / 37 GHz), LRA (Laser Retro – Reflector Array), A common antenna shared by Altimeter & Radiometer (1 meter dia), DORIS instrument (Doppler Orbitography and Radio positioning Integrated by Satellite) 2) ARGOS: A-DCS Advanced Data Collection System, UHF Transmitter, L-Band Transmitter, Antenna, UHF Diplexer, Receiver Processing Unit, Data Interface Unit	• Climate & Environment • Earth Observation • Marine meteorology and sea state forecasting • Operational Oceanography • Seasonal forecasting • Climate monitoring • Ocean, earth system and climate research • Continental Ice Studies • Protection of biodiversity • Management and protection of maritime security
	Cartosat-2 Series Satellite[C4]	June 2, 2016	One Panchromatic Camera, PAN with Spatial resolution: 1 m Swath: 9.6 km	Cartographic applications like mapping, urban and rural infrastructure development and management as well as application in Land Information System (LIS) and Geographical Information System (GIS), and DEM generation
	RESOURCE SAT – 2A[C5]	Dec 7, 2016	LISS-III: 4 Bands, 23.5 m resolution, 141 km swath LISS-IV: 3 Bands, 5.8 m resolution, 70 km swath AWiFS: 4 Bands, 56 m resolution, 740 km swath	Resource Monitoring Application
	Cartosat-2 Series 3[C6]	Second Quarter 2017	PAN - High-Resolution Multi-Spectral, Pushbroom, 12288 pixel/line, swath 9.6 km. Possible to be tilted along-track (10° aft- and 26° fore-) for in-orbit stereoscopy, and cross-track within a field of regard of 400 km HRMX - High-Resolution Multi-Spectral, Pushbroom, 10 km swath, steerable within a FoR of 400 km and along-track	LIS – Land Information System, GIS – Geographical Information System. (Cartographic Application, Urban and rural Applications, Costal Land use and regulation, utility management like road network monitoring, water distribution, creation of land use maps, change detection to bring out geographical and manmade features and various)
	CARTOSAT – 3[C7]	First Quarter 2018	PAN – Panchromatic Camera, Pushbroom, 12288 pixel/line, swath 6 km. Possible to be tilted along-track, HYSI – Hyper spectral Short-wave Infrared Radiometer, Swath 5 km. Steerable within a FoR of 400 km and along-track, MX – Multispectral VNIR, Swath 16 km, steerable withis a FoR of 400 km and along-track	PAN - Very-high-resolution land imagery HYSI for High resolution land observation and vegetation process monitoring MX - High resolution land observation and cartography
	INSAT – 3D[C8]	July 26, 2013	6 channel multi-spectral Imager, 19 channel sounder, Data Relay Transponder(DRT), Search and Rescue Transponder	For improved understanding of weather systems. Meteorological observations, monitoring of land and ocean surfaces, generating vertical profile of the atmosphere in terms of temperature and humidity for weather forecasting and disaster warning.
	INSAT – 3DR[C9]	Sept 8, 2016	Multispectral Imager, 19 channel sounder, Data Relay Transponder and Search and Rescue Transponder	Imaging in middle Infrared band to provide night time pictures of low clouds and fog,
	GISAT – 1[C10]	Expected by 2018	1)700 mm Ritchey-Chretien telescope based on the Cartosat 2 design 2) Array detectors in VNIR, SWIR and LWIR bands • High-resolution multi-spectral VNIR (HRMX - VNIR): 50 m resolution • High-resolution multi-spectral (HRMX - LWIR): 1.5 km resolution • Hyper-spectral VNIR: 320 m and 192 m resolution	1) Earth observing satellite operating from geostationary orbit to facilitate continuous observation of Indian sub-continent, quick monitoring of natural hazards and disaster 2) Multiple acquisition from Geosynchronous Orbit, 3) Provide near real time pictures of large areas of the country, under cloud free conditions, at frequent intervals. 4) Selected Sector-wise image every 5 minutes and entire Indian landmass image every 30 minutes at 50 m spatial resolution.

			• Hyper-spectral SWIR: 320 m and 192 m resolution 3) Camera electronics and data handling system 4) Electronically steerable transmit antenna system 5) High agility platform to enable large payload steering requirements	
	OCEANSAT – 3 [BC1]	Expected by 2018	1) An 13-band Ocean Colour Monitor (OCM) in VNIR (400-1010 nm range) with 360 m spatial resolution and 1400 km swath for ocean Colour monitoring 2) 2-band Long Wave Infra Red (LWIR) around 11 and 12 µm for Sea Surface Temperature (thermal channels) at 1080 m resolution. 3) A Ku-Band Pencil beam SCATTEROMETER with a ground resolution of 50 km × 50 km for Continuity of wind vector data for cyclone forecasting and numerical weather modeling.	provide continuity of ocean colour data with improvements to continue and enhance operational services. To enhance the applications by way of simultaneous Sea Surface Temperature (SST) measurements using additional thermal channels, Continuity of wind vector data through repeat of Scatterometer for cyclone forecasting and numerical weather modelling. improve the repetivity of ocean colour measurements to every 24 hour and wind vector measurements to every 12 hour.
	RISAT – 1A [C12]	First Quarter 2018	C-band SAR (Synthetic Aperture Radar)	The first satellite imaging mission of ISRO using an active C-band SAR imager. Objective of the RISAT mission is to use the all-weather as well as the day-and-night SAR observation capability

In Geostationary satellite, looking at the future thrust areas and application needs, the detailed mission design, needs capabilities such as higher spatial resolution, narrower spectral bands, higher repeatedly, active microwave payloads with wider swaths and more frequencies, stereoscopic coverage, multisensory concept and viewing at different angles. The high spatial or spectral resolution of data naturally put stringent requirements on data handling capabilities of on-board and ground processing systems. So further improvements in these fields are related to progress in data handling system

In next step, we will discuss on geostationary satellite payload system that gathering data from the earth surface which handled on onboard memory of satellite.

V. Conclusion

VI.

ISRO encouraged by the successful operation of the present EO satellites missions, many more missions have been planned for realization in the next few years. These missions will have suitable sensors for applications in cartography, crop and oceanography atmospheric studies using geostationary satellite. Satellite launched after 2013, it is designed mainly for to meet the growing user demands for new payloads and services. Considerable progress has been achieved in several technologies as the demand for four resolutions – spatial, spectral, radiometric and temporal increase, the complexity of imaging sensors systems increases in geostationary satellite. In future, more focus on cartographic service will providing through geostationary satellite. So mainly focus on resources applications and improve payloads will provide enhanced data for EO in polar sun synchronous orbit as well as in Geostationary Orbit.

To meet the information requirement to study the Planet Earth as an integrated system, satellite missions are planned which would enable global observations of land, climate, ocean and the atmosphere, particularly covering the tropical regions, where sufficient data sets are not available. The instruments like radiometers, sounders, spectrometers etc. for studying the land, ocean and atmospheric interactions are being planned for these missions.

REFERENCES

A) Publications

[1] Rajat kumar, Ancy.S, "A Series of Earth Resource Satellites and its Potentialities", International Journal of Advancements in Research & Technology, Vol. 3, Issue 4, April-2014, ISSN 2278-7763.

[2] R. R. Navalgund, V. Jayaraman, A. S. Kiran Kumar, Tara Sharma, Kurien Mathews and K K Mohanty, "Remote Sensing Data Acuisition, Platforms and Sensor Requirements", journal of the Indian Society of Remote Sensing, Vol 24, No. 4, 1996.

[3] Ramapriyan, Hampapuram, Behnke, Jeanne, Sofinowski, Edwin, Lowe, "Evolution of the Earth Observing System(EOS) data and information system", Lecture Notes in Geoinformation and Cartography, 63 – 92.

B) Annual Report

1) Annual Report 2016 – 2017 of ISRO, by Government of India department of Space
2) Annual Remote Sensing, Vol. I and II. (ed. Colwell) American Society of Photogrammetry, Falls Church, Va. 1983
3) Indian Remote Sensing Satellites – e-Learning 112.133.214.6/gis/gis2-3.aspx
4) Current Science, special section IRS – 1C, 70(7), 2007
5) Current Science, special issue, Vols 3 & 4, 1996

C) Websites

[C1] https://www.nrsc.gov.in/Earth_Observation_ Missions
[C2] http://www.isro.gov.in
[C3] http://www.isro.gov.in/Spacecraft/saral
[C4] http://www.isro.gov.in/Spacecraft/cartosat-2-series-satellite-1
[C5] http://space.skyrocket.de/doc_sdat/resourcesat-2.htm
[C6] http://www.isac.gov.in/earth-observation/html/cartosat-2s3.jsp
[C7] www.geol-amu.org/notes/mw4-2-6.htm
[C8] http://satellite.imd.gov.in/dynamic/insat_3DR.htm
[C9] http://space.skyrocket.de/doc_sdat/risat-1.htm
[C10] http://space.skyrocket.de/doc_sdat/gisat-1.htm
[C11] http://space.skyrocket.de/doc_sdat/oceansat-3.htm

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