Continuously Operating Reference Stations (CORS) GNSS network :challenges and benefits in Indian context

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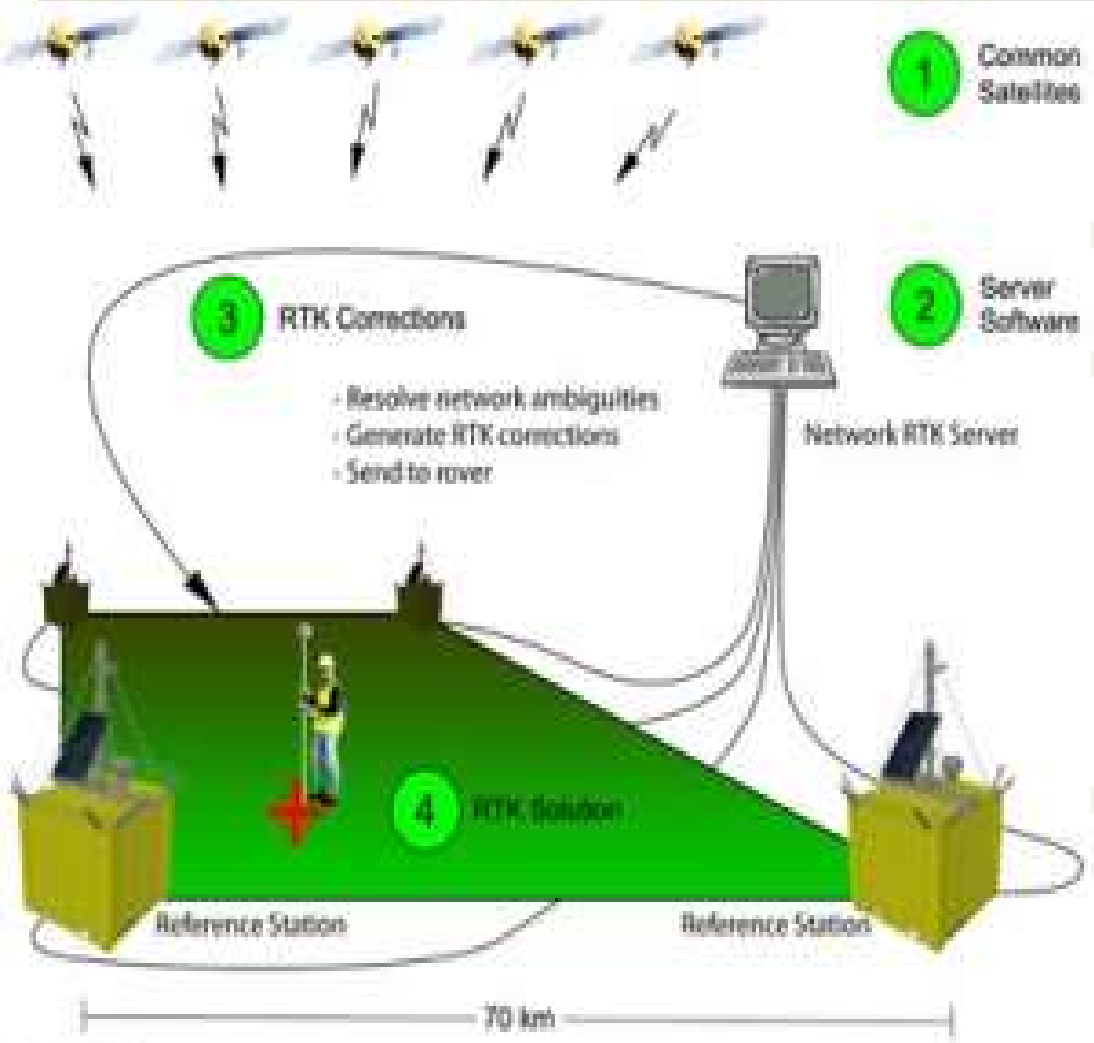
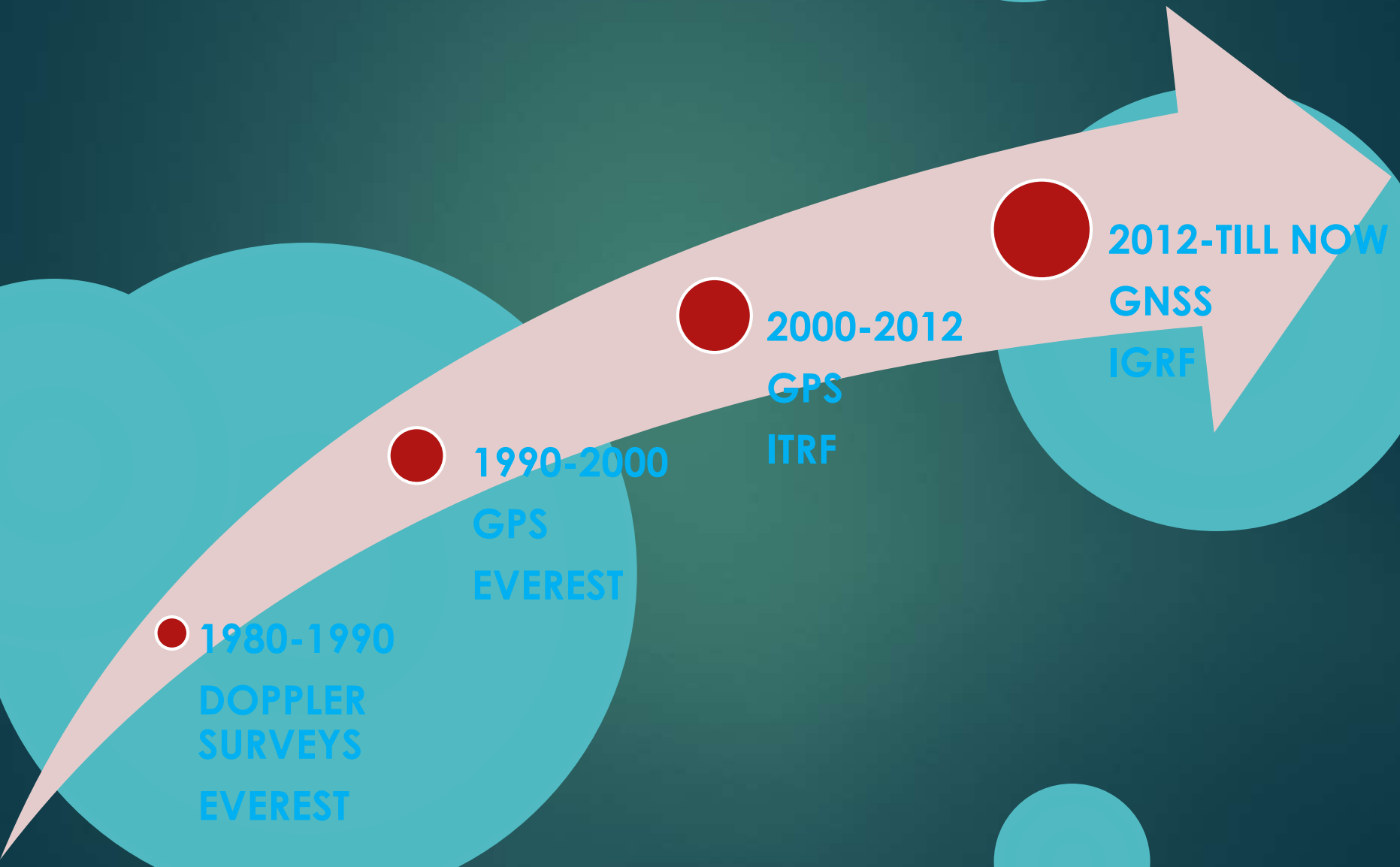
CORS: As a Service

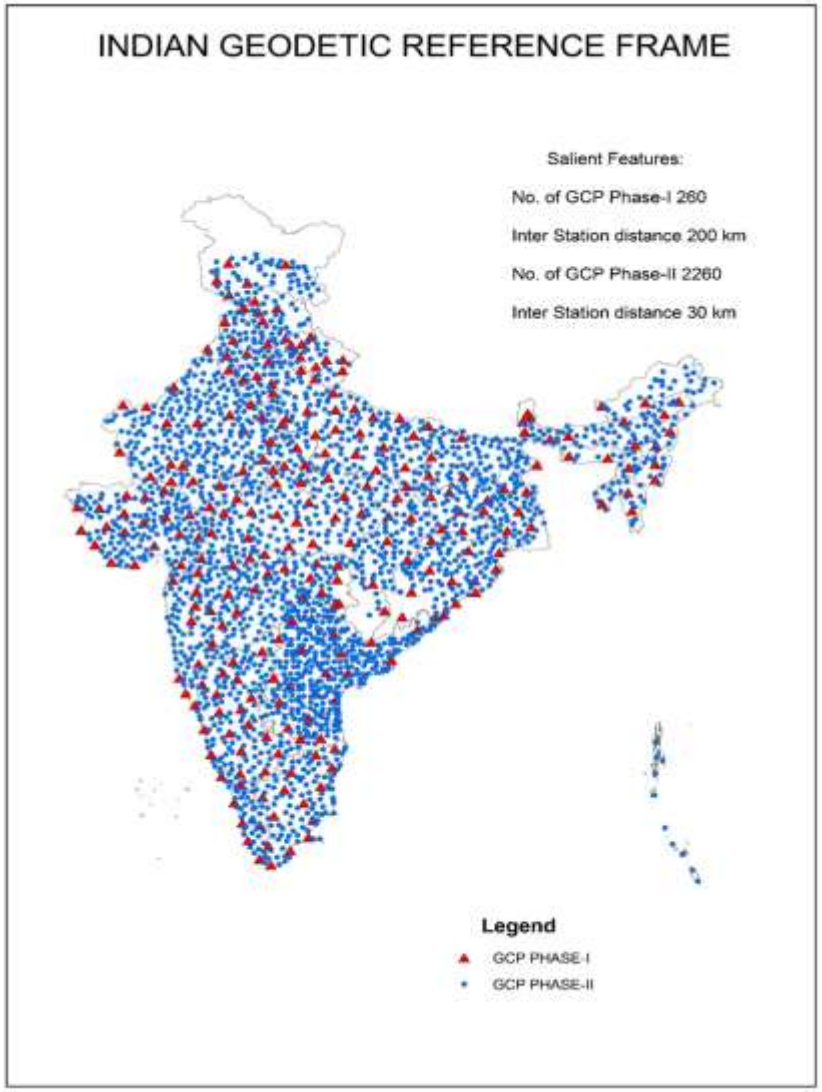


- CORS GNSS Network is used for providing fit-for-purpose positioning.
- Corrections are instantly sent to the rover receiver (user end) from control centre which helps to provide centimetre-level accuracy services for positioning of rover in real time.
- CORS network need to have an integrated national setup.
- Network-based Real Time Kinematic (NRTK) GPS positioning is considered to be a superior compared Real Time Kinematic (RTK) which is highly affected by the distance dependent errors such as satellite orbital and atmospheric biases.
- CORS network envisaged is one such model that correctly model the distance-dependent errors.

EVOLUTION OF SPACE BASED TECHNIQUES & GEODETIC DATUMS IN INDIA

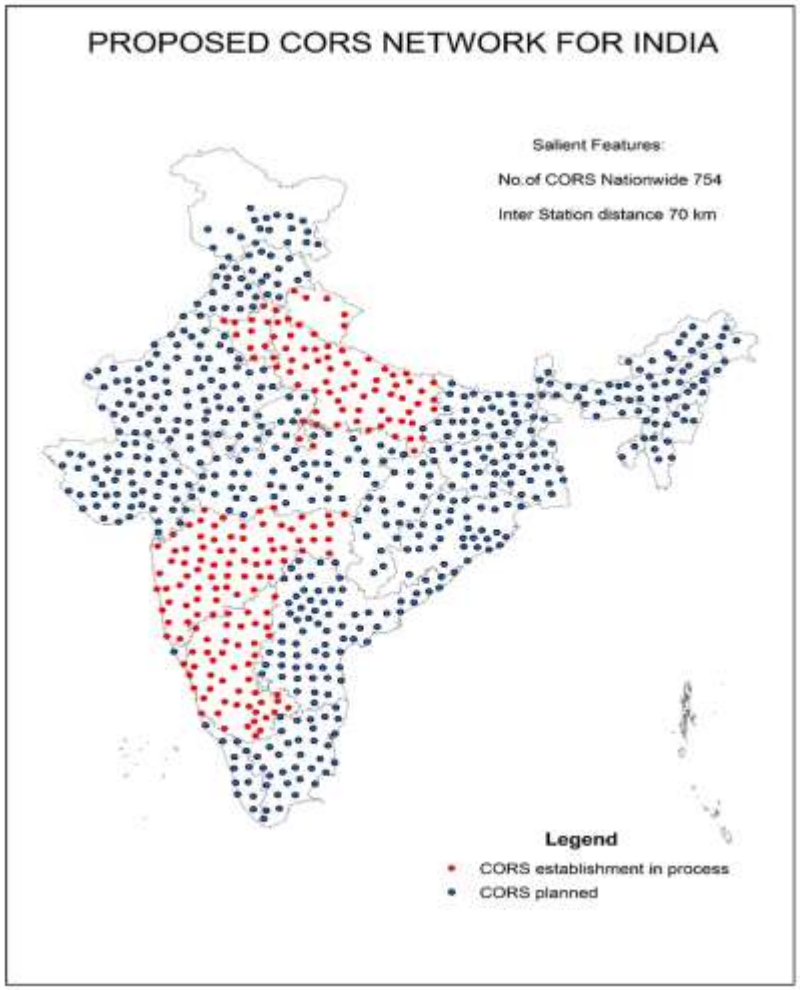


INDIAN GEODETIC REFERENCE FRAME (IGRF)



- Indian geodetic reference frame (IGRF) was established through a "passive" network of about 260 well spread Ground Control Points (GCPs) at a spacing of 250-300 km apart across the country during the period from 2006 to 2008.
- This network was observed and adjusted in combination with few IGS stations surrounding the Indian territory. The current Indian horizontal reference frame is linked to the *International Terrestrial Reference Frame* (ITRF) epoch 2005.
- The network was further densified with 2260 precision Ground Control Points at a spacing of 30 to 40 km apart withhin the framework of IGRF.
- The IGRF is only suited for relative positioning, primarily for mapping applications.
- The "passive" networks of groundmarks is going to be replaced with "active" networks of CORS receivers.

Proposed CORS network in India



- The CORS network project is in the pipeline.
- CORS will be introduced nation wide in phase wise manner.
- In the first phase the CORS network will be introduced in Uttar Pradesh & Uttarakhand, Maharashtra, Haryana and Karnataka (depicted by red dots) with its control and analysis centre at Dehradun, Uttarakhand.

Best Practices in CORS operation

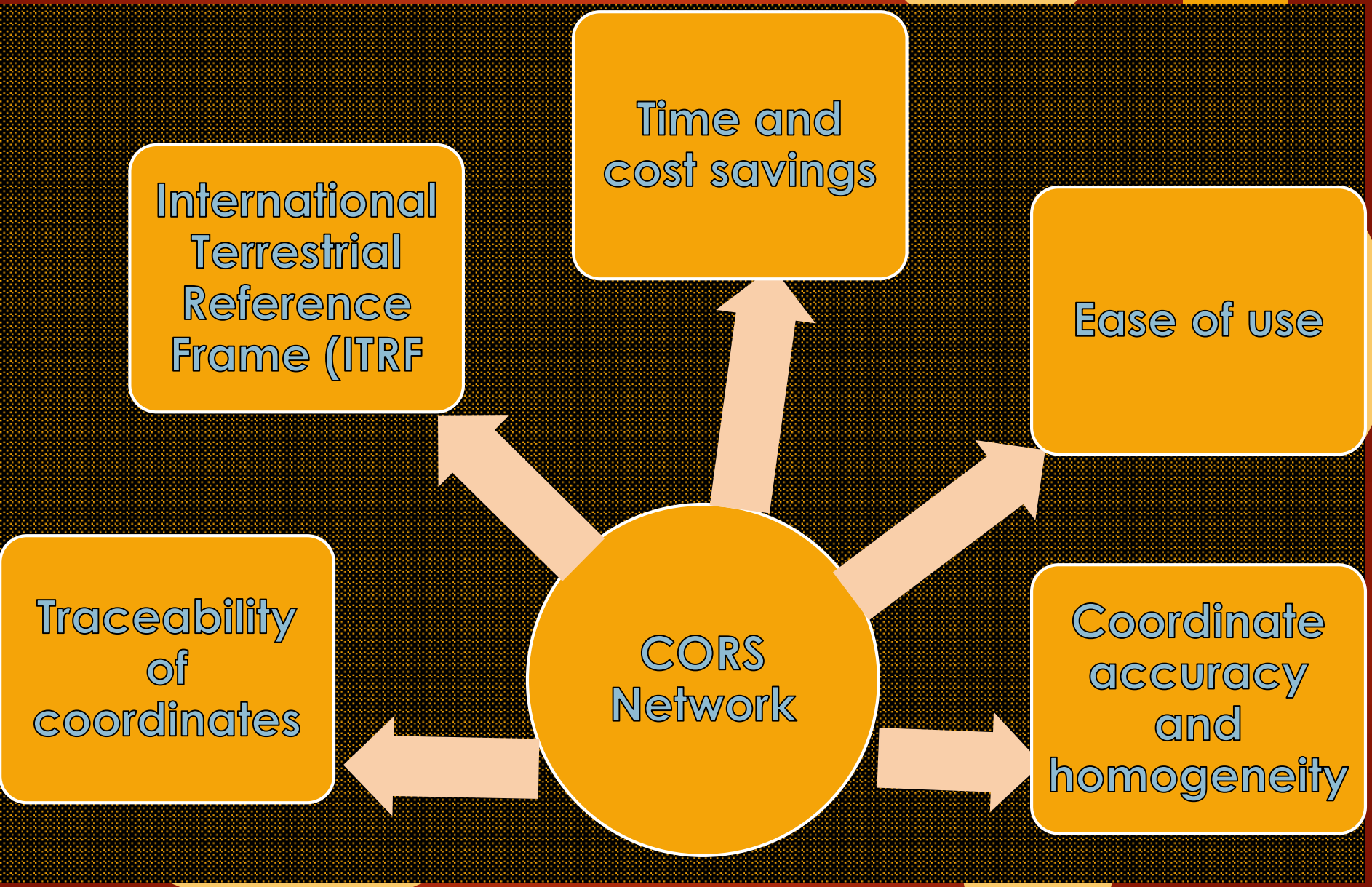
- When claiming to operate within the national reference frame, the coordinates of the site need to be calculated in a traceable manner.
- GNSS CORS antenna reference point should be continually monitored for the stability.
- The observation data is to be archived in the RINEX format to ensure compatibility for post-processed applications with the greatest range of equipment and processing software available.
- The raw data is to be archived from the GNSS CORS equipment in a proprietary format.
- Comprehensive metadata is to be maintained for each CORS site.

  - Site
  - Receiver
  - Antenna
  - Monument
  - Coordinate deviation
  - Power
  - Communications
  - Data Formats
  - Reliability of service
  - Stability
  - Additional Site Sensors
  - Data Access
  - Etc.

Methodology Adopted for CORS

Specify System	Own Stations	Network the Data	Process Network	Deliver Service
Target Density, Coverage, Reliability and Availability	Site Selection and Construction	Data Communication from Network Stations	Copy of Network	Retail Sale of Data products
Site Quality	Equipment Purchasing and Installation	Control Center	Data Processing	
Equipment Quality				
Geodetic Reference Frame	Station Data Communication			
Data Service Produced	Site Maintenance	Quality Control of Data	Production of Data Streams	Marketing
Data Access Policy	Equipment Replacement Cycle	Data Archive	Distribution of Data Streams	

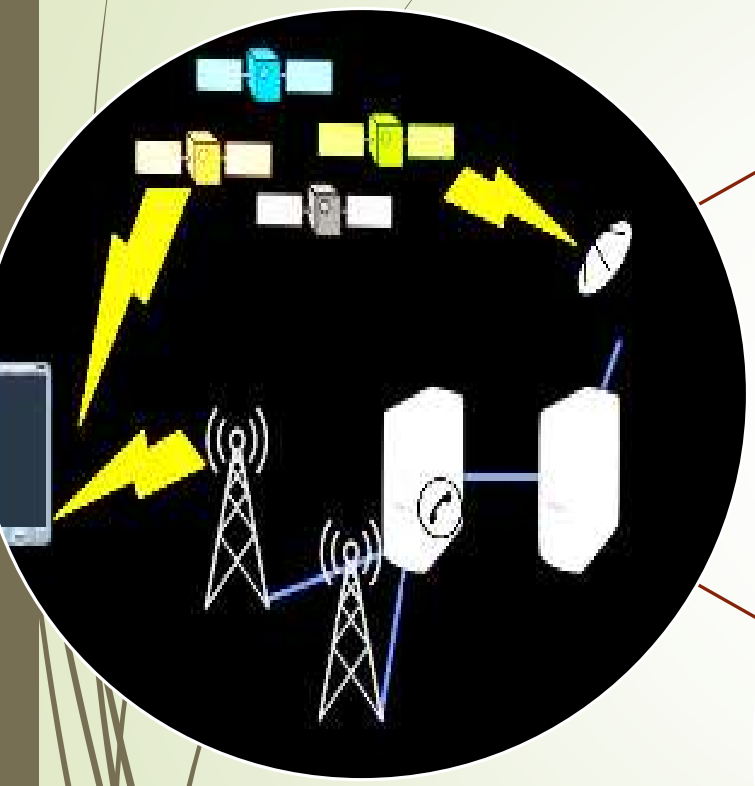
Benefits of CORS Network



CHALLENGES OF CORS NETWORK

- Cable/ Mobile Internet Coverage
- Power Supply
- Security
- Maintenance
- Future proof

Usage of CORS Network in India



Accurate 3D positioning

- Scientific research that require greater positional accuracy, as well as continuity of data.
- Crustal Deformation and Plate Tectonics Study, Land Subsidence and Vertical Ground Motion Study, Dam Deformation Study and Structural Health Monitoring etc.

subscription based service

- Surveying, navigation, construction, mining, precision agriculture
- Large Scale Mapping, Cadastral Survey, Flood Plain Mapping, Fleet Management and DEM Generation

CONCLUDING REMARKS

- THERE ARE MANY BENEFITS AND CHALLENGES ASSOCIATED WITH CORS GNSS NETWORKS. FOR WHICH A THOROUGH FEASIBILITY STUDY SHOULD BE CONDUCTED PRIOR TO BEGINNING A CORS PROJECT:

1. ANALYSIS OF THE CABLE/MOBILE INTERNET COVERAGE WITHIN THE NETWORK AND AT PROPOSED CORS STATIONS.
2. CAREFUL DESIGN AND EXAMINATION OF THE LOCATION OF EACH CORS STATION TO ENSURE THAT SUFFICIENT COVERAGE, ACCESSIBILITY AND SECURITY CAN BE ENSURED.
3. ASSURANCE THAT THE SYSTEM IS COMPLETELY FUTURE PROOF, AND THAT THE CORS NETWORK CAN BE EXPANDED WITHOUT DISCRIMINATION OF GNSS RECEIVER BRANDS.

THANKS