DR. PRIYESH KUNNUMMAL

Project Scientist I

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https://scholar.google.co.in/citations?user=mp7vffcAAAAJ&hl=en

https://www.scopus.com/authid/detail.uri?authorId=57200725969

Web:
https://www.geopotential.in

PERSONAL PERTICULARS:

Date of Birth : 17th Dec. 1988
Nationality : Indian
Gender : Male
Marital status : Married

LANGUAGE PROFICIENCY

MALAYALAM
ENGLISH
HINDI
TAMIL

ACADEMIC RECORD

Ph.D. in Geophysics @Indian Institute of Geomagnetism, Andhra University (2020)
M.Sc. in Marine Geophysics, Cochin University of Science and Technology (2011)
B.Sc. in Physics, (Mathematics & Chemistry Subsidiary), Calicut University (2009)

POSITIONS HELD & NATURE OF WORK

- Project Scientist-I, NCPOR Goa, 2022 – Present
  EEZ Mapping,
  Hydrothermal project

- National Post-Doctoral Fellow (SERB-NPDF), CSIR-NIO, Goa, 2022
  "Geophysical investigation over the Mid-Oceanic Ridges in the Indian Ocean to understand the morphotectonic characteristics and lithospheric structure along its sectors with variable spreading rates"

- Research Associate II , IIG Mumbai, 2021 – 2022
  "Study of lithospheric structure, tectonism and Morphological characteristics of Carlsberg Ridge and Central Indian Ridge segments of the Indian Ocean Mid-Oceanic Ridge system using high-resolution satellite derived gravity data"

- Research Associate I, IIG Mumbai, 2020 – 2021
  "Development of an open source MATLAB based graphical user interface for geopotential data analysis, modelling and interpretation"

- Research Scholar, IIG Mumbai, 2011-2018
  "Crustal Architecture and Isostasy of Aseismic Ridges in the North Central Equatorial Indian Ocean using High Resolution Satellite derived Gravity Data"

RESEARCH INTEREST

- Structure and Evolution of Aseismic Ridges in the Northern Indian Ocean
- Geophysical study of Indian Ocean Mid-Oceanic Ridge system
- Lithospheric flexure and determination of effective elastic thickness
- Development of open source MATLAB based software modules for gravity and magnetic data interpretation
- Gravity inversion techniques for Moho depth determination

RESEARCH ACTIVITIES

- Qualitative analysis and interpretation of marine gravity, magnetic and its various transformations based on wavelengths for identifying structural features.
- Estimation crustal thickness / Moho depth variation over the aseismic ridges using gravity inversion technique
- Study of spatial variation of effective elastic thickness (Te) along aseismic ridges to understand mode of isostatic compensation & emplacement history based on Coherence and Admittance analysis as well as 2D and 3D flexural modelling.
- Derivation of 2D and 3D crustal models using satellite derived/ship-borne gravity and magnetic data.
- Three dimensional depth estimation for various crustal interface using energy spectral analysis.
- Identification of Fracture Zones and Demarcation of Ocean-Continent Boundary (OCB) using geopotential data by employing various edge enhancement techniques.

FELLOWSHIPS / AWARDS /RECOGNITION

- 01.2022 National Post-Doctoral Fellowship – Science and Engineering Research Board, Dept. of Science and Technology, Govt of India.

SOFTWARE EXPERTISE

GEOSOFT
MATLAB
SURFER
GRAPHER
ADOBE ILLUSTRATOR
GMT
QGIS
INKSCAPE

PERMANENT RESIDENCE:

KUNNUMMAL HOUSE
KODENCHERI (P.O)
PURAMERI (VIA)
KOZHIKODE (DIST)
KERALA – 673503, INDIA

ACADEMIC ACHIEVEMENTS

Qualified **GATE** 2014 & 2015

REFERENCES

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Dr. Yatheesh Vadakkeyakath
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CSIR-NIO
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FIELD EXPERIENCE

- Participated in one month multi-disciplinary cruise of Ministry of Earth Sciences on-board the National flagship ORV Sagar Kanya (SK-273).
- Participated as a team member in the collection of Ground magnetic data Over Deccan Covered Regions of Maharashtra conducted by IIG, in 2011 - 2016
- Participated as a team member in the collection of Gravity, Magnetic and DGPS survey conducted by IIG, in 2016

Instruments handled: GSM-19 Overhauser Magnetometer, GEM GSM-19 Overhauser Gradiometer, Scintrex CG-5 Gravimeter, DGPS, VLF instruments, hand held GPS.

DISSERTATION WORKS

- "The Processing of Aeromagnetic Data over The Shillong Plateau with Special Emphasis on Grid Stitching" carried out at Indian Institute of Geomagnetism, Mumbai
- Completed dissertation work entitled “Extent of the Laxmi Ridge derived from the Satellite-derived Free-air gravity anomalies” at National Institute of Oceanography, Goa.

EXTERNAL ACTIVITIES

- Member, Asia Oceania Geosciences Society (AOGS), 2016 - 2019

LIST OF INTERNATIONAL PUBLICATIONS

Priyesh Kunnummal, S.P. Anand, (2022). Crustal structure and tectonic evolution of Greater Maldive Ridge, Western Indian Ocean, in the context of plume-ridge interaction. *Gondwana Research*, 106, 142-163. doi.org/10.1016/j.gr.2022.01.006

Priyesh Kunnummal, S.P. Anand, (2019). Qualitative appraisal of high resolution satellite derived free air gravity anomalies over the Maldive Ridge and adjoining ocean basins, western Indian Ocean. *Journal of Asian Earth Sciences*, 169, 199-209. doi.org/10.1016/j.jseaes.2018.08.008

Priyesh Kunnummal, S.P. Anand, Haritha C, Rama Rao Paluri, (2018). Moho depth variations over the Maldive Ridge and adjoining Arabian and Central Indian basins, Western Indian Ocean, from three dimensional inversion of gravity anomalies. *Journal of Asian Earth Sciences*, 156, 316-330. doi.org/10.1016/j.jseaes.2017.12.012

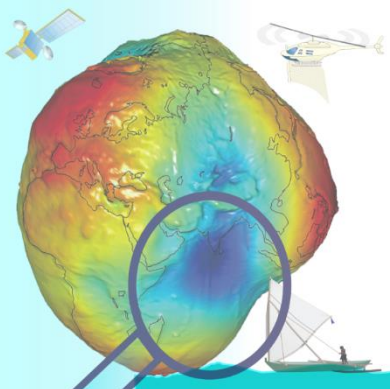
CONFERENCE PRESENTATIONS

i. **Priyesh Kunnummal**, S.P. Anand, Nisha Nair (2018). Structure and Nature of the Laccadive – Maldive Segment of the Aseismic Chagos-Laccadive Ridge, Western Indian Ocean. *SCOR-InterRidge workshop held at CSIR-NIO, Goa*. (Oral Presentation)

ii. **Priyesh Kunnummal**, S. P. Anand (2018). Crustal architecture of Maldive Ridge segment of the Chagos-Laccadive Ridge, western Indian Ocean – A Geopotential appraisal. *40th annual convention of AEG at IIT Mumbai*. (Poster Presentation)

iii. **Priyesh Kunnummal**, S. P. Anand (2016). Crustal structure and evolution of Comorin Ridge and Adjoining Regions in the Northern Indian Ocean using Geopotential Data. *13th Annual meeting of AOGS-2016 held at Beijing, China*. (Oral Presentation)

iv. **Priyesh Kunnummal**, S. P. Anand (2015). A Reappraisal of the crustal architecture and evolution of Comorin Ridge and adjoining regions using Geopotential data. *IGU 52nd annual convention held at MoES-NCAOR, Goa*. (Poster Presentation)



RESEARCH HIGHLIGHTS

- As a first step to understanding the nature of the crust, an attempt has been made to estimate the Moho depth and crustal thickness variation in the Maldive Ridge and adjoining Arabian and Central Indian Basin using high resolution satellite derived Free Air gravity data. The crustal thickness and Moho depth, place first order constraints in understanding the tectonic and geochemical processes that have led to crustal formation and evolution. The Moho undulation and the crustal thickness of the Maldive Ridge and adjoining regions were computed by inversion of the gravity data incorporating lithospheric thermal and pressure gravity anomaly correction in addition to sediment correction. Greater Maldive Ridge (GMR), which consists of the Maldive Ridge, deep sea channel region, is underlain by ~ 22 km thick crust representing either oceanic crust with magmatic underplating or continental crust. Along the GMR the crustal thickness decreases from north to south with thickness of 27 km below the Maldives Ridge reducing to ~9 km at 3°S and further increasing towards Chagos Bank. (*Kunnummal et al., 2018*).

- High resolution satellite derived free-air gravity (FAG) anomalies over the Greater Maldive Ridge and parts of the adjoining Arabian Basin and Central Indian Basin was analysed to have a qualitative understanding on the structural set up of the Maldive Ridge and DSC. Various transformation operations including wavelength filtering were carried out on the Indian Ocean Geoidal Low (FAG-IOGL) corrected free-air gravity data to isolate the gravity sources at different depth levels. From the analysis, it was found that Vishnu Fracture Zone extends north of 0°N and extend into the previously assumed ocean continent boundary. While the gravity anomalies associated with the shallow to intermediate wavelength anomalies over the MR reflects the reef platforms/top of the lava flow unit/acoustic basement, the long wavelength anomalies reflect the signature of the underplated material related to the movement of Indian plate over the Reunion hotspot. Depth to top of shallow and deep interfaces over the MR and DSC were computed from the radially averaged power spectrum of the FAG-IOGL gravity data. The shallow interface gave an average depth of 5.5 km from the surface while the deeper interface was found to lie at an average depth of 11.0 km. The depths obtained from spectral analysis were compared to that computed from two-dimensional forward modelling along a N-S profile along the western segment of the Maldive Ridge. Integrating the results obtained with available seismic refraction, reflection, drilled wells, broad band seismic data supported by the 2D forward model, it was inferred that the shallow depth corresponds to the top of the acoustic basement and the deeper reflects the depth to the top of the initial Moho before the formation of magmatic underplated rocks. The Deep Sea Channel is interpreted to be purely oceanic in nature with the delineation of the extension of fracture zones in this region. (*Kunnummal & Anand, 2019*).

- The spatial variations in effective elastic thickness (T_e), isostasy and crustal structure of GMR using high resolution satellite derived gravity, residual geoid and bathymetry data were investigated in detail to understand its tectonic evolution. The estimated T_e values along the GMR from 2D & 3D flexural modelling ranges from 6.5 km – 16.5 km with comparatively lower T_e values over MR (7 km – 9 km) and slightly higher values over the DSC region (> 10 km). Geoid Topography Ratio computed for two wavelength bands shows almost similar kind of variation along the ridge with a maximum value of 1.4 m/km in the DSC region, decreasing northwards to 0.6 m/km over MR. Integrating results from the present study with crustal thickness, Moho undulations and Curie depth along the entire length of the GMR suggest that MR was formed in the vicinity of spreading centre while DSC region was under a long transform fault which has given rise to the gap zone between Chagos and Maldive Ridge during plume-ridge interaction. (*Kunnummal & Anand, 2022*).

- Graphical User Interface (GUI) for the following methodologies have been developed. The codes are written in the MATLAB environment, incorporating the GMT-Matlab API capabilities for easily handling of geographic data sets.
  a) For the estimation of effective elastic thickness (Te) & Isostatic studies
     i. 2D & 3D flexural modelling using gravity-bathymetry & geoid-bathymetry relationship.
     ii. 3D Admittance analysis for Free-air gravity/Bouguer gravity/Residual Geoid using Multi-taper method/Conventional FFT.
     iii. 3D Coherence analysis for Bouguer gravity/Mantle residual gravity using Multi-taper method/Conventional FFT
     iv. Geoid to Topography analysis: analysis in the space domain using polygons/ in the frequency domain using geoid admittance.
  b) 3D depth estimation using Moving Window Technique and Expanding Window Technique.
- Existing codes are compiled and modified extensively for Moho depth estimation through 3D gravity inversion.