

Dr. Francis P. A.
Director

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Centre for Excellence in Marine Studies
University of Mumbai
Kalina Campus, Santacruz East, Mumbai-400098

Date of Birth : 1-June-1976

Research Interests:

1. Indian Monsoon Variability
2. Indian Ocean Circulation
3. Numerical Ocean Modeling
4. Operational Oceanography

Major Professional Contributions:

- Associate Editor, Journal of Earth System Sciences.
- Conceptualized and developed the operational ocean forecast system for the Indian Oceans
- Developed the INCOIS Ph. D. programme
- Management of INCOIS Knowledge Resource Centre
- Co-ordination of R&D projects in ocean modeling, data assimilation and process studies.

Major Scientific Contributions:

- Discovery of Equatorial Indian Ocean Oscillation (EQUINOO).
- Studies on the links between extremes of Indian summer monsoon variability, ENSO and EQUINOO.
- Identifying the mechanisms for the triggering of EQUINOO and Indian Ocean Dipole.
- Study on the space-time variability of intense rainfall events over the west coast of India.
- Studies on the representation of EQUINOO-ISMIR links in coupled O-A GCMS.
- Configuration of numerical ocean circulation models for the Indian Ocean.
- Development of the High-resolution Operational Ocean Forecast and reanalysis System
- Studies on the subtidal circulation along the east coast of India.
- Studies on the energetics of internal tides in the Bay of Bengal.

Education:

Degree	Department/Faculty/College	Institute/University	Year	% of Marks/ Division/Thesis title
Ph. D.	Centre for Atmospheric and Oceanic Sciences, Faculty of Engineering. <i>Supervisor: Prof. Sulochana Gadgil</i>	Indian Institute of Sciences, Bangalore.	2006	Thesis: Extremes of Indian Summer Monsoon Rainfall and Equatorial Indian Ocean Oscillation
M. Sc. (Engineering)	Centre for Atmospheric and Oceanic Sciences, Faculty of Engineering. <i>Supervisor: Prof. Sulochana Gadgil</i>	Indian Institute of Sciences, Bangalore.	2002	Thesis: Intense Rainfall Events over the West Coast of India
M. Sc. (Meteorology)	Department of Atmospheric Sciences, Faculty of Marine Sciences	Cochin University of Science and Technology,	2000	75.3%, First Class with Distinction and University First Rank.

		Kochi		
PG Diploma in Computer Applications		IHRDE, Govt. of Kerala, Kochi	1997	83.4%, First class with Distinction.
B. Sc. (Physics)	St. Paul's College Kalamassery	Mahatma Gandhi University, Kottayam, Kerala	1996	67.8%, First class.

Job Profile:

1. Director, CEMAS, University of Mumbai
2. Scientist-F (2020-), INCOIS, MoES, Hyderabad
3. Scientist-E (2015-2019), INCOIS, MoES, Hyderabad
4. Scientist-D (2010-2014), INCOIS, MoES, Hyderabad
5. Scientist-C (2006-2010), INCOIS, MoES, Hyderabad
6. Visiting Fellow (2005) Lamont-Doherty Earth Observatory of Columbia University, CU, New York.
7. Research Fellow (2000-2006), Indian Institute of Science, Bangalore.

Previous Administrative Assignments:

1. Head, Ocean Modeling and Data Assimilation Division, INCOIS
2. Manager, Knowledge Resource Centre, INCOIS
3. Manager, Academic Programs, INCOIS

Awards/Honours:

1. 2018- Elected Fellow, Telangana Academy of Sciences, Hyderabad.
2. 2016- National Geosciences Award-2014, Ministry of Mines, Govt. of India
3. 2010- MoES Merit Certificate, Ministry of Earth Sciences, Govt. of India
4. 2005- START Young Scientist Fellowship, START International Secretariat, Washington-DC.
5. 2000- CV Kurian Endowment Award, Cochin University of Science and Technology, Kochi

Students:

Ph. D.

Awarded

1. Vishnu S Nair (INCOIS-Andhra University, Ph.D. awarded in July 2018)
2. Radharani Sen (IIT Kharagpur, Joint Supervisor, Ph. D. awarded in April 2021)
3. Effy John (INCOIS-Andhra University, Ph. D. awarded in January 2022)
4. Jithin Abraham (INCOIS-Andhra University, Ph. D. awarded in January 2022)

Ongoing

5. K. G. Sandhya (INCOIS-Mangalore University, 2018-)
6. R. S. Mahendra (INCOIS-Mangalore University, 2018-)
7. B. Balaji (INCOIS-Mangalore University, 2019-)
8. M. R. Anju (KUFOS, 2019-)
9. Midhila Varna (INCOIS-KUFOS, 2020-)
10. K. Vijayakumar (NIO-AcSIR, Co-guide, 2021-)
11. Biswamoy Paul (INCOIS-UoH, Co-guide, 2021-)

M. Phil./M. Tech.

12. Pooja Tiwari (M. Phil, JNU, Joint Supervisor, 2020)
13. Meera Muralidharan (M. Tech. CUSAT, 2020)

Post Doctoral Fellows

14. Charls Antony, SERB NPDP

Teaching:

Ocean Atmosphere Modeling	- University of Hyderabad
Ocean General Circulation	- University of Hyderabad
Atmospheric General Circulation	- KUFOS, Kochi
Upper Ocean Processes	- India Meteorological Department
Climate Modeling	- Indian Institute of Technology, Hyderabad

Major Projects involved:

- 2012-2017 : High-resolution Operational Ocean Forecast and reanalysis System (HOOFS)
- 2017-2021 : Ocean Modeling Data Assimilation and Processes Specific Observations (O-MASCOT)
- 2017-2021 : Monsoon Mission

Professional Services:

1. Associate Editor, Journal of Earth System Sciences, Indian Academy of Science (2022-2024).
2. Organizer, National Oceanography Workshop, 2018.
3. National System Representative, Ocean Predict (2010-2014)
4. Member, Ocean Predict Advisory Group (2019-present)
5. Mentor students for summer internships as part of Summer Research Fellowship programs of the national science academies.
6. Mentor students for their M. Sc./B. Tech dissertation.
7. Reviewed for several national/international SCI journals (J. Climate, GRL, MAP, Current Science, JESS, ERL, Scientific Reports, Climate Dynamics, Ocean Modeling, Ocean Dynamics, JGR-Atmosphere, JGR-Oceans, Earth and Space Science, Pure and Appl. Geophys. etc.) and Ph. D. theses.

Research Publications:

1. Gadgil Sulochana, PN Vinayachandran, **PA Francis**, S Gadgil (2004) Extremes of the Indian summer monsoon rainfall, ENSO and equatorial Indian Ocean oscillation, *Geophysical Research Letters* 31 (12)
2. Gadgil Sulochana, PN Vinayachandran, **PA Francis** (2003) Droughts of the Indian summer monsoon: role of clouds over the Indian Ocean, *Current Science* 85 (12), 1713-1719
3. Gadgil Sulochana, M Rajeevan, **PA Francis** (2007) Monsoon variability: Links to major oscillations over the equatorial Pacific and Indian oceans, *Current Science* 93 (2), 182-194
4. **PA Francis**, Gadgil, Sulochana (2006) Intense rainfall events over the west coast of India, *Meteorology and Atmospheric Physics* 94 (1), 27-42
5. **PA Francis**, Gadgil, Sulochana (2010) Towards understanding the unusual Indian monsoon in 2009, *Journal of Earth System Science* 119 (4), 397-415
6. **PA Francis**, Gadgil, Sulochana (2010) The aberrant behaviour of the Indian monsoon in June 2009, *Current science* 97 (9), 1291-1295
7. **PA Francis**, Gadgil, Sulochana PN Vinayachandran (2007) Triggering of the positive Indian Ocean dipole events by severe cyclones over the Bay of Bengal, *Tellus A* 59 (4), 461-475
8. RS Nanjundiah, **PA Francis**, M Ved, Gadgil, Sulochana (2013) Predicting the extremes of Indian summer monsoon rainfall with coupled ocean-atmosphere models, *Current Science* 104 (10), 1380-1393
9. **PA Francis**, PN Vinayachandran, SSC Shenoi (2013) The Indian ocean forecast system, *Current Science* 104 (10), 1354-1368
10. **PA Francis**, Gadgil, Sulochana (2011) A note on new indices for the equatorial Indian Ocean oscillation, *Journal of Earth System Science* 122 (4), 1005-1011
11. S Vishnu, **PA Francis** (2014) Evaluation of high-resolution WRF model simulations of surface wind over the west coast of India, *Atmospheric and Oceanic Science Letters* 7 (5), 458-463
12. S Surendran, S Gadgil, **PA Francis**, M Rajeevan (2016) Prediction of Indian rainfall during the summer monsoon season on the basis of links with equatorial Pacific and Indian Ocean climate indices, *Environmental Research Letters* 10 (9), 094004
13. S Vishnu, **PA Francis**, SSC Shenoi, S Ramakrishna (2016) On the decreasing trend of the number of monsoon depressions in the Bay of Bengal, *Environmental Research Letters* 11 (1), 014011

14. Prasad, S.J., B Nair, **PA Francis**, T Vijayalakshmi (2015) Hindcasting and Validation of Mumbai Oil Spills using GNOME, *International Research Journal of Environment Sciences* 3 (12), 18-27
15. Marina Tonani et al (2015) Status and future of global and regional ocean prediction systems, *Journal of Operational Oceanography*, 8, 201-220.
16. Gadgil, Sulochana, **PA Francis** (2016) El Nino and the Indian rainfall in June, *Current Science* 110 (6), 1010-1022:
17. S Vishnu, **PA Francis**, SSC Shenoi, SSSV Ramakrishna (2018) On the relationship between the Indian Summer monsoon rainfall and the EQUINOO in the CFSv2, *Climate Dynamics*, <https://doi.org/10.1007/s00382-018-4190-7>:
18. Nair, P.J, A Chakraborty H Varikkodan, **PA Francis**, J Kuttippurath (2018): Local and Global Climate Forcings induced inhomogeneity of Indian rainfall, *Nature Scientific Reports*, 8:6026 DOI:10.1038/s41598-018-24021-x
19. Vishnu S, **PA Francis**, SC Shenoi, SSSV Ramakrishna (2018): On the relationship between the Pacific Decadal Oscillation and monsoon depressions over the Bay of Bengal. *Atmos Sci Lett.*;19:e825. <https://doi.org/10.1002/asl.825>
20. Prerna S., B. Paul, **PA Francis** and SSC Shenoi (2018), Physical Sciences of Ocean: A report to IAPSO/IUGG, Ed. Harsh K. Gupta.
21. Prasad SJ, **PA Francis**, TM Balakrishnan Nair, SSC Shenoi and T Vijayalakshmi (2018), Oil spill trajectory prediction with high resolution ocean currents, *Journal of Operational Oceanography*, 10.1080/1755876X.2019.1606691
22. Arnab Mukharjee, Abhisek Chatterjee and **PA Francis** (2019), Role of Andaman and Nicobar Islands in eddy formation along western boundary of the Bay of Bengal, *Nature Scientific Reports*, 9 (1), 10152
23. Sulochana Gadgil, **PA Francis** and P. N. Vinayachandran (2019), Summer Monsoon of 2019: Understanding the performance so far and speculating about the rest of the season, *Current Science*, 117(5), 783-793.
24. Jithin K Abraham, **PA Francis**, AS Unnikrishnan and SSSV Ramakrishna (2019) Modeling of internal tides in the western Bay of Bengal : Characteristics and energetics, *J. Geophys. Res.-Oceans*, 10.1029/2019JC015319.
25. Sulochana Gadgil, **PA Francis** and P. N. Vinayachandran (2019), Monsoon and EQUINOO: Validation of the educated guess for the season of 2019, *Current Science*, 117(11), 1782–1784.
26. Effy BJ, **PA Francis**, Ramakrishna SSVS and Mukherjee A (2020), Anomalous warming of the western equatorial Indian Ocean in 2007: Role of ocean dynamics. *Ocean Modelling*. 101542. 10.1016/j.ocemod.2019.101542.
27. **Francis PA**, Jithin Abraham, Abhisek Chatterjee, Arnab Mukharjee, D Shankar and PN Vinayachandran (2020), Structure and Dynamics of under currents in the south-east coast of India, *Ocean Dynamics*, 01340-9 <https://doi.org/10.1017/s10236-019-01340-9>.
28. Jithin AK, MP Subeesh., **PA Francis**, A.S Unnikrishnan., SSVS Ramakrishna, (2020) Amplification of semidiurnal internal tides in the Bay of Bengal. *Scientific Reports* **10**, 6059 (2020). <https://doi.org/10.1038/s41598-020-62679-4>
29. **Francis PA**, Jithin AK, Effy BJ et al. (2020), High-resolution Operational Ocean Forecast and reanalysis System, *Bulletin of American Meteorological Society*, **101** (8): E1340–E1356. <https://doi.org/10.1175/BAMS-D-19-0083.1>
30. Jithin AK and **Francis PA** (2020) Why deep Andaman Sea is warmer than Bay of Bengal?, *Sci. Rep.* 10(11982) DOI: [10.1038/s41598-020-68708-6](https://doi.org/10.1038/s41598-020-68708-6)
31. Radharani Sen, Suchita Pandey, Sumit Dandapat, **PA Francis**, Arun Chakraborty, (2020). A numerical study on seasonal transport variability of the North Indian Ocean boundary currents using Regional Ocean Modeling System (ROMS), *Journal of Operational Oceanography*, <https://doi.org/10.1080/1755876X.2020.1846266>.
32. Elizabeth AI , BJ Effy and **PA Francis** (2020) On the upper ocean response of Bay of Bengal to very severe cyclones Phailin and Hudhud, *J. Operational Oceanography*, DOI: [10.1080/1755876X.2020.1813412](https://doi.org/10.1080/1755876X.2020.1813412)
33. Jithin, K. A. **PA Francis**, A.S Unnikrishnan and SSVS Ramakrishna, (2020), Energetics and spatio-temporal variability of semidiurnal internal tides in the Bay of Bengal and Andaman Sea, *Progress in Oceanogr.*, 189, 102444, <https://doi.org/10.1016/j.pocean.2020.102444>.
34. Rao, S. A., A.K. Sahai, P.Mukhopadhyay, A.K. Mitra, V.S. Prasad, **PA Francis**, D.S. Pai, D.R. Pattanaik (2020), Major achievements of Monsoon Mission. *CLIVAR Exchanges*, No.79, November 2020, 10-15.

35. P. J. Nair, H. Varikoden, **PA Francis**, A. Chakraborty and P. C. Pandey, (2021) Atmospheric moisture as a proxy for the ISMR variability and associated extreme weather events, *Environmental Research Letters*, 16, 014045, <https://doi.org/10.1088/1748-9326/abcfe0>
36. Subeesh M. P., A. S. Unnikrishnan and **PA Francis** (2021), Generation, propagation and dissipation of internal tides on the continental shelf and slope off the west coast of India, *Continental Shelf Res.*, 214, 104321, <https://doi.org/10.1016/j.csr.2020.104321>.
37. Kuttippurath J., Murasingh S, Stott P., Balan B. S., Jha M., Kumar P, Nair P., Varikoden, H, Raj S, **Francis PA**, Pandey P. (2021), Observed rainfall changes in the past century (1901–2019) over the wettest place on the Earth, *Environmental Research Letters*, 16, 024018, *Environ. Res. Lett.* 16 (2021) 024018 <https://doi.org/10.1088/1748-9326/abc78>.
38. Biswamoy Paul, Balaji B, Arya Paul, **Francis PA** and Satish Shetye (2021), Absence of the annual cycle in shelf current inshore of the East Indian Coastal Current, *Cont. Shelf. Res.*, 125, 104355, <https://doi.org/10.1016/j.csr.2021.104355>
39. Radharani S., **Francis PA**, Chakraborty A. and Effy B J., (2021). A numerical study on the intraseasonal variability of the upper ocean characteristics in the Bay of Bengal, *Ocean Dynamics*, 71, pages 527–543, <https://doi.org/10.1007/s10236-021-01452-1>.
40. Pradhan M., Ankur Srivastava, Suryachandra Rao A., Deep Sankar Banerjee, Abhisek Chatterjee, **PA Francis**, O. P. Sreejith, M. Das Gupta, V. S. Prasad (2021) “Are Ocean Moored Buoys Redundant for Prediction of Indian Monsoon?” *Meteorology and Atmospheric Physics*, 133, pages 1075–1088, <https://doi.org/10.1007/s00703-021-00792-3>.
41. Pooja Tiwari, A. P. Dimri, S. S. C. Shenoi, **Francis P. A.** and Jithin Abraham (2021). Impact of Surface forcing on simulating Sea Surface Temperature in the Indian Ocean – A study using Regional Ocean Modeling System (ROMS). *Dyn. of Ocean. and Atmos.* 95, 101243, <https://doi.org/10.1016/j.dynatmoce.2021.101243>.
42. RS Mahendra, PC Mohanty, **PA Francis**, S Joseph, TM Nair, TS Kumar (2021). Holistic approach to assess the coastal vulnerability to oceanogenic multi-hazards along the coast of Andhra Pradesh, India, *Environmental Earth Sciences* 80 (18), 1-14.
43. Anup, N., Vijith V., Jithin AK, Rohit B., Amol P. and **Francis PA** (2021), Quasi biweekly oscillation in sea level along the western Bay of Bengal, *Cont. Shelf. Res.*, *Accepted for publication*.
44. Jithin Abraham and **Francis P. A.**, (2021) Formation of an intrathermocline eddy triggered by coastally trapped waves in the northern Bay of Bengal, *Journal of Geophys. Res. (Oceans)*. In Press.

Books/Chapters

45. Gadgil Sulochana, **PA Francis** (2010), *Oceans and Monsoon*, Monsoon Monograph-II, India Meteorological Department, N. Delhi.
46. PN Vinayachandran, **PA Francis**, SA Rao (2010) Indian Ocean dipole: processes and impacts, *Current trends in science*, 569-589
47. Sulochana Gadgil, **PA Francis**, K, Rajendran, Ravi S. Nanjundiah and A. Suryachandra Rao (2020), Role of Land Ocean contrast in the interannual variation of the Indian Summer Monsoon, *The Multiscale Global Monsoon System*, Ed. CP Chang, 3-12.
48. Sulochana Gadgil, **PA Francis**, P. N. Vinayachandran and Sajani S. (2021). Interannual variation of the Indian summer monsoon, ENSO, IOD and EQUINO, *Indian Summer Monsoon*. Ed. C. Gnanaseelan, Springer

Proceedings/Reports/Articles

49. AK Jithin, **PA Francis**, A Chatterjee, K Suprit, V Fernando (2017) Validation of the simulations by the High-resolution Operational Ocean Forecast and reanalysis System (HOOFS) for the Bay of Bengal, *INCOIS-TR-2017/01*
50. **Francis PA** (2017) Research and Development in Operational Oceanography- Indian Scenario, *Ocean Digest*, 4(1), 2-4.
51. **PA Francis**, T Srinivasa Kumar, S Joseph, H Rahaman, TVS Udaya Bhaskar, Balakrishnan Nair, EP Rama Rao, BV Satyanarayana, A Chatterjee, K Chakraborty, B Paul, PLN Murty, CH Patanjali

Kumar, A Roadmap for Unified Ocean Modeling and Forecasting system for INCOIS, ESSO-INCOIS-MDA-TR-04(2020).

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Professional References:

1. Prof. Sulochana Gadgil, Retired Professor, CAOS, IISc, Bangalore (sulugadgil@gmail.com)
2. Dr. S. S. C. Shenoi, Former Director, INCOIS, Hyderabad (shenoi1958@gmail.com)
3. Prof. Ravi S Nanjundiah, Director, Indian Institute of Tropical Meteorology (ravisn@tropmet.res.in)
4. Dr. S. R. Shetye, Former Vice Chancellor, Goa University (satishrshetye@gmail.com)
5. Prof. P. N. Vinayachandran, Professor in Oceanography, CAOS, IISc, Bangalore (vinay@iisc.ac.in)
6. D.r D. Shankar, Chief Scientist, CSIR-NIO, Goa (shankar@nio.org)