

REU

Research presentation:

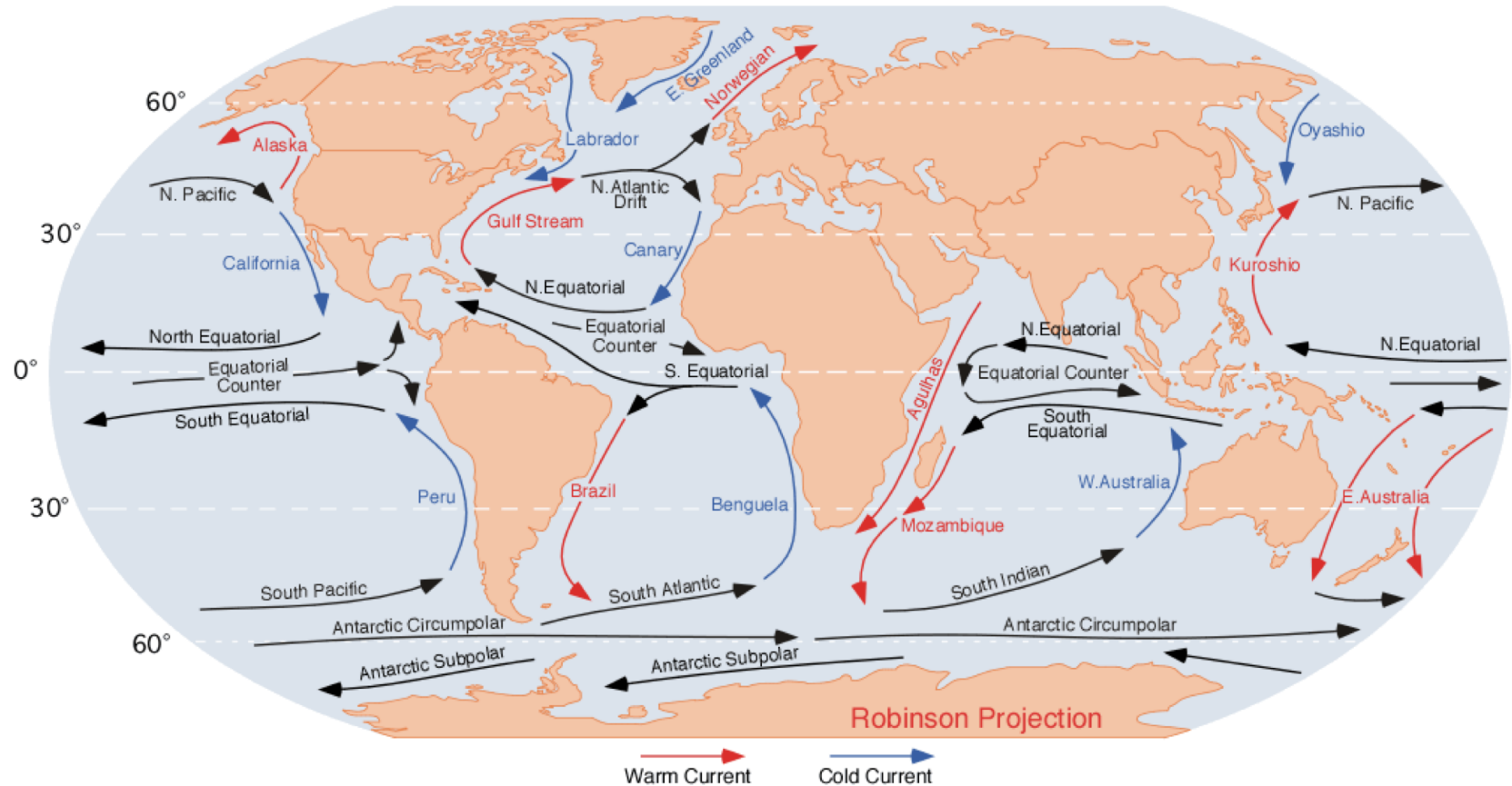
Presented by:

Samikshya Poudel, Andrea Selkow, and Kathryn Zic

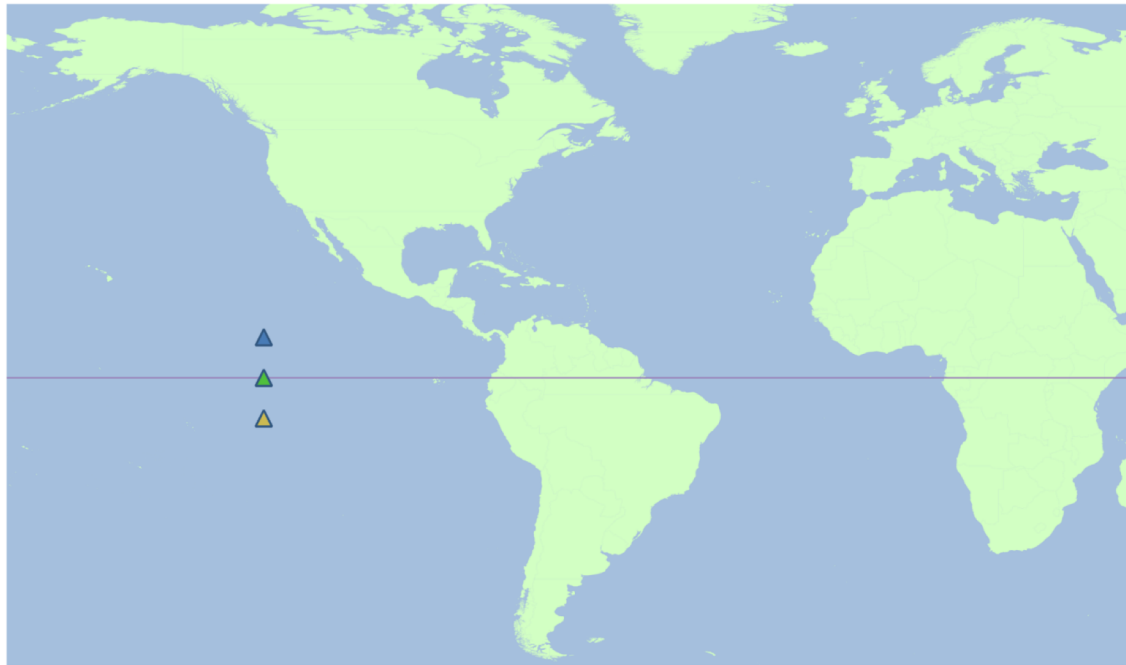
Statement of Question :

Do points within the North and South Equatorial Currents have more variability in sea surface temperature than the Equatorial Counter Current, in the Pacific?

Background Info



Data Collection Sites



- ▲ Equatorial Buoy
- ▲ Southern Buoy
- ▲ Northern Buoy
- Equator
- Land
- Ocean



0 500 1000 km



Map created by Kathryn Zic, Samikshya Poudel, and Andrea Selkow on June 18th, 2020. Data from IPUMS International and the Tropical Atmosphere Ocean Project.

Data: Choosing Years

- El Nino Southern Oscillation (ENSO) index

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
1990	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.4	0.4
1991	0.4	0.3	0.2	0.3	0.5	0.6	0.7	0.6	0.6	0.8	1.2	1.5
1992	1.7	1.6	1.5	1.3	1.1	0.7	0.4	0.1	-0.1	-0.2	-0.3	-0.1
1993	0.1	0.3	0.5	0.7	0.7	0.6	0.3	0.3	0.2	0.1	0.0	0.1
1994	0.1	0.1	0.2	0.3	0.4	0.4	0.4	0.4	0.6	0.7	1.0	1.1
1995	1.0	0.7	0.5	0.3	0.1	0.0	-0.2	-0.5	-0.8	-1.0	-1.0	-1.0
1996	-0.9	-0.8	-0.6	-0.4	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.5
1997	-0.5	-0.4	-0.1	0.3	0.8	1.2	1.6	1.9	2.1	2.3	2.4	2.4
1998	2.2	1.9	1.4	1.0	0.5	-0.1	-0.8	-1.1	-1.3	-1.4	-1.5	-1.6
1999	-1.5	-1.3	-1.1	-1.0	-1.0	-1.0	-1.1	-1.1	-1.2	-1.3	-1.5	-1.7
Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2000	-1.7	-1.4	-1.1	-0.8	-0.7	-0.6	-0.6	-0.5	-0.5	-0.6	-0.7	-0.7
2001	-0.7	-0.5	-0.4	-0.3	-0.3	-0.1	-0.1	-0.1	-0.2	-0.3	-0.3	-0.3
2002	-0.1	0.0	0.1	0.2	0.4	0.7	0.8	0.9	1.0	1.2	1.3	1.1
2003	0.9	0.6	0.4	0.0	-0.3	-0.2	0.1	0.2	0.3	0.3	0.4	0.4
2004	0.4	0.3	0.2	0.2	0.2	0.3	0.5	0.6	0.7	0.7	0.7	0.7
2005	0.6	0.6	0.4	0.4	0.3	0.1	-0.1	-0.1	-0.1	-0.3	-0.6	-0.8
2006	-0.8	-0.7	-0.5	-0.3	0.0	0.0	0.1	0.3	0.5	0.7	0.9	0.9
2007	0.7	0.3	0.0	-0.2	-0.3	-0.4	-0.5	-0.8	-1.1	-1.4	-1.5	-1.6
2008	-1.6	-1.4	-1.2	-0.9	-0.8	-0.5	-0.4	-0.3	-0.3	-0.4	-0.6	-0.7
2009	-0.8	-0.7	-0.5	-0.2	0.1	0.4	0.5	0.5	0.7	1.0	1.3	1.6
Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2010	1.5	1.3	0.9	0.4	-0.1	-0.6	-1.0	-1.4	-1.6	-1.7	-1.7	-1.6
2011	-1.4	-1.1	-0.8	-0.6	-0.5	-0.4	-0.5	-0.7	-0.9	-1.1	-1.1	-1.0
2012	-0.8	-0.6	-0.5	-0.4	-0.2	0.1	0.3	0.3	0.3	0.2	0.0	-0.2
2013	-0.4	-0.3	-0.2	-0.2	-0.3	-0.3	-0.4	-0.4	-0.3	-0.2	-0.2	-0.3
2014	-0.4	-0.4	-0.2	0.1	0.3	0.2	0.1	0.0	0.2	0.4	0.6	0.7
2015	0.6	0.6	0.6	0.8	1.0	1.2	1.5	1.8	2.1	2.4	2.5	2.6
2016	2.5	2.2	1.7	1.0	0.5	0.0	-0.3	-0.6	-0.7	-0.7	-0.7	-0.6
2017	-0.3	-0.1	0.1	0.3	0.4	0.4	0.2	-0.1	-0.4	-0.7	-0.9	-1.0
2018	-0.9	-0.8	-0.6	-0.4	-0.1	0.1	0.1	0.2	0.4	0.7	0.9	0.8
2019	0.8	0.8	0.8	0.7	0.6	0.5	0.3	0.1	0.1	0.3	0.5	0.5
Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2020	0.5	0.6	0.5	0.3								

Data from National Weather
Service Climate Prediction Center

Data: Choosing Years

- El Nino Southern Oscillation (ENSO) index
 - We chose neutral years

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
1990	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.4	0.4
1991	0.4	0.3	0.2	0.3	0.5	0.6	0.7	0.6	0.6	0.8	1.2	1.5
1992	1.7	1.6	1.5	1.3	1.1	0.7	0.4	0.1	-0.1	-0.2	-0.3	-0.1
1993	0.1	0.3	0.5	0.7	0.7	0.6	0.3	0.3	0.2	0.1	0.0	0.1
1994	0.1	0.1	0.2	0.3	0.4	0.4	0.4	0.4	0.8	0.7	1.0	1.1
1995	1.0	0.7	0.5	0.3	0.1	0.0	-0.2	-0.5	-0.8	-1.0	-1.0	-1.0
1996	-0.9	-0.8	-0.6	-0.4	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.5
1997	-0.5	-0.4	-0.1	0.3	0.8	1.2	1.6	1.9	2.1	2.3	2.4	2.4
1998	2.2	1.9	1.4	1.0	0.5	-0.1	-0.8	-1.1	-1.3	-1.4	-1.5	-1.6
1999	-1.5	-1.3	-1.1	-1.0	-1.0	-1.0	-1.1	-1.1	-1.2	-1.3	-1.5	-1.7
Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2000	-1.7	-1.4	-1.1	-0.8	-0.7	-0.6	-0.6	-0.5	-0.5	-0.6	-0.7	-0.7
2001	-0.7	-0.5	-0.4	-0.3	-0.3	-0.1	-0.1	-0.1	-0.2	-0.3	-0.3	-0.3
2002	-0.1	0.0	0.1	0.2	0.4	0.7	0.8	0.9	1.0	1.2	1.3	1.1
2003	0.9	0.6	0.4	0.0	-0.3	-0.2	0.1	0.2	0.3	0.3	0.4	0.4
2004	0.4	0.3	0.2	0.2	0.2	0.3	0.5	0.6	0.7	0.7	0.7	0.7
2005	0.6	0.6	0.4	0.4	0.3	0.1	-0.1	-0.1	-0.1	-0.3	-0.6	-0.8
2006	-0.8	-0.7	-0.5	-0.3	0.0	0.0	0.1	0.3	0.5	0.7	0.9	0.9
2007	0.7	0.3	0.0	-0.2	-0.3	-0.4	-0.5	-0.8	-1.1	-1.4	-1.5	-1.6
2008	-1.6	-1.4	-1.2	-0.9	-0.8	-0.5	-0.4	-0.3	-0.3	-0.4	-0.6	-0.7
2009	-0.8	-0.7	-0.5	-0.2	0.1	0.4	0.5	0.5	0.7	1.0	1.3	1.6
Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2010	1.5	1.3	0.9	0.4	-0.1	-0.6	-1.0	-1.4	-1.6	-1.7	-1.7	-1.6
2011	-1.4	-1.1	-0.8	-0.6	-0.5	-0.4	-0.5	-0.7	-0.9	-1.1	-1.1	-1.0
2012	-0.8	-0.6	-0.5	-0.4	-0.2	0.1	0.3	0.3	0.3	0.2	0.0	-0.2
2013	-0.4	-0.3	-0.2	-0.2	-0.3	-0.3	-0.4	-0.4	-0.3	-0.2	-0.2	-0.3
2014	0.4	0.4	0.2	0.1	0.3	0.2	0.1	0.0	0.2	0.4	0.8	0.7
2015	0.6	0.6	0.6	0.8	1.0	1.2	1.5	1.8	2.1	2.4	2.5	2.6
2016	2.5	2.2	1.7	1.0	0.5	0.0	-0.3	-0.6	-0.7	-0.7	-0.7	-0.6
2017	-0.3	-0.1	0.1	0.3	0.4	0.4	0.2	-0.1	-0.4	-0.7	-0.9	-1.0
2018	-0.9	-0.8	-0.6	-0.4	-0.1	0.1	0.1	0.2	0.4	0.7	0.9	0.8
2019	0.8	0.8	0.8	0.7	0.6	0.5	0.3	0.1	0.1	0.3	0.5	0.5
Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2020	0.5	0.6	0.5	0.3								

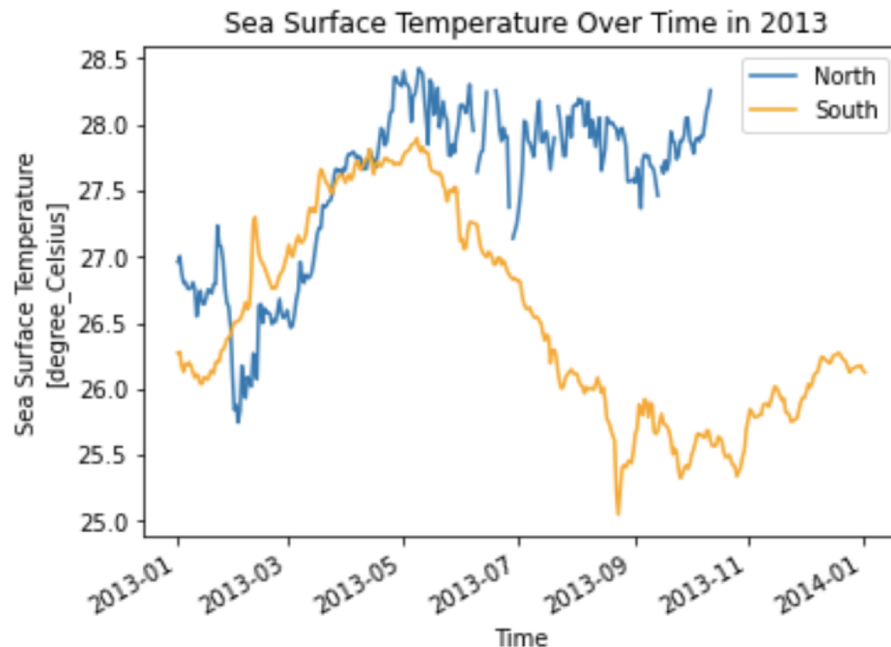
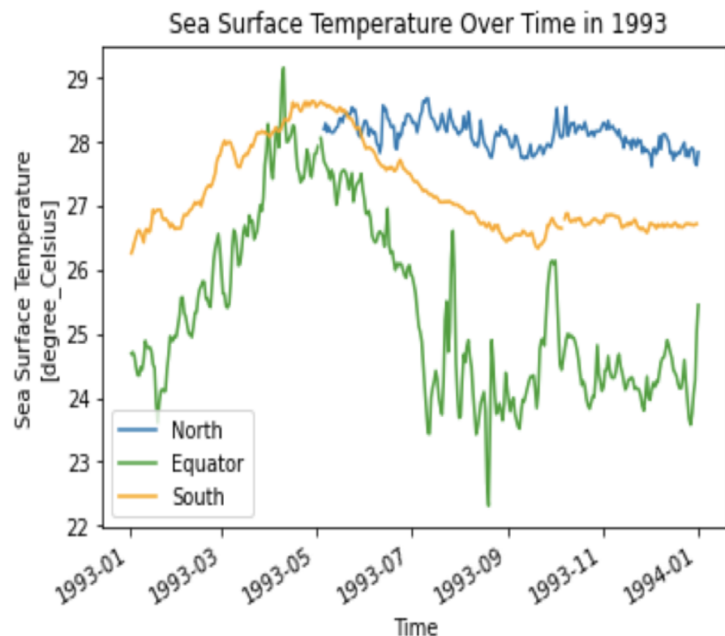
Data from National Weather
Service Climate Prediction Center

Analysis

- ❑ Southern SST is relatively changing with equatorial SST.(Direct correlation)
- ❑ In the beginning of the year,the temperature of of the northern hemisphere is decreasing and southern is increasing until mid February.
- ❑ The sea Surface temperature is less during summer and high during winter.
- ❑ Overall, Northern and Southern SST is fairly constant even though equatorial SST is fluctuating.
- ❑ Hence, from this graphical analysis, we can say that equatorial current has more variability in the sea surface temperature than northern and southern currents in Pacific.

Results: 1993

2013



Discussion

- Despite the expected values, the equator had the most variability in SST

Potential reasons:

- **Equatorial Counter Current** had migrated northward more than expected
- Equatorial Upwelling

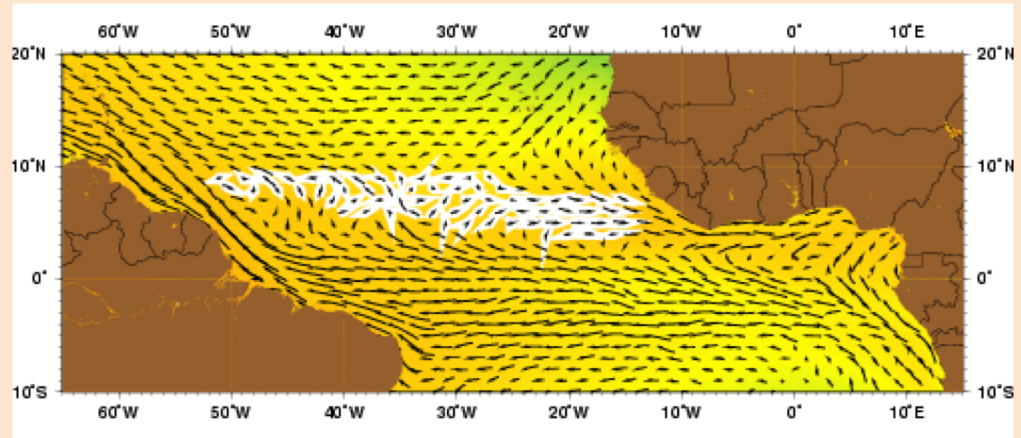


Image from Barbie Bischof, Arthur J. Mariano, Edward H. Ryan. "The North Equatorial Counter Current." *Ocean Surface Currents*. (2004).
<https://oceancurrents.rsmas.miami.edu/atlantic/north-equatorial-cc.html>.

Discussion

- Despite the expected values, the equator had the most variability in SST

Potential reasons:

- Equatorial Counter Current had migrated northward more than expected
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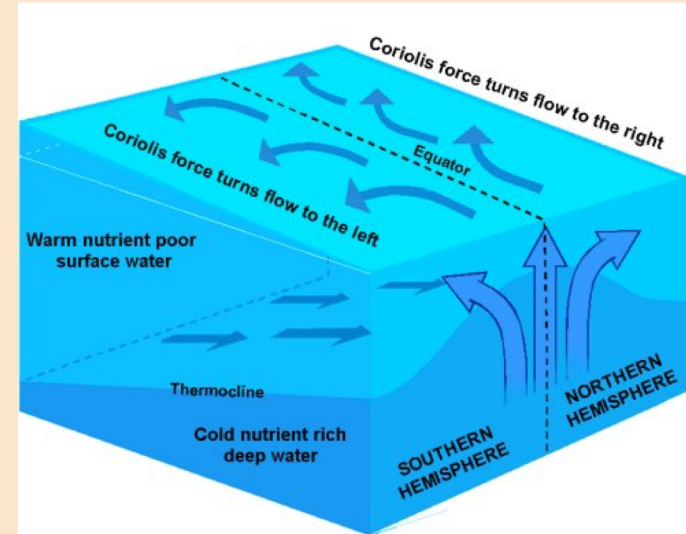


Image from the SEOS Project.

Implications for Further Research

- Knowing more about the “expected vs. observed” discrepancy
 - Variation in average temperatures across single months
 - Using different years to see if the observed trends are consistent
 - El Niño v. La Niña
- Utilizing MODIS for a more in-depth analysis of the surface water movements
 - Moderate Resolution Imaging Spectroradiometer

Acknowledgements

Thank you to the National Weather Service Climate Prediction Center and the Tropical Atmosphere Ocean Project for the data used in our analysis

Also, thank you to the mentors of this project and all who ran the Research Experience for Undergraduates program

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RUTGERS



Thank you for listening

Questions?