

# Climate Change and Water Resources

## The Marshall Islands

Climate, Water, and Indigenous Knowledge Dialogue

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# Outline

- Brief Introduction to the Marshall Islands
- Expected climate change impacts on water
  - El Nino Southern Oscillation System
  - InterTropical Convergence Zone
  - Sea Level Rise
- Some indigenous-based adaptation strategies being developed to deal with climate change, drought, water availability, and food security issues

QuickTime™ and a  
TIFF (Uncompressed) decompressor  
are needed to see this picture.

# Climate Change impacts ENSO

## El Niño Southern Oscillation

ENSO events have been occurring for thousands of years.

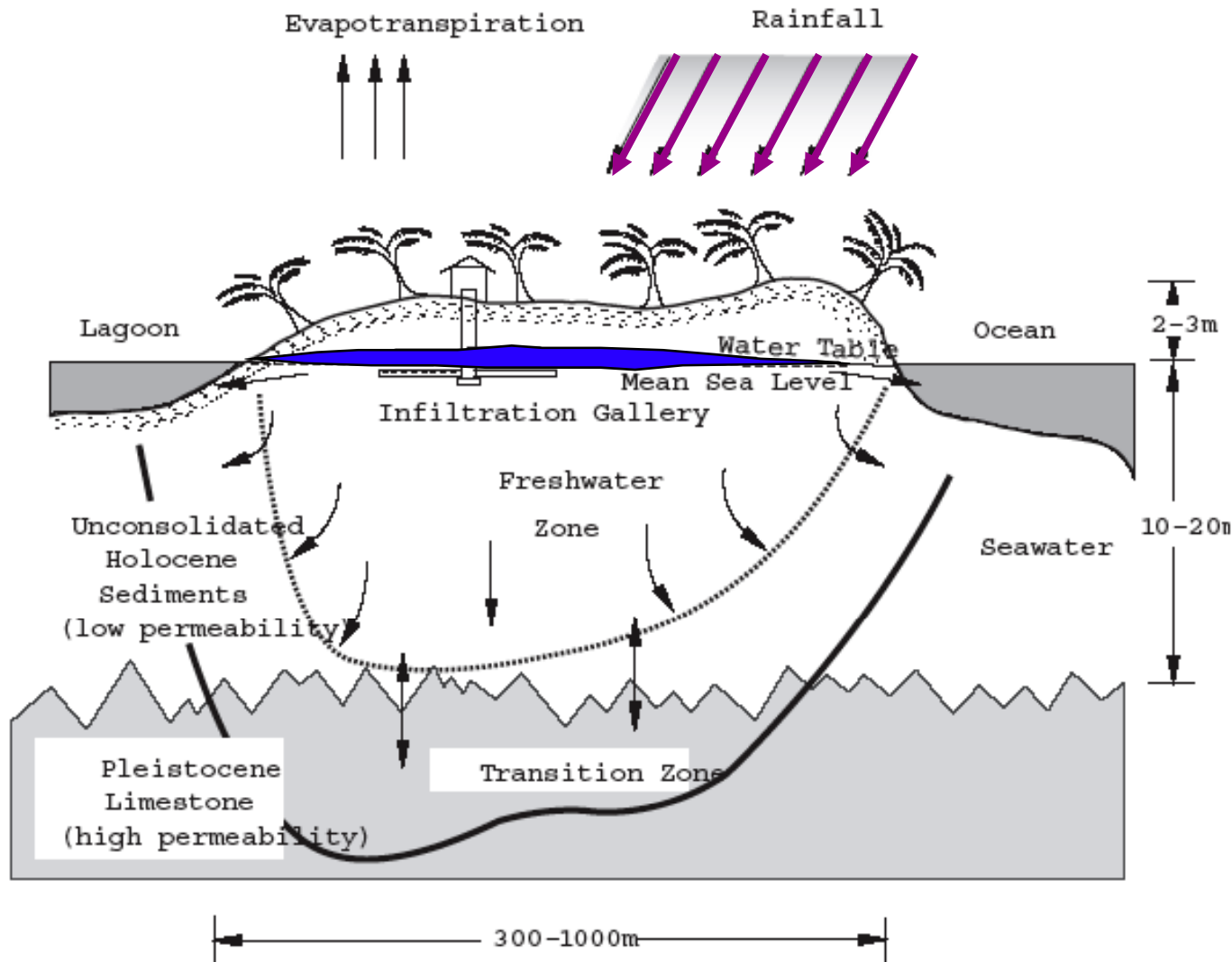
ENSO events are caused by changes in ocean surface temperature.

The droughts of 1983, 1992, and 1998 were ENSO events.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1978	3.60	5.25	3.39	12.65	13.90	10.70	16.25	8.86	9.73	20.56	23.56	14.35	142.80
1979	6.78	2.77	7.14	11.75	7.91	13.23	6.67	13.03	6.54	15.04	11.33	7.10	109.29
1980	8.11	9.70	5.05	7.03	11.34	6.73	8.48	13.89	12.85	9.25	5.35	10.56	108.34
1981	0.90	4.34	17.40	10.20	9.04	5.43	16.53	12.24	6.71	7.28	14.61	14.47	119.15
1982	12.63	9.72	13.29	4.68	11.46	16.98	14.66	11.72	18.94	8.17	19.08	<b>3.17</b>	144.50
<b>1983</b>	<b>0.83</b>	<b>0.98</b>	<b>0.66</b>	<b>1.97</b>	<b>1.49</b>	14.45	12.58	6.05	11.25	13.47	9.84	12.74	86.31
1984	16.12	16.83	1.29	3.87	4.18	5.40	9.35	9.20	6.42	14.77	13.31	14.95	115.69
1985	8.70	16.56	4.59	15.38	9.67	14.67	13.18	16.77	8.03	18.06	12.81	11.30	149.72
1986	10.51	3.91	14.75	12.23	14.94	15.89	12.09	19.98	10.52	7.32	9.37	17.10	148.61
1987	6.24	10.38	4.34	2.14	9.22	14.76	21.17	8.36	11.09	11.29	15.45	7.48	121.92
1988	14.65	1.52	6.76	5.92	6.85	9.11	14.33	10.59	13.86	17.87	7.19	13.65	122.30
1989	7.75	8.30	4.76	8.54	11.18	7.20	17.44	10.34	14.55	16.41	19.84	8.52	134.83
1990	7.01	4.21	10.36	9.43	16.56	7.28	9.09	14.39	7.57	6.17	15.87	10.36	118.30
1991	9.87	11.68	29.54	20.46	13.24	16.60	16.41	11.04	19.73	10.44	15.35	<b>3.48</b>	177.84
<b>1992</b>	<b>7.73</b>	<b>0.20</b>	<b>0.15</b>	<b>0.36</b>	14.21	8.41	10.36	12.62	5.90	13.57	10.05	3.52	87.08
1993	5.82	8.51	13.49	14.10	11.31	8.17	13.92	13.32	9.80	20.48	14.41	19.24	152.57
1994	9.37	1.72	9.45	14.14	15.69	5.70	8.28	11.70	13.19	10.42	11.31	16.68	127.65
1995	8.17	4.37	4.59	21.97	7.91	12.22	10.60	11.89	15.78	10.59	11.18	12.10	131.37
1996	14.12	16.70	8.28	19.47	10.61	12.96	7.39	7.49	15.70	9.74	13.24	16.87	152.57
1997	5.44	6.95	6.57	14.54	21.33	8.19	4.93	11.69	19.09	10.91	<b>7.93</b>	<b>7.63</b>	125.20
<b>1998</b>	<b>1.57</b>	<b>0.34</b>	<b>0.27</b>	<b>0.64</b>	<b>6.59</b>	10.51	16.29	12.05	9.30	19.45	13.57	11.48	102.06
1999	7.23	3.82	10.15	5.32	8.20	13.07	8.94	10.99	11.35	17.85	17.27	9.85	124.04
2000	23.83	20.93	6.59	8.81	4.02	5.31	11.31	11.06	7.02	12.27	15.03	9.20	135.38
2001	5.73	5.10	0.46	4.07	7.07	15.10	10.04	11.72	20.89	20.19	14.92	9.02	124.31
2002	9.00	6.80	7.57	8.44	14.40	15.77	11.85	15.33	14.29	15.28	8.79	17.41	144.93
2003	8.62	9.95	1.47	13.38	10.55	11.50	10.16	6.33	16.62	17.02	9.14	15.26	130.00
2004	7.51	14.72	8.84	15.19	10.79	12.29	9.09	13.53	4.27	7.26	6.00	11.06	120.55
2005	5.59	9.92	9.31	9.51	6.84	8.02	12.79	14.94	10.32	14.56	18.50	11.84	132.14
2006	10.50	6.41	6.50	7.31	6.28	11.55	11.03	9.34	8.68	10.74	8.68	7.74	104.76
2007	2.00	4.90	4.31	11.26	11.42	6.67	8.64	7.27	10.25	20.74	20.31	-	107.77

Majuro Area ( [ThreadEx Station](#) ) Monthly Totals/Averages Precipitation (inches)

# Changes in Rainfall Patterns

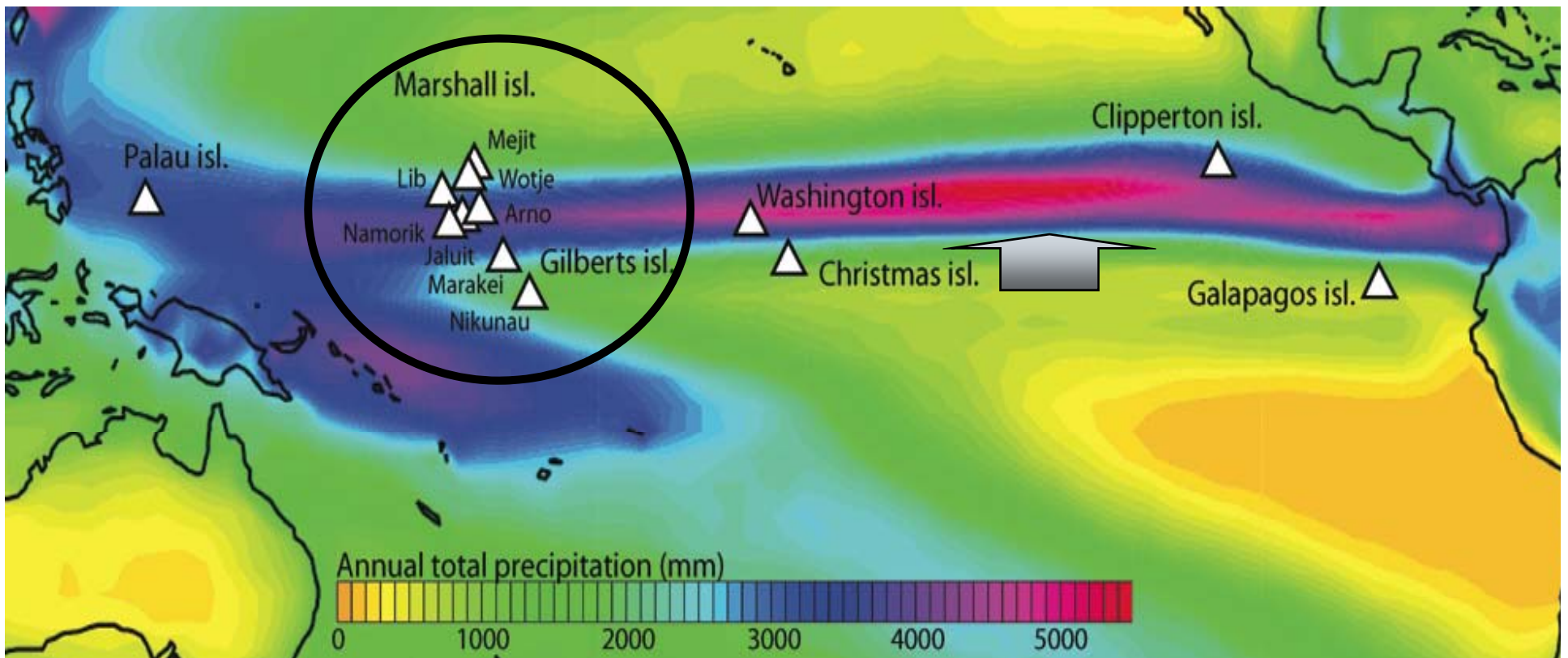


“... a 10% reduction in average rainfall by 2050 is likely to correspond to a 20% reduction in the size of the freshwater lens...”

- IPCC 2007

# Change in Rainfall Patterns

Has the ITCZ “rain band” really moved  
300 miles North since 1630 A.D.?



# Projected sea level rise

91 years later Sea level would have risen by 39 cm



# Indigenous-based adaptation

- Some indigenous-based adaptation strategies being developed to deal with climate change, drought, water availability, and food security issues

# Indigenous-based adaptation

## **Planting Resilience to Climate Change**

**Measuring  
Youth  
Engagement**  
Majuro, Marshall Islands

February/March 2009





# Taro Patch after high tide

Rotten, spoiled,  
and uneatable



Question (Palau): Atoll islands really need studies of impacts of SLR on taro cultivation because they have had problems with saltwater intrusion and need assistance.

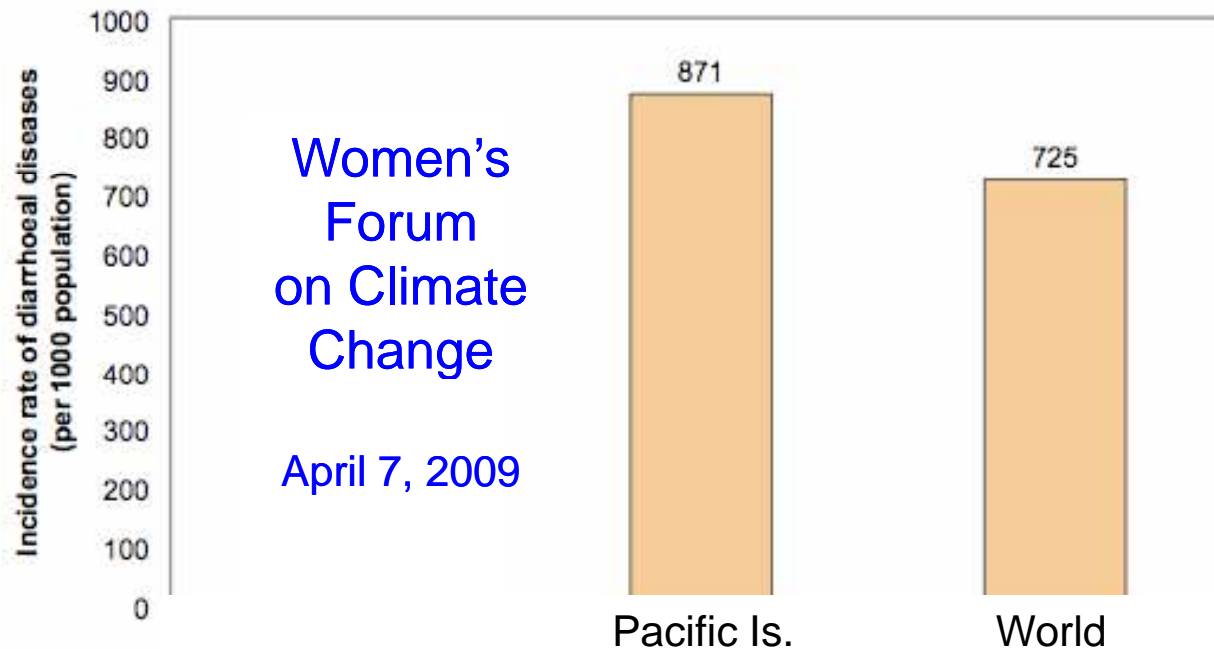
Answer: Franko (MI): said this is an issue in all atoll islands, so the important thing for adaptive strategies for taro cultivation in atolls is to raise the beds over a period of 2-3 years, must adjust for neap and spring tides; must not abandon taro fields in atolls, must relearn traditional knowledge of forefathers' taro cultivation practices that isn't dependent upon weather forecasts to enhance resilience; in the event of SLR and saltwater intrusion into taro fields, we must talk to our elders for guidance, and not taking outside views and trying to apply them to local issues.

Question (Julie in Hawaii): Salt water intrusion—how much has to do with coral reef/mangrove damage and can there be reforestation to aid this issue?

Answer Franko (MI): there are two issues—subterranean saltwater intrusion into taro fields vs. tidal surge saltwater intrusion; to adapt-clean bed and replant; conserve water; raise beds; when plant taro, don't plant it very deep must plant it halfway height; careful selection of taro (quick maturity rates during dry periods, slower maturity during periods of less SLR and higher rain); regarding food security, there is great need for an evaluation of the crop so that food availability is more sustainable over time by having overlapping stocks of crop harvests and find the most sustainable cycling and rotation of different crops (diversify in a staggered manner)

Chip: likes the part where we need to take the traditional information and mix it with the technology—this is where they come in and can give forecasts of climate change related events through their technology; part of the problem is that this information is available at the urban centers, but isn't communicated to the rural areas; need to talk with the government to create enhanced communication mechanisms to relay this information to rural communities. He provides workshops in rural areas to spread this information once a year, but rarely sees people from more rural atolls; again, the disaster people aren't talking with climate people nor weather people, which must happen to enhance resiliency; we haven't done a good job as a Pacific ENSO climate applications center in publicizing ourselves, so that is something we need to do a better job on.

# Indigenous-based adaptation



## Gender roles in water

- How is water used?
- Who collects/stores/purifies drinking water?
- Who clears the gutters and waterways of cat/rodent/bird droppings?
- How can women be agents of change to improve water management at the household level?

# Cholera Outbreak on Ebeye in 2000

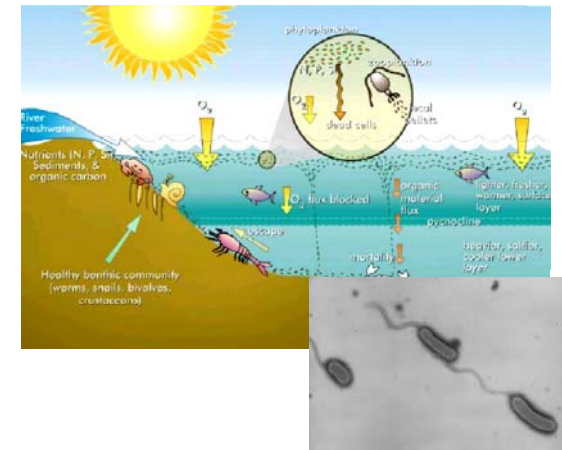
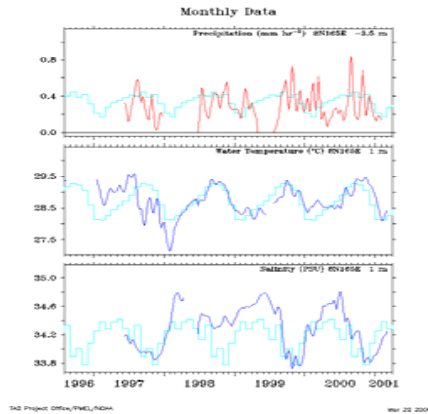
**Climate Change  
(Strong La Nina & Drought)**



**Poor sanitation (Trash & human/animal waste) in the lagoon**



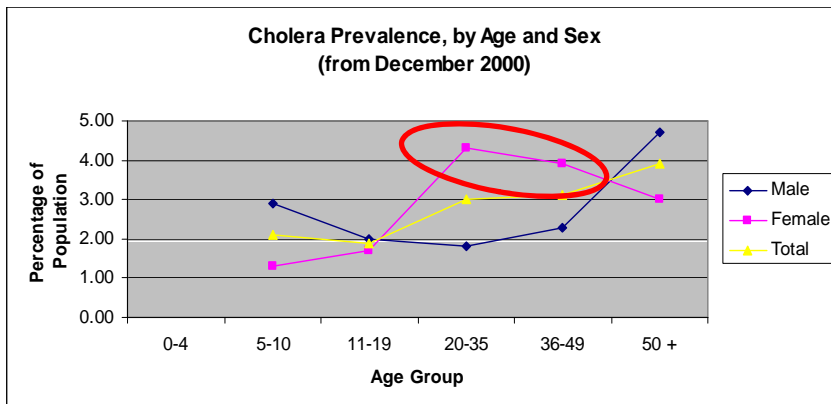
**Led to dangerous bacteria growing in the water**



**Which.....**

**Made many people sick (400 sick, 6 deaths)**

**Especially women, who handle the water resources (cooking, cleaning, washing, laundry)**



# Indigenous-based adaptation

- Improve literacy by “localizing” the curriculum

	Cook islands	Fiji islands	FSM	Kiribati	Marshall islands	Nauru	Niue	Palau	Samoa	Solomon islands	Tokelau	Tonga	Tuvalu	Vanuatu
Primary School enrolment (% of target age group)	92 (2001)	96	92	94	90	@ (60.3)	90	76	90	80	62	91	100	94
Enrolled children reaching grade 5 (%)	@ (98.2)	99	-	82	86	@ (92)	-	-	84	-	-	93	70	92
Estimated child population under 18 years) †	6,042	339,542	55,472	45,717	28,792	4,918	669	6,435	92,315	236,051	692	44,146	4,320	113,250

# Kommool tata

Questions and/or comments?

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Marshall Islands