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SYNTHETIC ORGANIC CHEMICALS, MICROORGANISMS, AFRICAN AND ASIAN DUST AND CORAL REEFS

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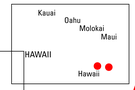
CENTRAL PACIFIC
Hawaii

Collaborators in Hawaii

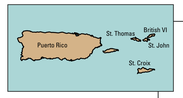
- Mauna Loa Observatory, NOAA
- WRD, USGS
- State of Hawaii DAR
- Fish & Wildlife Service



NORTHEASTERN CARIBBEAN
St. John & St. Croix, US Virgin Islands

Collaborators in Virgin Islands

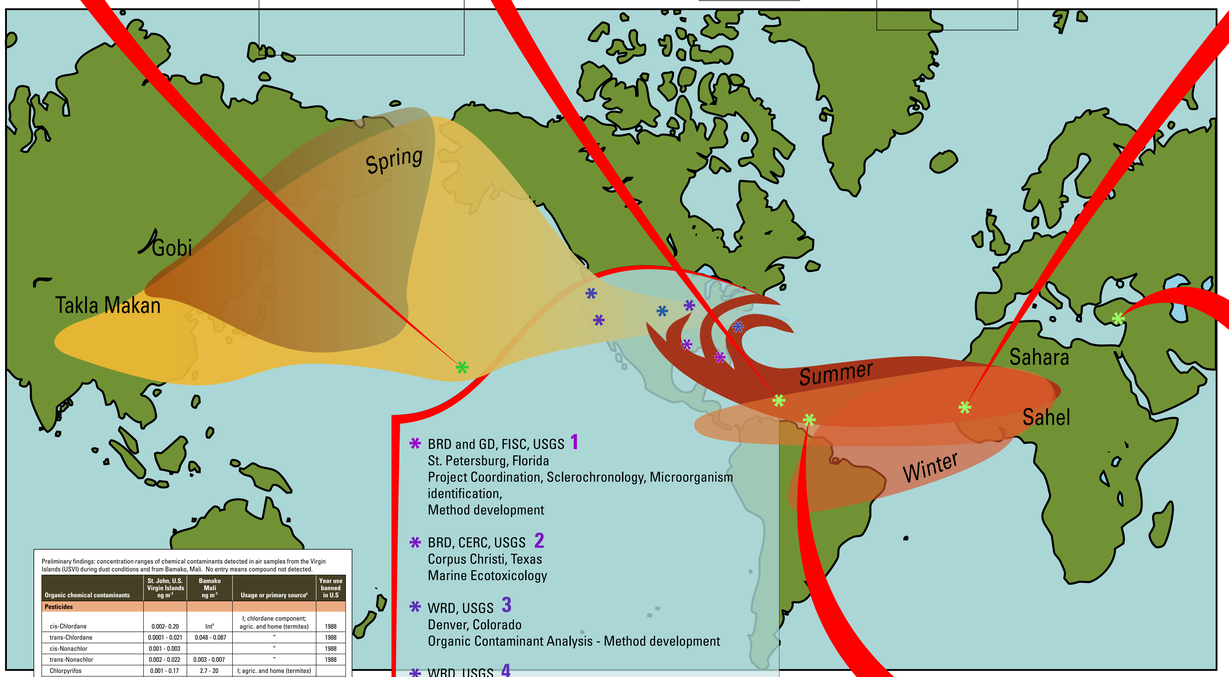
- Virgin Islands National Park
- University of the Virgin Islands
- VI Territorial Marine Park



SAHEL
Bamako, Mali

Collaborators in Mali

- University of Mali, Faculty of Science & Technology
- Ministry of Geology & Mines
- Ministry of Communications



- BRD and GD, FISC, USGS 1
  St. Petersburg, Florida
  Project Coordination, Sclerochronology, Microorganism identification,
  Method development
- BRD, CERC, USGS 2
  Corpus Christi, Texas
  Marine Ecotoxicology
- WRD, USGS 3
  Denver, Colorado
  Organic Contaminant Analysis - Method development
- WRD, USGS 4
  Sacramento, California
  Organic Contaminant Analysis - Method development
- Oregon State University 5
  Corvallis, Oregon
  Organic Contaminant Analysis
- University of South Carolina, Aiken 6
  Marine Microorganisms
- GD, USGS
  Denver, Colorado
  Metals Analysis
- BRD, CERC, USGS
  Columbia, Missouri
  Organic Contaminant Analysis - Reef waters

Preliminary findings: concentration ranges of chemical contaminants detected in air samples from the Virgin Islands (USVI) during dust conditions and from Bamako, Mali. No entry means compound not detected.

Organic chemical contaminants	St. John, U.S. Virgin Islands ng m^{-3}	Bamako Mali ng m^{-3}	Usage or primary source[a]	Year use banned in U.S
Pesticides				
cis-Chlordane	0.002- 0.20	Int[b]	I; chlordane component; agric. and home (termites)	1988
trans-Chlordane	0.0001 - 0.021	0.048 - 0.087	"	1988
cis-Nonachlor	0.001 - 0.003		"	1988
trans-Nonachlor	0.002 - 0.022	0.003 - 0.007	"	1988
Chlorpyrifos	0.001 - 0.17	2.7 - 20	I; agric. and home (termites)	
Dacthal (DCPA)	0.002 - 0.33	0.004	H; agric. and home	
Diazinon	0.023	0.13 - 1.9	I; agric. and home (turf)	
Dieldrin	0.43	0.077 - 2.0	I, agriculture	1987
p,p'-DDE	0.42	0.54 - 1.2	p,p'-DDT insecticide degradate; agric.; malaria	1975 DDT
Endosulfan I	0.003 - 0.031	6.3 - 10	I, agriculture	
Endosulfan II	0.003	1.7 - 3.1	I, agriculture	
Endosulfan sulfate		0.082 - 0.14	Endosulfan degradate	
Metolachlor	0.055		H, agriculture	
Polycyclic aromatic hydrocarbons				
Anthracene		0.32 - 8.1	Combustion sources	
Benzo(a)pyrene		0.09 - 1.3	Combustion; carcinogen	
Fluoranthene	<0.04 - 0.27	4.8 - 20	Combustion sources	
Phenanthrene	<0.05 - 0.66	5.3 - 33	Combustion sources	
Pyrene	<0.04 - 0.97	4.2 - 17	Combustion sources	
Miscellaneous				
PCBs (total)	0.14 - 1.0	0.34 - 0.59	Capacitors, transformers.	
Anthraquinone		3.2 - 7.7	Dyes/textiles; seed treatment; bird repellant	
Carbazole		0.36 - 1.3	Dyes, explosives, lubricants	
Indole	0.04	0.36 - 9.0	Pesticide inert ingredient; fragrance in coffee	
Isoquinoline		0.34	Flavor and fragrance	
Galaxolide [HHCB]	<0.06	0.25 - 0.75	Musk fragrance	
Tonalide [AHTN]	<0.08 - 0.21	0.29 - 2.4	Musk fragrance	

[a]I, insecticide; H, herbicide
[b]Int, interferent inhibited determination.

MEDITERRANEAN
Erdemli-Icel, Turkey

Collaborator in Turkey

- Middle East Technical University

SOUTHEASTERN CARIBBEAN
Galera Point, Trinidad

Collaborators in Trinidad

- University of the West Indies
- Environmental Management Authority
- Maritime Services

OVERVIEW

Hundreds of millions of tons of African dust are transported annually from the Sahara and Sahel to the Caribbean and southeastern U.S. A similar dust system in Asia carries dust from the Gobi and Taklimakan deserts across Korea, Japan, and the northern Pacific to the Hawaiian Islands, the western U.S., to Europe and beyond. Although these global atmospheric systems have been transporting fine soil particles for hundreds of thousands of years, the quantities of dust vary annually as a result of global climate, local meteorology, geomorphology of source areas, and human activities. It is thought that the quality of the dust has changed as a result of human-related changes in the source regions and areas over which the dust travels: burning of biomass and waste; use of antibiotics, pharmaceuticals, and pesticides; increased industrialization. We hypothesize that air masses carrying African and Asian dust transport living microorganisms and synthetic organic chemicals thousands of kilometers and that these chemical and microbial contaminants are adversely affecting coral reefs and human health.

SUMMARY OF FINDINGS FROM AFRICAN DUST SYSTEM INVESTIGATIONS

1. Synthetic organic chemical contaminants (pesticides, PAHs and PCBs) have been identified in air samples from the US Virgin Islands during dust conditions and from Mali. Air samples from Mali contained higher concentrations of the same suite of organic contaminants than VI air samples. Many of the contaminants are known endocrine disruptors.
2. Over 200 species of microorganism have been identified from air samples taken in the Virgin Islands during dust and non-dust conditions. Air samples collected during dust events in the VI contain 8-10 times as many microorganisms per volume as do air samples collected during non-dust conditions. 25% are known plant pathogens and 10% are known opportunistic pathogens of humans.
3. Air in Mali contains orders of magnitude more microorganisms per volume than air in the VI (even during dust conditions) and more species (not yet quantified due to personnel and funding constraints). Of the hundreds of microorganisms isolated from Sahara and Sahel (Mali, West Africa) air samples, 19 genera of bacteria and 3 genera of fungi have been identified. Of the bacteria, 10% are known animal pathogens, 5% are plant pathogens, and 27% are opportunistic human pathogens.
4. A pilot study found that dust collected in the VI during African dust conditions was toxic to sperm and embryos of some marine organisms.
5. The pathogenic strain of the fungus known to cause sea fan disease and mortality of sea fans throughout the Caribbean region has been isolated from:
   a. air samples collected in the VI during African dust conditions.
   b. lesions of diseased sea fans.
   c. soil from the Sahel (Mali).
   d. sediment from the Gulf of Paria (SE Caribbean).

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