VOCALS Modeling and Regional Experiment (REx) Synergy

Draft Working Groups

Dear VOCALists,

Given below are tables in which the VOCALS Program hypotheses are presented, together with the proposed observational platforms and numerical models to be used in their validation. We have organized the hypotheses organized into two broad themes: (1) aerosol-cloud-precipitation interactions, including physicochemical and spatiotemporal properties of aerosols; and (2) ocean-land-atmosphere interactions.

Based upon discussions and feedback I have had from individual PI groups during the VOCALS meetings in Boulder, we have given a strawman indication of where these individual groups will focus their analysis or modeling efforts. We would like to open up the discussion on these mission teams. As VOCALS-REx progresses, and groups begin their work to address VOCALS goals and refute the VOCALS hypotheses, these groups will become more clearly defined. There are several reasons why we think that assembling activities into focused groups will help:

- Facilitate interactions between observational and modeling groups
- Avoid unnecessary duplication of data analysis and modeling activities
- Develop more intelligent and more consistent data archival methodologies
- Determine the needs of the modeling community for observational integrated datasets (IDs) to facilitate the broader use of VOCALS-REx observations in the scientific community

Please let us know any comments you may have at your earliest convenience. It is intended that future VOCALS meetings will include plenaries and breakout sessions focused around these hypotheses, so we'd like to make a start on putting these elements into place.

Regards

Roberto and Rob

VOCALS AEROSOL-CLOUD-PRECIPITATION HYPOTHESES

#	Hypothesis	Obs.	Models	PI Teams [primarily modeling/obs/both]	IDs [deliverable integrated datasets]
1A	Variability in the physicochemical properties of aerosols has a measurable impact upon the formation of drizzle in stratocumulus clouds over the SEP.	C-130, RHB, Twin Otter, G-1, BAe-146	LES WRF-Chem GCMs	Howell/Huebert/Clarke Bandy/Blomquist Wood/Bretherton Covert/Bates/Quinn Albrecht Feingold Daum Cotton/Carrió Ovchinnikov/PNNL Jensen Anderson/Twohy Lawson/Baker	Combined dataset with collocated measurements of cloud thickness, LWP, aerosol and cloud microphysical properties, and precipitation rate
1B	Precipitation is a necessary condition for the formation and maintenance of pockets of open cells (POCs) within stratocumulus clouds.	C-130, RHB, G-1	LES COAMPS	Wood/Bretherton Fairall/Yuter/deSzoeke Leon/Snider Feingold Albrecht Daum Wang/NRL Jensen Lawson/Baker	GCSS BLCWG Cases documenting POC formation/maintenance Satellite-derived mesoscale classification (POC, closed cells….) across VOCALS study region
1C	The small effective radii measured from space over the SEP are primarily controlled by anthropogenic, rather than natural, aerosol production, and entrainment of polluted air from the lower free-troposphere is an important source of cloud condensation nuclei (CCN).	C-130, RHB, G-1, Twin Otter, BAe-146 Land site	WRF Chem CTMs GCMs	Huebert/Clarke Covert/Bates/Quinn Gallardo/Cordova Zuidema Wood/Thorton/Zaveri Twohy/Collett/Anderson Donner/Golaz Fast/PNNL	6 Cross-Section Flights documenting MBL, lower free-tropospheric, cloud and aerosol structure, along 20°S at same local time of day
1D	Depletion of aerosols by coalescence scavenging is necessary for the maintenance of POCs.	C-130	Parcel Model GCMs LES GCMs	Leon/Snider Feingold Jensen Lawson/Baker	Lagrangian multi-flight case studies of aerosol evolution in polluted and clean conditions

VOCALS COUPLED OCEAN-ATMOSPHERE-LAND HYPOTHESES

#	Hypothesis	Obs.	Models	PI Teams [primarily modeling/obs/both]	IDs [deliverable integrated datasets]
2A	Oceanic mesoscale eddies play a major role in the transport of heat and fresh water from coastally upwelled water to regions further offshore.	RHB, R/V Wecoma, R/V Olaya, C-130	ROMS CGCMs	Weller/Straneo Grados Paulson/Letelier/Dever/Pizarro Miller Garreaud Strub/Chelton McWilliams/Hall/Large Mechoso/Pan	To be defined
2B	Upwelling, by changing the physical and chemical properties of the upper ocean, has a systematic and noticeable effect on aerosol precursor gases and the aerosol size distribution in the MBL over the SEP.	C-130 RHB	WRF-Chem GCMs	Huebert/Matrai Blomquist/Huebert Covert/Bates/Quinn Strutton/Hales Fast/PNNL	To be defined
2C	The diurnal subsidence wave ("upsidence wave") originating in northern Chile/southern Peru has an impact upon the diurnal cycle of clouds and provides a useful framework for analysis of numerical model performance on diurnal time scales.	RHB R/V Wecoma R/V Olaya Twin Otter Land site Quikscat	MM5/WRF GCMs	Garreaud/Rutllant Bretherton/Wood Takahashi/Silva Wang/NRL	Diurnal composite lower tropospheric and MBL structure at 5 distances (100-1500 km) from the Andes
2D	The entrainment of cool fresh intermediate water from below the surface layer during mixing associated with energetic near-inertial oscillations generated by transients in the magnitude of the trade winds is an important process to maintain heat and salt balance of the surface layer of the ocean in the SEP.	RHB R/V Wecoma	Parcel Model LES	Gregg Weller/Straneo Ward McWilliams/Hall/ Gruber/Large	To be defined
2E	Poor representation of stratocumulus-topped MBL and near coastal winds contribute significantly to systematic coupled GCM model errors in the SEP.	C-130 Cross Sections RHB vertical structure Chilean land site IMET buoy long term data	CGCMs	Mechoso/Pan Kohler Garreaud Wang/Xie/deSzoeke Bretherton Donner/Golaz S. Wang Fast/PNNL	VOCALS Assessments (PreVOCA and VOCA) Model improvement for alleviation of systematic errors.