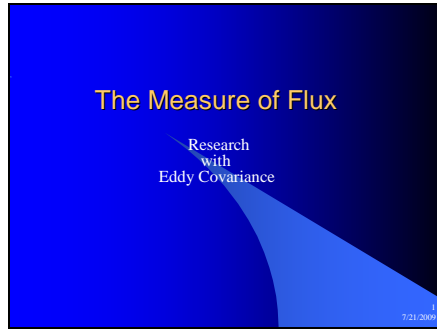
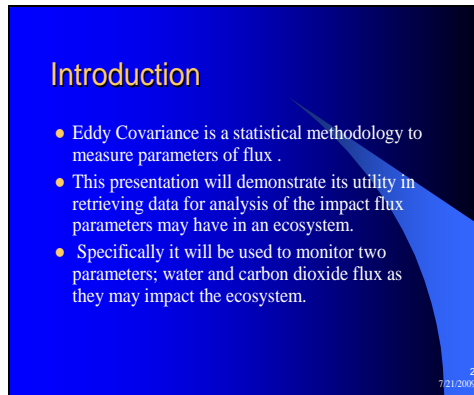


Slide 1

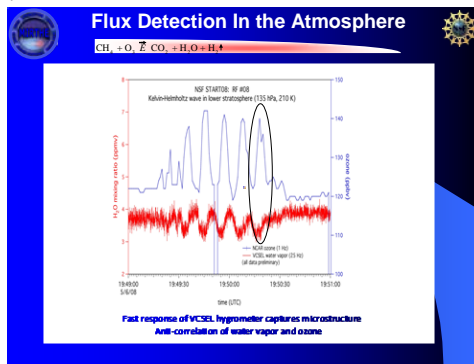


NJCCCS: 51Aff;552A1,52B1;
52B2;52B3;51B2;54ff.

Slide 2



NJCCS: 51A1;51A3;51B2;52A1;
55A1;51A2;51B1;54A1;54C1;54A1



1. A method to describe flux in the parameters of interest in the sampling area in the environment.
2. A question to study is raised; for example: ***do carbon dioxide and water aerosols flux together in the environment.***
3. Explain why this question is important: ***these are vital components needed in photosynthesis and vary within gradients established inorganically.***
4. The method standardizes the variables in order to compare them.
5. Analysis of results allows the formulation of an hypothesis: ***plants increase the surface density of these gases to increase flux, how does other extraneous sources of these gases change the flux pattern.***

Slide 3

Agenda

- Detecting Flux [10 min]
- Complexities in ecosystem flux [10 min]
- Instrumental measure of flux [10 min]
- Assumptions in ecosystem flux [10 min]
- Data collected in the flux field [10 min]
- Questions for further study [10 min]

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Slide 4

Overview

- Flux is a complex concept, which describes chaotic change in a system. The basic state of systems is change observed; however, homeostatic control is necessary to "capture free energy" from chaotic change for a stable system.
- To analyze change due to many variables in a system, pattern recognition seems most important when applying mathematical rules.
- The system of interest in this research study is the gas exchange system of the atmosphere.
- Statistical detection of change in atmospheric parameters, then, is essential for analyzing many complex relationships that can change the stability in the atmosphere.
- By making certain assumptions, flux can be detected, and data collected can be analyzed regarding atmospheric parameters, for meaningful inferences as to the exact nature of change in the atmosphere as it may impact the earth and its biosphere.
- Data collected in this study involved detection of changes in two ecosystem parameters: carbon dioxide and water.
- From analysis of flux in these parameters, inferences about change in the ecosystem will be presented.
- Questions are formulated for further study.

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NJCCCS:
51A3;51A4;51B1;54A1;
54C1

Slide 5

Vocabulary

Qualitative	Descriptive	Quantitative
Air mass	collision	covariance
Density	force	gradient
Energy	gradient	diffusion
Fluid	momentum	concentration
Flux	kinetic energy	
Turbulence	pressure	
Eddy	surface	
Boundary	temperature	
Stability	velocity	
Particle	volume	
Fetch	vector	
Footprint	convection	

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Slide 6

Topic One: Detecting Flux
A. What is Flux

- *Qualitative definition:* **flux**, in the atmosphere, is the mixing of fluid particles within boundaries based on turbulence in the density of these fluids in the density of the air mass that contains them. These turbulent flows are called *eddies*, which have certain energy based on density changes [gradients] affected by the **fetch** in which they distribute from the **footprint** which is their source in the atmosphere.

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Slide 7

Detecting Flux
A. What is Flux?

- *Descriptive definition:* **flux of particles** specifically is the vector resolutions that move particles with certain kinetic energy in the space of motion and pressure of the volume that contains their mass – their density. Based on their densities, they distribute in the field of flux in gradients with a certain velocity.
- The distributing velocity is due to collisions along their surfaces with some force and frequency in the moments of these collisions, and gives the *field strength* to the flux of particles; according to velocity and surface area

$$\frac{dV}{dA \cdot dt}$$

- The distributing particles of interest in the atmosphere are gases, so they follow the gas laws, and are influenced by other complex changes, as they are engaged in energy transformations in convection, in forming their gradients of distribution, in the atmosphere.

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Slide 8

Detecting Flux
A. What is Flux

- *Quantitative definition:* the typical particle movement depends on the concentration, or the density, of the particle within a certain space in the atmosphere. Concentrations vary due to the variation in the gradient of particle densities in the atmosphere. These variations occur by intrinsic factors of diffusion, or by more complex interactions that involve energy transformations and have many variables which influence the flux [change] in concentrations within the atmosphere. This complex interactivity requires a statistical measure of the variables, which together, are thought to influence fluctuating concentrations of a particle – **covariance**.

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Slide 9

Detecting Flux
B. Eddy Covariance

- Complex interactivity of many parameters, which together influence density concentration flux, is called covariance. When this interactivity involves turbulent flows in the atmosphere, that is eddies, then one detects **eddy covariance**.
- This eddy covariance can be visualized:

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NJCCCS: 51A1;51B2;51C1;
54ABC;53C1.

Slide 10

Detecting Flux:
Eddy Covariance

- The typical particle movement, in terms of concentration, is within a stationary current, with regard to particle number and angle of radial action.
- A gradient, z , forms as particles are emitted in a negative flux with respect to the ground, there is a higher concentration at the ground, becoming less concentrated as vertical movement proceeds.
- Air flux, beginning from below, mixes upward in a certain vector with a higher number of particles, that is concentrated (x_0).
- Air flux, beginning from above, mixes downward in a certain vector with a lower number of particles, that is less concentrated (x_i).
- Note with these fluxes, $x_0 > x_i$, so a positive flux is determined by the velocity, due to wind, of particles. [$F_{zi} = vx_i$]; this is assumed to be uniform, not varying consistently.
- Only the flux due to the imparted velocity of the particles is considered; since mixing is in the direction of the gradient.

The diagram shows a circular eddy with a vertical z-axis. A vertical arrow labeled 'z gradient' points upwards. Two horizontal arrows represent fluxes: one labeled x_0 pointing right from the center, and another labeled x_i pointing left from the center.

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NJCCCS: 53B1;53C1;53D1

1. Explain the geometry of the disc model of the eddy.
2. Explain the mathematics of turbulence which affects the eddy.
3. Explain the divergence of density to form a concentration gradient.
4. Explain the movement within a diffusion gradient.

Slide 11

Detecting Flux
Eddy Covariance

- Using a statistical analogue
[a math description of this observation]:

$$\text{concentration} = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})(z_i - \bar{z})$$
 where x_i refers to vertical velocity (z_i and \bar{x} will represent the concentration or covariance \bar{z}), \bar{x} is the mean that is every passing moment of having a given concentration, \bar{z} is the mean that is the lowest level heat or surface which contributes to the concentration gradient, or the temperature that is wind or air that has been passed into the atmosphere, or another heat gradient to air temperature that is heat heat in the vertical, which will have a gradient as it mixes into the air). Time (n) is compared as 5 minute fluxes that reads approximately every 1000 to 1000000 (10 hours) to 1000000 (1000000) so the lowest number was the average number for 1000 which gives a standard condition so as to compare the values of interest.

- Flux can be statistically determined using the product mean of the covariance, using the velocity [assumed as uniform] of a certain number of particulates in motion, in terms of concentration.

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Slide 12

Topic Two: Complexities in Ecosystem Flux

- If the shape of the flux system changes, the flux will change.
- For example: if a stationary vertical disc is not the shape denoting the flux pattern,
 - * rather, a horizontal disc, drag in aerodynamics will affect the flux;
 - * if the shape assumed a sphere [a globule], a consideration of a spherical moment of inertia would be necessary, as it passes through the field of flux making a "hole" in the space as it passes, which would affect the flux of the particles in a spin as they progress in their movement [rather like a round screw];
 - * further, as a sphere shape may be unstable as it passes; acquiring a rotation action itself about an axis, but also making a "wavefront" [akin to its aerodynamic flow] as an impulse "starts and stops" in its motion interacting with other particles in the air;
 - * also, as a shape may be "trapped" in its motion by a "conveyor" [a carrier] system that easily associates with the particle, but "hastens" its motion as it progresses;
 - * another factor to consider in the complexity of flux is angular orientation that up/down drafts may impart [akin to a wobble in a vortex].

8/9/2009

NJCCCS: 51A2;51A3;51A4;81A;81B12345789;52A1;82B13

1. In lab groups, discuss the idea of eddy covariance.
2. In lab groups, discuss possible sources of error.
3. Devise a group plan to study the parameters of interest.
4. Present your research and plan.

Slide 13

Topic Three: Instrumental Measure of Atmospheric Flux

- When using instruments to measure these patterns of flux, the instruments must be able to detect small scale movements; therefore motion detectors with sound and lasers are employed.
- Further, considerations must include responding to very fast finite changes without detecting "ghosts", which are false feed as sensors respond to speed around the sensors.

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1. Plans will be critiqued based on the following slides.
2. A finished research document will be formulated.

Slide 14

Instrumental Measure Of Atmospheric Flux

- With these instrumental considerations in mind, the key to meaningful detection involves the frequency of response to movement in the sensors.
- Frequency of response must be geared to the size of the eddies detected and the frequency of their occurrence in the field of flux under examination; simply, smaller eddies move faster.
- Therefore ground characteristics must be considered.

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Slide 15

Instrumental Measure of Atmospheric Flux

- This is to say, considerations must be made to the roughness of the ground below the vertical uplifts, gradients $[z_0]$, and the height at which the eddies in them will be formed so as to measure them.
- Specifically, the mean divergence $[z(\text{div})z_0]$
- A maximum divergent area seems to give larger particle flux, and, therefore, easier detection by the sensing probe.
- So, using ultrasonic sensors, which react to breaks in the flow, are standardized motion detectors to a $f = 1-100\text{Hz}$.

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Slide 16

Topic Four: Assumptions in Detecting Atmospheric Flux

- Detection assumes a stationary current of particle flow, with respect to number and orientation.
- Detection, further assumes finite aerosols [colloidal spheres], rather than a continual change in number and orientation of these particles.
- Optical Particle Counters are employed.

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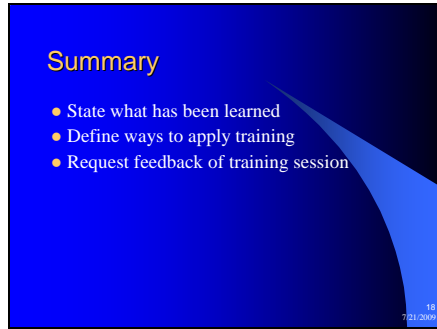
Slide 17

Topic Four: Assumptions in Detecting Atmospheric Flux

- These instruments are standardized by a known aerosol fluid of some concentration breaking a laser beam as the flux pattern crosses; pulses of such scattered light are counted, and computer algorithms process these counts using the covariance statistical method to obtain raw data.
- Weather parameters must be recorded in order to analyze the data generated; for example, fog, which demonstrates the Tyndall Effect of an homogenous mixture of particles.
- Other considerations controlled: the stability of the plane of cavity [instrument detection area], the velocity of flux, deposition of aerosol in the cavity, natural and extraneous fetch and footprint, horizontal advection [this causes flux in concentration gradients as eddies mix], vertical movements caused by thermals and rain diminish vertical flux patterns.
- Control is effected through instrumental rotation with respect to flux patterns to correct for wind movement; background flux patterns are statistically normalized with a Fourier Transformation of raw data.
- A still day with low: wind movement, heat, and humidity, constitute the best conditions for instrumental detection of flux patterns in atmospheric parameters.

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Slide 18



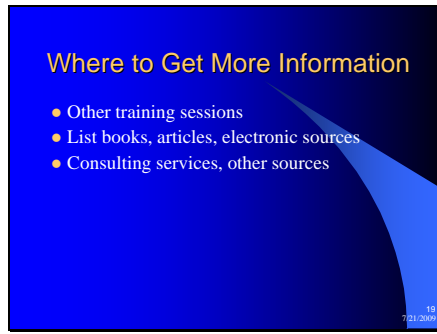
Summary

- State what has been learned
- Define ways to apply training
- Request feedback of training session

18
7/21/2009

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Slide 19



Where to Get More Information

- Other training sessions
- List books, articles, electronic sources
- Consulting services, other sources

19
7/21/2009

This slide features a dark blue background with a lighter blue curved graphic element on the right side. The title 'Where to Get More Information' is in yellow, and the bullet points are in white. A small white box in the bottom right corner contains the slide number '19' and the date '7/21/2009'.