

**Myrl the Mentor:
View from the Top of the Atmosphere**

**Bruce Wielicki
1980 Scripps Phys. Ocean. PhD
NASA Langley**

**Myrl Symposium
Dec 1, 2006**

A little bit of:

- **Myrl as Advisor in the late 1970s**
- **Grad Students entering Scripps in 1975**
- **One student's torturous path**
- **Climate Science**

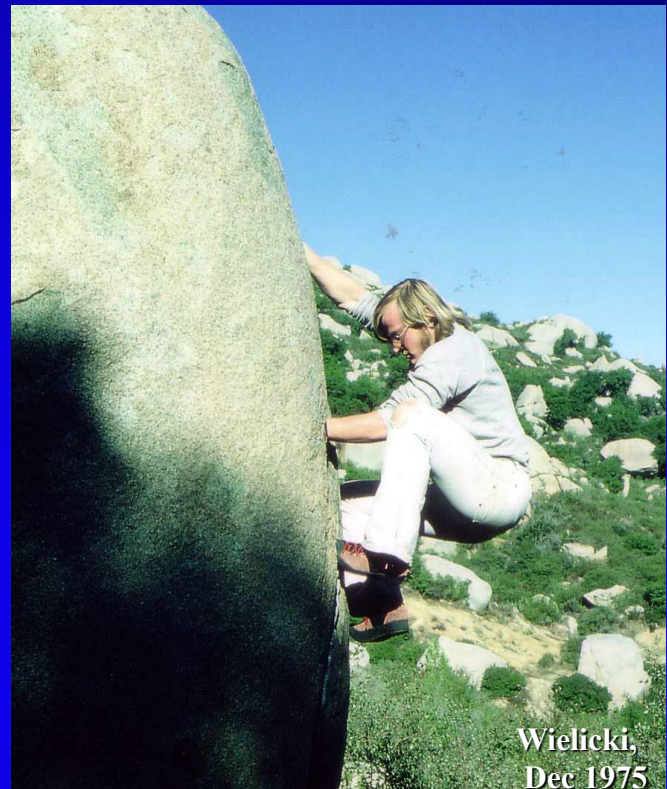
Step 1: What Myrl had to work with

- **A midwest oceanographer-wanna-be inspired by Jacques Costeau TV shows in the 1960: (no Discovery Channel)**
- **B.S. from Univ of Wisconsin with a bastard degree in applied math/physics/engineering: "interdisciplinary"**
- **UW recommended Woods Hole as the best grad school: Had just gone to visit Woods Hole and Hank Stommel (great) and the rest of Woods Hole (what, you don't have a thesis topic?)**
- **Visited Scripps and met Myrl and Rick Salmon: ah...relief.**
- **Office with Rick Salmon and Greg Holloway in IGPP, then below the IGPP conference room with Art Lerner-Lam.**
- **Other new P.O. students: Dudley Chelton, Mike McPhaden, Brooks McKinney**

The Dudley Chelton Connection:



Chelton, Mt Laguna, March 1976



Wielicki,
Dec 1975



Del Mar Apt., Oct 1976

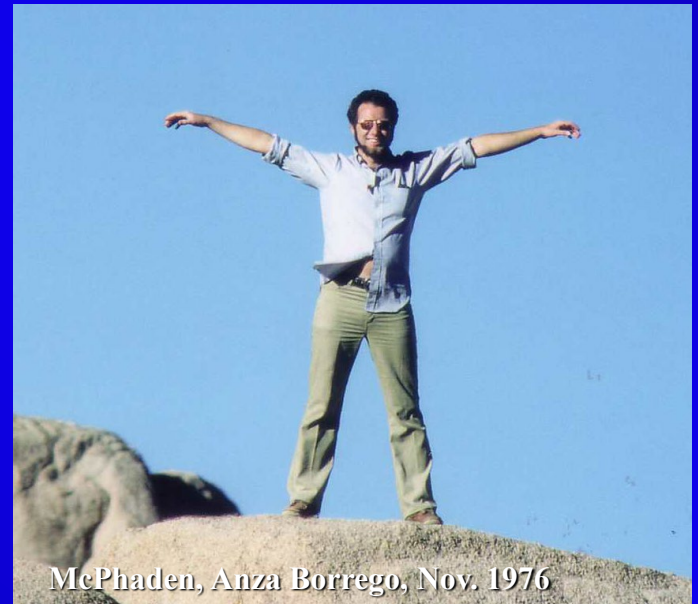


McPhaden, El Camino Real, May 1976

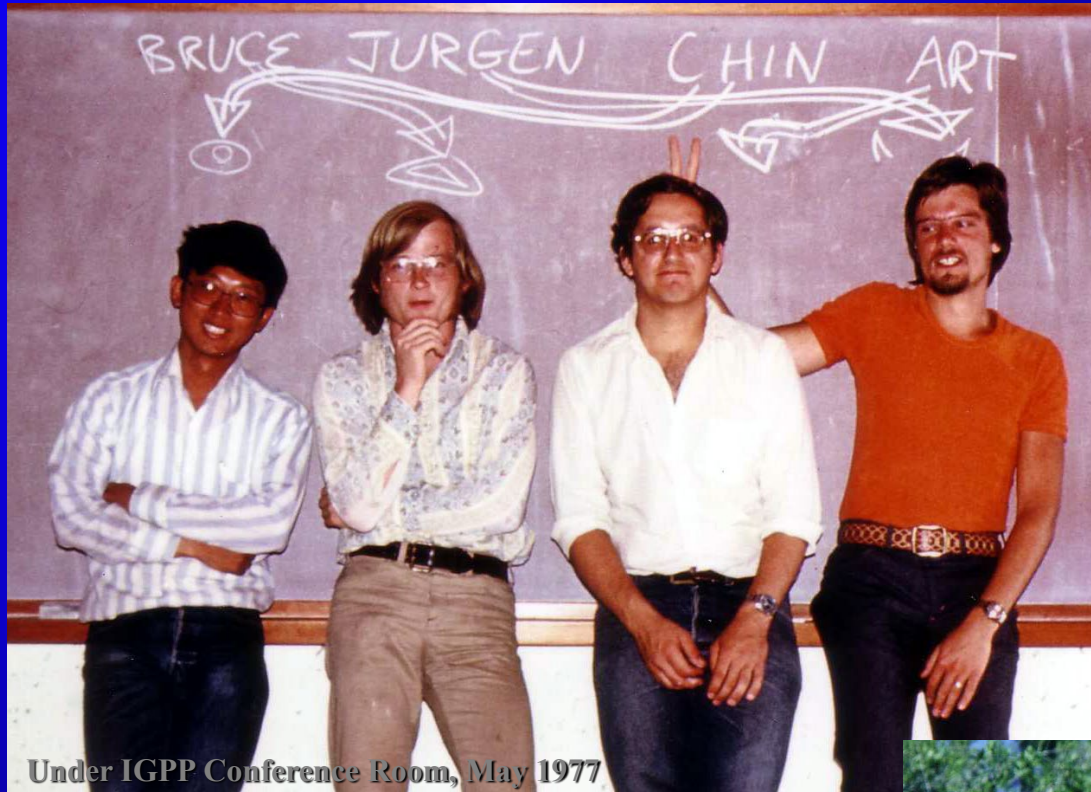


McPhaden, San Francisco, Dec 1977

Life with Mike McPhaden in the "Scripps Ghetto" in Del Mar: ask Mike about the "Pink Flamingo Movie" and its socially redeeming values...



McPhaden, Anza Borrego, Nov. 1976

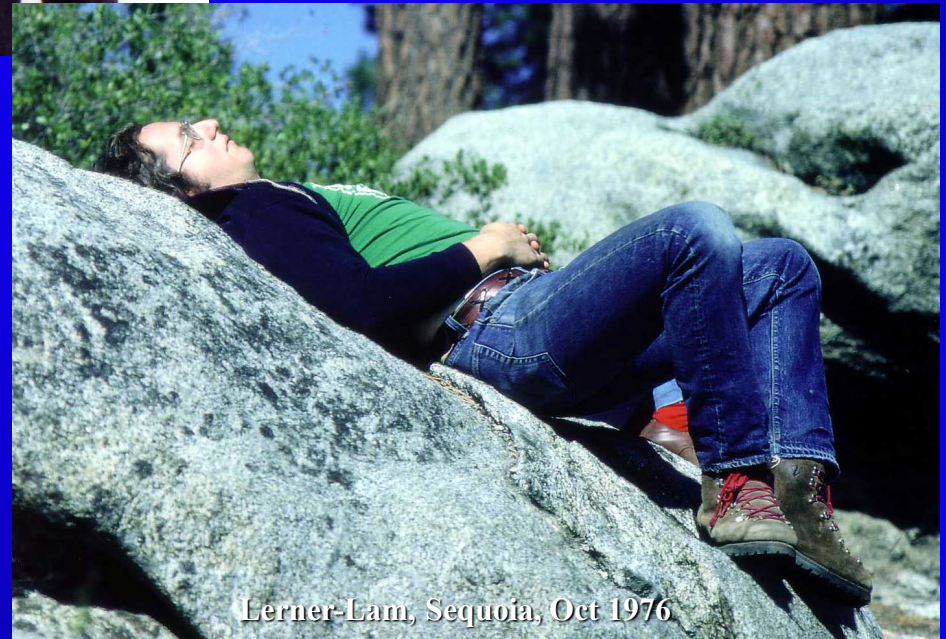


Under IGPP Conference Room, May 1977



Art and Eye
Lerner-Lam,
Oct 1977

Living Under the IGPP Conference Room With Art Lerner-Lam



Lerner-Lam, Sequoia, Oct 1976

**There were casualties
along the way...
Fortunately none fatal.**



Sequoia, Oct 1976



Del Mar, Nov 1975

Step 2: What I saw:

- Myrl's incredible ability to walk between math and physics universes in a way I had never seen before
- Myrl's incredible patience with students & approachability
- I would sorely test both these capabilities
 - *Needed the Morse and Feshback deep tissue spa treatment for the mathematically challenged*
 - *Not sure what the hell I wanted to do as a thesis topic*

The group of young talent orbiting Myrl:

- Rick Salmon: a rock in any storm, but working turbulence
- Greg Holloway the daredevil hang-glider
- Paola Rizzoli the Venice escapee: who dubbed me "Junior"



Wyoming,
June 1977

Water was a key part of many of our futures....

**Myrl and Rick were my main
mentor and support group...**



Wyoming, June 1977

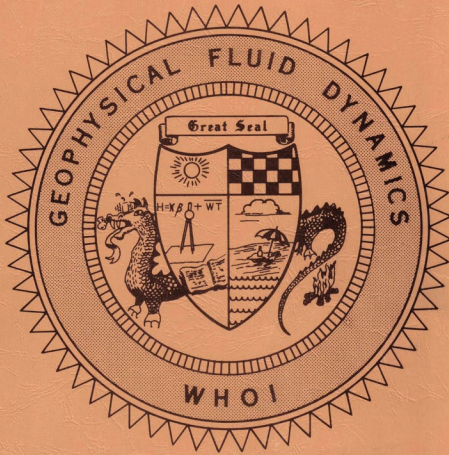


Wyoming, June 1977

Step 3: What do we do with him?

- Adding the "balance terms" to a *2-layer Quasi-Geostrophic Spherical Harmonic Atmosphere Model driven by SST anomalies* that Rick Salmon and Myrl had developed
- Whereupon I spent 6 months trying to get it to conserve energy: Equation problem? Coding error? Round off error?
- Myrl: How do we get this guy a clue?
- Send him to Woods Hole Summer GFD program, 1976 which happened to be on climate.

1976



COURSE LECTURES
 ABSTRACTS OF SEMINARS
 FELLOWSHIP LECTURES

The stability analysis is quite straightforward (see North 1976). Consider the time-dependent equation:

$$\frac{\partial}{\partial t} I_n(t) + L_n I_n + \left[\sum_m (I_m - I_m^0) F_{nm}(x_s) \right] = Q \cdot H_n(x_s) \quad (5)$$

let the perturbations from equilibrium I_n^* and x^* be small:

$$I_n(t) = I_n^* + \delta_n(t)$$

$$x_s(t) = x^* + \epsilon(t)$$

Linearizing:

$$F_{nm}(x_s) = F_{nm}(x^*) + F'_{nm}(x^*) \cdot \epsilon$$

$$H_n(x_s) = H_n(x^*) + H'(x^*) \epsilon$$

where primes denote the obvious derivatives. Substituting into Eq.(5) and dropping terms of order $\epsilon \cdot \delta$ leads to:

$$\frac{\partial}{\partial t} (\delta_n) + L_n \delta_n + \left[\sum_m \delta_m F_{nm}(x^*) + \sum_m (I_m^* - I_m^0) F'_{nm}(x^*) \cdot \epsilon \right] = Q H_n(x^*) \cdot \epsilon \quad (6)$$

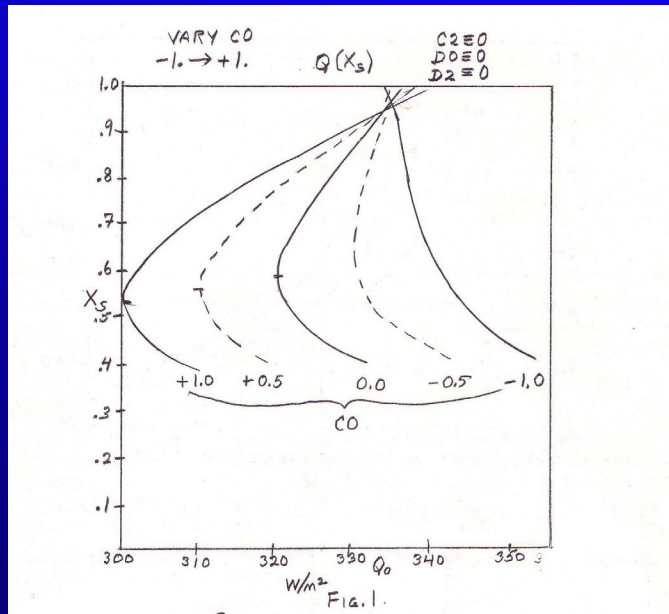
Similarly expanding the ice line condition $\sum I_n P_n(x_s) = I_s$ leads to a relation between ϵ and δ :

$$\epsilon = - \frac{\sum \delta_m P'_m(x^*)}{\sum I_2^* P'_2(x^*)} ; P' = \frac{dP}{dx_s}(x^*)$$

Now let $\delta_n(t) = D_n e^{-\lambda t}$. Equation (6) then becomes a set of coupled linear homogeneous equations for the D_n :

$$(L_n - \lambda) \cdot D_n + \left[\sum_m D_m F_{nm}(x^*) - \sum_m (I_m^* - I_m^0) F'_{nm}(x^*) \cdot \left(\frac{\sum D_2 P'_2}{\sum I_2^* P'_2} \right) \right] = -Q H'_n(x^*) \cdot \left(\frac{\sum D_2 P'_2}{\sum I_2^* P'_2} \right)$$

For which non-trivial solution exists only if the coefficient determinant = 0



Equations and Graphics in The Dark Ages...

When handwriting was still legible



The Woods Hole 1976 Summer GFD Graduate Students

Step 4: You want to do what?

- Woods Hole has Gerry North and a new toy energy balance climate model
- I add cloud feedback to it (1% cloud fraction / 1K) and it blows the model off to an Snowball Earth solution
- Richard Somerville is there with the NCAR climate model and lo and behold it has the same cloud feedback...no ice
- I have my cloud epiphany
- Return to Scripps: Tell Myrl that my 2-layer balance quasigeostrophic spherical harmonic climate model has no clouds, radiation or water vapor feedbacks: I can't do this anymore: it has no relevance to "real climate".
- Myrl finds this fascinating, and suggests I go to NCAR (where he does tides modeling on their nice big computers)
- Wielicki runs off to be a joint NCAR/Scripps grad student
- Myrl gets stuck writing up the 2-layer quasi... results



**Graduate Student Transportation and all possessions:
Motorcycle and mattress, heading to NCAR...**

Step 5: The Thesis Qualifier & Defense

- **Dump dynamics and dive into radiative transfer theory at NCAR with Coakley, Ramanathan, & Wiscombe. Coakley and Myrl are joint thesis advisors.**
- **Initially use new satellite cloud and radiative flux data from Nimbus 6 but data is bad: time for a theoretical analysis of errors in satellite remote sensing of cloud properties**
- **And this has what to do with Scripps? Myrl is undaunted and continues support.**
- **The thesis qualifier talk at Scripps: You want to do what?**
- **Wait outside for an hour while committee struggles with this odd duck thesis topic. Myrl and Coakley evidently carry the day. Longest hour I can recall.**
- **Thesis defense is tense, but Chahine is finally convinced this is the good stuff, and there basically are no questions (except for the biological oceanographer before it started..)**



San Francisco
Dec 1977



Wyoming,
June 1977

**Wife (Barb) & PhD:
Thanks to Myrl!**

Step 6: So where did this end up?

- **A wife (Barb) via Myrl, NCAR, and Greg Holloway in 1979**
- **Scripps P.O. PhD in Dec 1980: after a 6 year journey**
- **26 years at NASA Langley on clouds, radiation and climate**
- **Co-I on 3 satellite missions, P.I. on one (4 current in orbit)**
- **Chelton and Freilich (a year behind) also take off to satellite remote sensing and OSU**
- **Mike Freilich now at NASA HQ as Earths Science Director**
- **Jim Coakley now also at OSU**
- **Mike McPhaden stayed buoyed to ocean water**
- **Worked on U.S. CLIVAR executive steering committee with Bob Weller**
- **Working on ocean heat storage with Josh Willis: net radiation and ocean heat storage interannual anomalies**
- **Sommerville and Ramanathan now at Scripps**
- **Scripps has become a major player in climate**

Why did Scripps, with no remote sensing, contribute so strongly to satellite climate research? Why not Woods Hole?

- **Myrl was an excellent example of the open-mindedness to new opportunities and directions**
- **NASA was retooling from Apollo to increased earth and space sciences**
- **Ties to JPL (Chelton/Freilich went there to sort out SeaSat altimeter and scatterometer capabilities)**
- **Ties to NCAR**
- **Oceanography's interdisciplinary nature: climate is also a complex mix of biology, chemistry, physics, geology**
- **The oceans longer time scale than atmospheric weather leads to a longer term research perspective.**

La Jolla, Dec 1976



- After 26 years, we still don't understand clouds: especially in marine boundary layer
- In IPCC AR4, clouds still largest uncertainty in climate sensitivity, while aerosol effect on clouds is the largest uncertainty in climate radiative forcing
- Time to recruit Myrl and Rick...



Scripps, Apr 1976