Background:

Jerry was an American original (they broke the mold after he was born). He grew up during the Great Depression. Although he was offered a full four-year scholarship to attend Wesleyan University, he had to give that up to help his family after his father fell ill. Jerry himself fell ill with tuberculosis one year after he graduated from high school and had to shelve his plans to go to college. Jerry took correspondence courses in physics, mathematics, and meteorology while he was in isolation and during his subsequent slow recovery. He wrote various meteorologists looking for a job to no avail before he landed one working with H. H. Clayton who was doing meteorological analysis work for the Smithsonian Institution in Washington, DC, and needed an assistant. Jerry worked at the DC central office of the US Weather Bureau where he was thrilled to discover a comprehensive library that contained a wide variety of papers, books, and maps. What happened next can best be described in Jerry's own words as transcribed from an article in the WMO Bulletin (reference given above; I did not find a free online source) that appeared in July 1988:

".....the library contained the many scholarly papers of the Bergen School of meteorologists in Norway, and also a set of enthralling scientific reports turned out by the newly formed Department of Meteorology at the Massachusetts Institute of Technology under Professor Carl-Gustav Rossby. I had badly wanted to study there myself, but since there were only graduate courses I did not have the necessary entrance qualification (remember, Namias only had a high school degree at that point). Nevertheless, even with my limited grounding I found I could follow much of the treatises, but there were a couple of statements in Rossby's classic paper 'Thermodynamics applied to air-mass analysis' that floored me. I wrote to Rossby (Jerry was age 24 at this time) politely questioning these inferences, and quite soon received a reply from him saying that I was correct on one point but in error on the other, and giving a full explanation. In a postscript he asked who I was and invited me to call on him the next time I was in the Boston area. I needed no second bidding, and about a month later I was face to face with the great man who was to influence my whole life."

An outcome of the MIT meeting was that Rossby agreed to take him on as a graduate student. Namias continues...."He (Rossby) had to make a special case for me, arranging it so that I could concentrate on subjects germane to meteorology, both in his own department and in those of mathematics and physics. He went further and arranged a job for me evaluating the recordings of instruments carried by the department's research aircraft operating from East Boston (Logan) airport." Namias thrived at MIT and thanks to Rossby, he was also able to spend time at the Woods Hole Oceanographic Institute in Falmouth, MA, where his interest in physical oceanography blossomed. During his time at MIT, Namias actively worked on the thermodynamic characteristics of air masses and applied this knowledge to mesoscale weather features associated with frontal passages.

Thermodynamics and Isentropic Analysis:

Namias subsequently wrote a series of articles on weather phenomena, the thermodynamics of air masses, and the preparation of meteorological analyses for the Bulletin of the AMS (BAMS). With the help of a stellar cast of collaborators, Namias published a comprehensive article on how to use isentropic analysis to diagnose the evolution of weather systems and understand the distribution of the associated weather in BAMS in 1940. This article proved to be as influential in the field of synoptic meteorology at that time as later articles by Fujita (1955, 1963) on mesoanalyses were in the field of mesometeorology. The series of articles that Namias published in BAMS while he was at MIT in the late 1930s resulted in him becoming the first recipient of the new AMS Clarence Leroy Meisinger Award that was given to a young scientist with an interest in aerology. Namias was cited "for application of thermodynamic tools to weather forecasting."

US Weather Bureau: Head of the Extended Forecast Division:

By 1940, the winds of global war were blowing ever harder and in May of that year Namias accepted an offer to become the chief of the newly created Extended Forecast Division of the US Weather Bureau in DC (he received his M.S. degree from MIT in 1941). He used his new US Weather Bureau position as a launching pad to begin a series of pioneering investigations of large-scale atmospheric phenomena using the principles of aerology and dynamics taught to him by Rossby and his earlier groundbreaking work on air masses and atmospheric thermodynamics that was published in BAMS. Namias was a visionary who came to see and appreciate that continental and oceanic surface characteristics (e.g., the distribution of snow cover, soil moisture, and SST anomalies) were critical to understanding the life cycles of large-scale weather systems and the persistence of significant large-scale flow anomalies that could be associated with extreme weather owing to atmospheric and oceanic "memory" of surface characteristics anomalies (Haney 1986). In the process, Namias became convinced that the North Pacific Ocean was a key governor of intraseasonal and interannual variability and that extended forecasts on monthly, seasonal, annual, and interannual time scales over North America would be impossible without the development of a better understanding of how the coupled atmosphere-ocean system behaved and why it behaved as it did.

Awards:

In this regard, Namias was a true pioneer and visionary because very few other atmospheric and oceanic scientists viewed their respective domains of interest as coupled systems. For his pioneering scientific contributions and vision, Namias was awarded the highest honors that the AMS can bestow upon a scientist: The Carl-Gustaf Rossby Award for Extraordinary Scientific Achievement (now called the Carl-Gustaf Rossby Research Medal) in 1955 "for his contributions to, and stimulation of, research in the principles and application of extended and long-range forecasting techniques" and the Sverdrup Gold Medal in 1971 "for studies of the ocean's role in climatic variability. His long-term dedication to large-scale, air-sea interaction and inspiring leadership has laid the basis for present progress." It is testimony to Jerry's extraordinary scientific contributions to atmospheric science and physical oceanography that he is still the only scientist who has ever received both highest AMS awards that can be given in the atmospheric and oceanic sciences. In 1983, Namias was elected to membership in the National Academy of Sciences in recognition of his lifetime seminal contributions in the atmospheric and oceanic sciences.

Scripps:

Namias began a second career in 1971 when he "retired" from government service to begin a new career at the Scripps Institution of Oceanography beside his beloved Pacific Ocean. At Scripps, Namias was surrounded by other scientists who were receptive to new thinking about the physical processes in the upper ocean and lower atmosphere that governed low-frequency phenomena. Shortly thereafter, Namias established the First Experimental Climate Research Center at Scripps to deal with air-sea interaction problems. Namias continued his pioneering research on low frequency phenomena in the atmosphere and ocean at Scripps right up until he suffered a debilitating stroke in 1989. Sadly, he was unable to speak or work thereafter until his death from pneumonia in 1997.

Jerry from Personal Experience:

I was fortunate to know Jerry Namias pretty well. I first met him when I was a graduate student at MIT. Namias was a frequent visitor to MIT. He liked to talk with Fred Sanders (and Ed Lorenz) in front of the maps posted in the hallway of the 16th floor of the Green Building where the meteorology department was housed. I liked being a fly on the wall during the spirited hallway map discussions and I tried to soak up as many of the physical insights being tossed around about the atmosphere and ocean as my poor little limited brain would permit. Namias, like Fred Sanders, routinely made maps in his head from tabulations of coded surface weather reports from synoptic land and marine stations around the world, but especially over the North Pacific Ocean. Namias would infer the structure and evolution of low-frequency variability in the NH on the basis of time series of successive 24 h sea level pressure changes at key stations in Alaska, northern Canada, Hawaii, Pacific islands, and eastern Asia. For example, he was always looking for early evidence of changes in what later became known as the Pacific-North American pattern, a teleconnection pattern that Namias knew about in the 1950s (Smagorinsky 1986).

Watching Jerry and Fred in action was inspiring and never grew old. I was fortunate to be able to interact with Jerry at AMS gatherings and other more informal settings. Jerry was a huge draw when he spoke at AMS conferences, so much so that nobody wanted to speak after him or in another room opposite him. It was no accident that Jerry was often scheduled to talk just before lunch or dinner so that no one had to speak after him. Jerry could tell a scientific story comparable to the incomparable Ted Fujita. Both of them had audiences eating out of their hands. Both of them enjoyed being on stage and the center of attention. And, most importantly, both of them always had something scientifically interesting to say. We now turn to a brief discussion of the scientific legacy of some of Jerry's papers and their continuing connection to research opportunities today.

Science: Air Mass and Isentropic Analyses and Links to the Present

Namias (1934, 1936a,b, 1938, 1940): 1) laid out the basic principles of air mass analysis based on the thermodynamic characteristics of the lower part of the atmosphere as derived from newly available radiosonde observations, 2) showed how basic principles of thunderstorm forecasting could be derived from isentropic analyses, and 3) summarized the basic principles of isentropic analysis in an extensive article written for the AMS with the help of some very distinguished colleagues. When I first started looking at weather maps I had naively assumed that moist air needed to sustain deep convection during the warm season east of the Rockies arrived from the Gulf of Mexico (North Atlantic) on southerly to southwesterly (southeasterly) winds. It had never occurred to me that tropical moisture from the Gulf of Mexico could move clockwise up and around a continental anticyclone and reach the Great Lakes, Ohio Valley and the Northeast from the northwest until I read Namias (1938) when I was a graduate student. I was stunned to see how by ignoring the clockwise flow of moist air up and around anticyclones I was missing an important component of the warm season convective story (Namias 1971).

Jerry's original isentropic analysis work in conjunction with warm season continental anticyclones nicely explains the "ring-of-fire" effect whereby mesoscale convective systems (MCSs) frequent the poleward and equatorward periphery of the continental anticyclones(see also Namias 1971). Tom Galarneau has provided a link (see below) to a "ring-of-fire" presentation we gave in 2007 on the severe MCSs that rolled clockwise around around a strong subtropical upper-level closed anticyclone (CA) from July 1995. The July 1995 CA was also associated with an intense but short-lived heat wave that killed hundreds of people in Chicago. At issue was the origin of mesoscale disturbances on the dynamic tropopause that acted to trigger multiple MCSs, many of which were severe, in the "ring-of-fire" around the periphery of the CA. The July 1995 event, and many others like it, link directly back to Namias (1938, 1940).
See: Galarneau and Bosart (2006); Ridge Rollers: Mesoscale Disturbances on the Periphery of Cutoff Cyclones, pdf attached.

Fultz (1986) noted that Namias (1940) played a critical role in introducing Norwegian air mass concepts in the US. Although Namias (1940) made extensive use of newly developed radiosonde data and flight data from the rapidly growing aviation meteorology community to expand the general applicability of air mass analysis, after World War II air mass analysis fell into general disfavor during the ascendancy of modern dynamics. Emanuel (2008; Sanders monograph) in an article provocatively entitled "Back to Norway" argues that the time may be ripe to reconsider air mass analysis within the context of modern PV thinking in order to get a more complete understanding of how diabatic radiative processes near the surface and in the free atmosphere (e.g., the production of continental arctic air associated with radiative cooling over snow-covered ground *and* the creation of deep cold pools due to radiative cooling in moist air) can be better linked to the production of continental arctic air. Emanuel showed that "Saturation Potential Vorticity (SPV)" with Ertel PV defined in the usual way except that potential temperature was replaced by the natural log of the saturation value of the equivalent potential temperature could be used to distinguish between arctic, stratospheric, and "convected air masses.

SPV values in these three air masses would typically be high in arctic air masses (because of radiative cooling), high in the stratospheric reservoir (because of long residence times where SPV ~ PV), and approximately zero in convective air masses (because moist adiabatic lapse rates are common). Emanuel (2008) suggested that air mas concepts be "resuscitated" (my term) and air masses redefined based on their characteristic SPV values because like PV, SPV can be inverted subject to a balance condition. Emanuel (2008) noted that "'SPV thinking' would proceed along much of the same lines as 'PV thinking,' but replacing surface temperature with surface equivalent potential temperature which in convected air is linked to saturation equivalent potential temperature above the boundary layer by the condition of convective neutrality. It would also be concerned with the diabatic formation of arctic air and the dynamics of the SPV transition between arctic and convective air." Emanuel's ideas link directly back to the work of Namias and the Norwegian school 70-90 years earlier and would appear to offer an important way forward toward better incorporating diabatic concepts into modern PV thinking.

Science: Confluence, Tropospheric Jet Stream and the Index Cycle

In a series of pioneering papers, Namias (1947), Namias and Clapp (1949), and Namias (1950) laid out the basis for fluctuations in the strength of the zonal circulation to characteristic types of weather patterns. Namias (1947) noted that the close correlations between temperature and pressure at midlevels of the atmosphere, essentially a statement of thermal wind balance, could be used to understand the physical mechanisms that govern fluctuations in the large-scale flow. He wrote "This interrelation is sufficiently close to suggest a physical link line of attack on the problem of fluctuations in the speed of the zonal circulation. A special case of frequent occurrence is described wherein increases in zonal speed result from large-scale confluence of cold and warm currents in the mid troposphere." Namias (1947) used newly emerging global radiosonde data availability to demonstrate that thermal wind balance concepts could be employed to deduce how zonal flow variations associated with confluence flow patterns could be linked to jet stream formation.

Subsequently, Namias and Clapp (1949) established how confluent flow jet-entrance regions corresponded could be associated with thermally directly vertical circulations and linked to areas of inclement weather (independent work by Sutcliffe 1947 and Sutcliffe and Forsdyke 1950 made similar points). Newton (1986), among others, discussed the importance of the findings of Namias and Clapp (1949) to understanding the basis of the NH general circulation. Namias (1950) introduced the concept of the zonal index cycle to measure measure how fluctuations in the zonal wind contributed to important weather variations. The zonal index cycle was computed on the basis of the SLP pressure difference (or 700 hPa height difference between) between 35 and 55 N. Strong (weak) westerly flow prevailed when the index was strongly (weakly) positive while a blocking pattern prevailed when the index changed sign (indicative of mean easterly flow). Although Namias understood that variations in the observed index cycle were only quasi periodic at best (i.e., the large-scale flow was chaotic), he argued that the atmosphere typically experienced the three phases of the zonal index cycle on time scale of four to eight weeks and that understanding what physically controlled the variation of the zonal index cycle could possibly be used to improve long-range weather forecasting.

That said, application of the zonal index cycle concept to long-range weather forecasting proved to be controversial and the work was ignored in many circles. The Namias (1950) index cycle concept was resurrected by Lorenz (1986). Lorenz (1986) stated that he was initially skeptical of the validity of the zonal index cycle because the work of others and some of his own work suggested that the sea level zonal index cycle fit a first-order Markov process, indicative of random behavior. Subsequent theoretical investigations by Lorenz using his well-known "toy" chaos model show that the index cycle was a measure of real physical phenomenon that was governed by chaotic behavior in the modern sense. Lorenz (1986) noted that "It appears then, that the variability of the temperature gradient and its associated westerly wind current, i.e., the index cycle, is acting as a weak quasi-random forcing upon the mean temperature, producing the "climatic" variations" that were initially discovered by Namias.

Science: Air-Sea Interactions and Links to the Present

Namias (1963) wrote a landmark paper that linked large-scale air-sea interactions over the North Pacific from summer 1962 through the 1962-1963 winter to the occurrence of high-impact weather events downstream over western North America and beyond. He argued on the basis of a combination statistical synoptic climatology evidence, physical reasoning, and associated intuitive leaps, that persistent and widespread positive SST anomalies over the central and eastern North Pacific going back to late spring 1962 contributed at least in part to the structure and evolution of highly anomalous downstream flow. Namias was especially intrigued by how a remnant of western Pacific tropical cyclone Freda (1962) underwent extratropical transition (ET) and moved eastward along the enhanced baroclinic zone associated with the anomalous SST gradient and then reintensified spectacularly as an extratropical cyclone (EC) off the west coast of Oregon on 12 Oct 1962. This storm, known as the Columbus Day windstorm, produced the greatest forest blowdown in the Pacific Northwest in modern times (Lynott and Cramer 1966). Namias speculated that TC Freda's track along the anomalous SST gradient enabled the storm to tap the enhanced baroclinicty and contributed to the spectacular reintensification of Freda as an EC.

To address this question, I have attached a series of SST and upper-air maps derived from the NOAA/ESRL/PSD interactive web link. Note the widespread region of > 1.5 C SST anomalies over the central and eastern North Pacific between May and September 1962, confirming Figs. 1 and 2 in Namias (1963). The SST anomaly analysis for 9-11 Oct 1962 during which time the remnants of TC Freda were accelerating ESE toward the West Coast shows that positive SST anomalies still prevailed in the central North Pacific while cold SST anomalies had developed in the Gulf of Alaska and in the subtropical and tropical eastern Pacific to the west of Mexico. The resulting enhanced meridional SST gradient, in conjunction with and in phase with an anomalously strong meridional 850 hPa temperature gradient, favored anomalously strong deep baroclinicity and an associated anomalously strong (> 60 m/s) 250 hPa jet stream between 9-11 Oct (it is likely that the jet was even stronger than analyzed by the NCEP/NCAR gridded reanalyses, given the absence of aircraft and satellite observations in 1962).

Inspection of Fig. 3 In Namias (1963) shows that at 40 N and 170 W the positive SST anomaly in 1962 and 1963 was so large that the actual SST temperature at that point in Oct 1962 lagged the climatological SST by two months. Comparison of Fig. 5 in Namias (1963), which shows Freda's track superimposed on the North Pacific SST analysis, with the attached images, confirms that Freda tracked along the core of the SST gradient anomaly that was in phase with the anomalously large atmospheric meridional temperature gradient and associated 250 hPa jet stream. The attached images of mean and anomalous precipitable water (PW) for 9-11 Oct show that tropical PW values (> 40 mm) were ingested into the aforementioned atmospheric baroclinic zone and undoubtedly helped to fuel the explosive baroclinic reintensification of the remnants of TC Freda.

The Oct 1962 event described by Namas (1963) is also relevant to ongoing research by UAlbany Ph.D. students Heather Archambault and Jay Cordeira. Both Heather and Jay are investigating the spectrum of possible downstream responses that can occur when TCs undergoing ET, ECs, and arctic PV anomalies interact with the North Pacific jet stream. These downstream responses can range from a series of progressive downstream Rossby waves to the generation of persistent high-latitude blocking with attendant extreme weather events. Previous Fri map discussion posts in 2009 and 2010 have addressed a number of these issues (especially predictability questions).

Although Namias (1963) put most of his emphasis on subtropical and midlatitude SST anomalies as potential important governors of climate (e.g., he argued that anomalous warm SSTs over the North Pacific in summer would lead to a strengthened Aleutian cyclone in the fall), he was well aware of the importance of tropical SST anomalies on the seasonal and interannual time-mean structure and evolution of the midlatitude flow. Namias (1976) investigated the sensitivity of the atmospheric circulation over the midlatitude North Pacific to the phase of the Southern Oscillation (SO). According to van Loon (1986), "he (Namias 1976) was then, as far as I know, the first person to discern between the effects of both extremes of the SO."

That said, the air-sea interaction results from Namias (1976) were not without controversy. As noted by Haney (1986; Namias Symposium), "a number of subsequent papers by Hasselmann, Frankignoul, Davis, and others showed that it was much easier to produce SST anomalies from atmospheric anomalies than it was to produce atmospheric anomalies from SST anomalies. A number of early general circulation model (GCM) sensitivity experiments by Kutzbach, Huang, Chervin, Houghton, and others also showed a remarkable insensitivity to mid-latitude SST anomalies, whereas these same early GCM experiments at least showed some sensitivity to tropical SSTs." In subsequent years the importance of tropical SST anomalies and the associated anomalous tropical heating in conjunction with both the MJO and ENSO has proven to be the dominant governor of higher latitude large-scale circulation anomalies. Still, I think that there is abundant evidence that midlatitude SST anomalies, if they are relatively long-lived such as occurred over the North Pacific from May to September 1962, can also play an important role in modulating large-scale midlatitude circulations.

Science: Anomalous Climate Patterns Associated with SST, Snow Cover and Soil Moisture Anomalies and Links to the Present

In subsequent years, Namias conducted extensive investigations of anomalous climate patterns and their causes. His results always implicated anomalies in SSTs, snow cover, soil moisture, and large-scale midlatitude flow anomalies associated with the phase of ENSO, all operating on different time and space scales and all exhibiting chaotic behavior, as critical factors in governing the evolution of the large-scale flow and the magnitude and persistence of he flow anomalies (Haney 1986). Namias (1978) built upon the results from Namias (1963) to argue that anomalous North Pacific SST gradients near 140 W increased overall atmospheric baroclinicity and strengthened fronts and cyclones in the region with downstream impact on ridge-building over western North America (and associated severe drought) during the remarkable cold winter of 1976-1977 in the central and eastern US. Namias (1979) further argued that the abrupt break in the 1975-1977 cool season drought over western North America during the subsequent 1978-1979 cool season could be linked to a reversal of the SST anomaly pattern over the North Pacific and NH large-scale flow patterns.

In another remarkable paper, Namias (1980) investigated the 1978-1979 winters which was unusual in that nearly all of the CONUS had below normal temperatures. He concluded that "In association with the [strong eastern North Pacific] ridge, the North Pacific circulation appears to have undergone the "negative feedback" effect, wherein cold surface water in summer in the northeastern Pacific usually brings about higher pressures than normal at surface and aloft in the subsequent fall, The new fall pattern remained quasi-stable throughout the winter perhaps in part due to coupled air-sea interaction. Premonitory signs of these events were evident as early as November 1978. Normally, the consequence of the strong eastern Pacific ridge would be a strong Bermuda high and upper level ridge affecting the southeast according to statistically derived teleconnections. However, the eastern ridge did not materialize because of strong and extensive blocking, dominating the area from Scandinavia through northern Canada and Alaska. This immense block demolished the Bermuda high as storm tracks were displaced southward. A satisfactory explanation of the blocking is not at hand."

Namias (1955) discussed the cause of drought over the CONUS in terms of the sensitivity of continental subtropical anticyclone development to oceanic subtropical anticyclone development in the North Pacific and North Atlantic. Drought issues were always on his mind as evidence by the above discussion of western US cool season drought. The summer drought and heat wave of 1980 over the southern Plains prompted Namias to turn his attention to CONUS summer drought Namias (1982, 1983, 1988, 1991). These later investigations by Namias established the droughts were not monolithic and likely had multiple causes. He noted that the great drought of 1988 appeared to be initiated by extratropical circulation anomalies whereas the less extensive 1980 drought looked to be driven by tropical heating anomalies that in turn drove midlatitude circulation anomalies.

Science: Tropical Cyclones and Links to the Present

I would be remiss if I didn't mention some of Jerry's work on TCs, particularly TC Agnes (1972). On the basis of a satellite and surface analysis, Namias (1973a) suggested that the birth of Agnes in the Caribbean in June 1972 was influenced by cloudiness associated with a decaying late season cold front that crossed Florida and a convective cloud cluster that originated over northern South America and moved northward into the NH and eventually intersected the remnant frontal cloud band. The South American convective cloud cluster connection proposed by Namias for TC Agnes may also have applicability to the genesis of Tropical Storm (TS) Erin (2007), a storm being analyzed by Tom Galarneau, Russ Schumacher, and myself from multiple perspectives, near the western tip of Cuba in August 2007. Satellite imagery and 700 hPa vorticity analyses from the 1.0 deg NCEP/GFS grids indicate the possibility (but no decisive smoking gun) that a westward-moving squall line and associated individual MCSs over northern South America spawned an MCS that crossed the northern coast of South America and moved northwestward where it may have interacted with a westward-moving African wave to create a favorable vorticity-rich environment for the genesis of TS Erin. This possible aspect of the Erin genesis is a subject for further investigation and is motivated by the results of Namias

(1973a).

Namias (1973b) examined the antecedent large-scale conditions associated with development of Agnes and concluded that a persistent mean trough over the eastern US that extended well southward into the Caribbean (his Figs. 8-9) helped to create a favorable large-scale environment for the genesis of the storm. This favorable environment helped to steer Agnes, once formed, northward along the Atlantic coast. Attached images of mean and anomaly 700 hPa geopotential heights and PW values for 9-17 Jun 1972 show that an unusually deep trough is situated over the Yucatan Peninsula with positive PW anomalies (upwards of 10 mm) situated on the poleward and eastward side of the 700 hPa trough. Agnes, which formed on 14 June near the Yucatan Peninsula, had the benefit of an unusually moist environment to develop into a TC (caveat: I did not attempt to sort out storm-related from background moisture).

Summary:

To sum up the many scientific contributions by Jerry Namias on the occasion of his 100th birthday, I would like to quote Harry van Loon (1986) who amplified the words that Namias (1975) used to describe Jack Bjerknes when he wrote "In his golden years [he] is no less active, no less productive and most important, no less imaginative and creative than in his early years. We lesser synopticians owe him a tremendous debt of gratitude for what he has done, and for giving us a model to emulate."

Lance

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