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2003年台風10号により北海道日高地方の泥岩と礫岩地域に発生した斜面崩壊に与える乾湿風化の影響

若月　強 *

2003年8月に北海道日高地方で発生した斜面崩壊に対して，地質の異なる3地域で斜面崩壊の発生位置，斜面の土層構造および基岩の乾湿風化特性について比較検討した．白亜系上部蝦夷層群の泥岩及びシルト岩地域の基岩は乾湿風化を受けると細粒化するが粘土とはならない．そのため，風化土層の浸透能は高くなり，厚い風化土層が形成され，崩壊深が大きくなった（3.2 － 3.7 m）と思われる．また，次に発生する崩壊は，現在の崩壊面を平行後退させるような形状となることが予想される．一方，中新統元神部層の凝灰質泥岩地域の基岩は乾湿風化を受けると急速に粘土化する．そのため，風化土層の浸透能は低くなり，薄い風化土層しか形成されず，崩壊深が小さくなった（0.4 － 1.2 m）と思われる．このような崩壊は，斜面最下部で繰り返し発生すると予想される．中新統元神部層の礫岩地域では，3つの地質の中で最も多数の崩壊（崩壊深 0.7 － 1.2 m）が発生していた．基岩の礫間の膠結物質にはスメクタイトが多く含まれており，風化土層ではこの膠結物質だけが強く風化していた．風化土層は斜面の上部から下部まで極めて薄く，どこからでも崩壊が発生すると考えられる．

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Learning from Lahars：the 18th March 2007 Break-out from Crater Lake, Ruapehu, New Zealand

V. Manville*

On 18th March 2007, the refilling summit Crater Lake of Mt. Ruapehu, New Zealand’ s highest volcano, breached an unstable barrier of tephra emplaced on the rock rim of the crater by volcanic activity 11 years previously. In the ensuing flood, c. 1.3 million m^3 of hot acidic water was released in less than 90 minutes, entraining snow, ice, colluvium and older lahar deposits along its flow path to become a hyperconcentrated/non-cohesive debris flow with a peak discharge of c. 2500 m^3/s. Owing to the foreseen nature of this event, a collective of New Zealand and international researchers were able to put in place a comprehensive science program to capture maximum scientific benefit from a single discrete lahar.

The science plan comprised a number of complementary components including：

1. Instrumentation of the 155 km long flow path with a diverse range of traditional and experimental sensors in order to capture time-series data on key flow parameters
2. Use of fixed digital still, video and web-cameras to collect visual information at instrumented sites, with additional footage shot by media organizations and members of the public.
3. Mobilization of observer teams to collect time-series lahar samples and visual records at downstream locations.
4. Characterisation and quantification of geomorphic changes caused by the lahar through capture of pre-and post-event, sub-metre resolution topographic and ortho-image data using airborne LiDAR and ground-based TLS and dGPS surveys.
5. Mapping of ephemeral lahar high-water marks using dGPS to determine stage heights, energy slopes, and flow velocities.

6. Traditional forensic field and laboratory sedimentology to study depositional sequences for cross-correlation with instrumental and observational data.
7. Development and calibration of a range of numerical models of lahar behavior.

By combining skills and resources we have captured arguably the most complete dataset on a single lahar anywhere in the world. Multi-parameter time-series data from multiple sites will enable us to analyze the downstream evolution of the flow from its inception as a clear-water discharge from the failing tephra dam, to its maximum discharge and sediment concentration, and then its subsequent attenuation and dilution during its downstream propagation and interaction with the ambient river. This will in turn help improve mitigation and planning approaches for protection of communities from both volcanic and non-volcanic lake break-outs, lahars, debris flows and hyperconcentrated flows in New Zealand and around the world.

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The Global Scalar Dissimilarity in the Atmospheric Surface Layer. Comparison between Case Studies over Homogeneous and Non-homogeneous Surfaces：Focus on the Influence of the Height of the Boundary Layer and of the Sea Spray.

Sempreviva Anna Maria*

Over the last three decades, the temperature (*T*) -humidity (q) covariance (*Tq'*) in the atmospheric surface layer (ASL) has received significant attention, partly because of its use in assessing similarities in bulk scalar transfer parameters, electromagnetic wave propagation in a non-ionized atmosphere among others. While these issues all deserve attention, examining the main mechanisms by which the covariance between two scalar fluctuations is produced, maintained, or dissipated is a legitimate fundamental problem in its own right.

Understanding these mechanisms can highlight new dynamical processes modulating the structure of turbulence within the ASL not readily detected by other approaches. In fact, they may even provide blue prints on how to proceed on other practical yet unresolved issues such as the imbalance between available net radiation and the sum of sensible and latent heat fluxes. A number of studies have suggested that dissimilarities in the temperature –humidity covariance is often attributed to one (or more) of the following causes：(i) the active roles of temperature (and humidity) in the production/destruction of turbulent kinetic energy, (ii) advection of heat or moisture (both longitudinally and vertically), (iii) unsteadiness in the outer-layer flow that can impinge on the ASL, (iv) source inhomogeneity at the ground surface, and (v) local entrainment processes from the top of the atmospheric boundary layer (ABL) , (vi) influence of sources and sinks of heat i.e. sea spray or blowing snow in over water and over ice environment respectively. In the upper part of the ABL, the correlation coefficient between heat and water vapour (*RTq*) is generally negative because of the entrainment of warm yet dry air. Hence, it is conceivable that any observed reductions from unity in *RTq* within the ASL can be partially explained by this top-down mixing of drier air. Though this latter argument is intuitive and theoretically appealing, the large distance separating the ASL from the entrainment zone, and the ubiquitous presence of other 'contaminating' issues（e.g., averaging times and non-stationarity as in, make this entrainment argument difficult to establish. Since progress on the latter point can benefit from an explicit expression that describes how an anti-correlation between temperature and humidity at some level within the ABL propagates down into the ASL a simplified expression that predicts how much of the dissimilarity in the temperature-humidity covariance within the ASL originates from a boundary condition above the ASL or from source dissimilarities at the ground can be derived using the budget of the covariance between scalars. In this seminar, all above issues will be reviewed and discussed presenting case studies in different atmospheric environments i.e. over the sea, over forests and over iced surface.

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ENSO に対する大気の非線形応答がその遷移にもたらす効果

大庭雅道 *

熱帯太平洋上で発生するエルニーニョ・南方振動（El Nino and Southern Oscillation; ENSO）は，大気の橋を介して地球上の他の地域へ大きく影響する．これまでに，ENSO の経年変動のメカニズムを説明するために，幾つかの振動モデルが考えられてきた．西太平洋振動子（Weisberg and Wang 1997），再充填振動子（Jin 1997a,b）はその理論モデル中でも特に重要な役割を果たすと考えられているものであり，これら振動子理論ではその線形的な発達・衰弱・遷移の振る舞いを説明することに成功している．しかしながら，実際の観測結果では warm phase から cold phase への遷移は急速に進むのに対し，cold phase から warm phase への遷移は多くのイベントで停滞する傾向があり（Kessler 2002），従来の振動子理論だけでは説明が困難であることが知られている（Hasegawa *et al.* 2006）．しかし，現存する気候モデルなどの全球大気海洋結合モデルでは ENSO イベントの頻度が高くなる（AchutaRao and Sperber 2006）・線形的な振動をする（Hannachi *et al.* 2002）など，多くのモデルで修正再充填振動子（Jin and An 1999）に代表されるような海洋内部の力学に依存してしまう傾向が見られる．ENSO の遷移プロセスの差違に対し，海洋内部の力学的効果に注目した研究はあるものの（An and Jin 2004），Hoerling *et al.*（1997）や Kang and Kug（2001）で述べられているような大気場の応答やその非対称性に注目した研究は少ない．そこで SST 偏差に対する大気（非断熱加熱）の非線形性が ENSO 自身の遷移プロセスにどのような効果をもたらすかを調べた．

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