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The Onset of the Very Stable Boundary Layer

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A good understanding of nocturnal boundary layer physics is relevant for various applications related to weather and climate. Observations show that nocturnal boundary layers can generally be classified in two major prototypes: continuous turbulent, weakly stable boundary layers, which tend to occur in windy and/or cloudy conditions and very stably boundary layers which occur under clear sky/weak wind conditions. The latter regime can be subdivided further in the so-called radiative regime (with negligible turbulence) and the intermittent regime (where quiet periods are interrupted by turbulent bursts).

In spite of its omnipresence we were so far unable to explain the reason why the very stable boundary would emerge as a distinct regime, so different from the weakly stable one. In this talk we will look at this topic from several different angles, using observational analysis as well as Direct Numerical Simulations and conceptual modeling. It will be shown that the presence of a sharp regime transition can in fact be anticipated from a maximum sustainable heat flux principle.

For those who might be interested in more background we refer to:
Wiel, B.J.H. van de, Moene, A.F. & Jonker, H.J.J. (2012). The cessation of continuous turbulence as precursor of the very stable boundary layer. Journal of the Atmospheric Sciences, 69(11), 3097-3115.

Wiel, B.J.H. van de, Moene, A.F., Jonker, H.J.J., Baas, P., Basu, S, Donda, J.M.M., Sun, J. & Holtslag, A.A.M. (2012). The minimum wind speed for sustainable turbulence in the nocturnal boundary layer. Journal of the Atmospheric Sciences, 69(11), 3116-3126

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